

331-200 T Chiller Replacement

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Battelle Memorial Institute, Pacific Northwest Division (Battelle) in connection with Battelle’s Operation and Maintenance of the U.S. Department of Energy’s Pacific Northwest National Laboratory (PNNL) at Richland, Washington under Contract number DE-AC05-76RL01830 is pleased to invite bids for the **331 – 200 T Chiller Replacement** to be installed under this Invitation For Bid (IFB).

IFB Number:	337486
Title:	331 – 200 T Chiller Replacement
Location:	331 Cypress St., Richland, WA 99352
Issue Date:	03/23/2016
Closing Date/Bid Opening:	Friday April 08, 2016, 10:00 AM PDT, BSF Room 1016 (McClintock)
NAICS Code:	236220 (Commercial & Institutional Building Construction)
Restriction:	None – Full and Open Competition
Contract Type:	Firm Fixed Price
Basis of Award:	Sealed Bid
Contractor Qualification Requirements:	<p>Prime Contractor shall be pre-qualified prior to <i>contract award</i>; likewise, Subcontractors to a Prime Contractor performing work shall be prequalified prior to <i>starting work</i>.</p> <p>Note - An Experience Modification Rate (EMR) of less than or equal to 0.9 for Prime Contractor (1.0 for Subcontractors) and no willful OSHA/State Labor & Industries Citations over the past three years is needed to meet the pre-qualification requirement. To apply for pre-qualification, see: https://ebs.pnl.gov/.</p>
Duration / Completion:	331–200 T Chiller Replacement Complete not later than 04/28/2016 .
Prebid Meeting / Job Walk:	The <u>MANDATORY (for General Contractors only)</u> Pre-bid Conference will be held at 11:00 AM PST, Wednesday, March 30, 2016 , at the 331 Building; 331 Cypress St., Richland WA 99352, Room 2. <u>Badges ARE Required.</u>
Contract Specialist:	<p>Name: Garrett Hyatt Office Phone: 509-371-7591 Email Address: garrett.hyatt@pnnl.gov</p>

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1. SYNOPSIS

1.1 SUMMARY

Contractor shall furnish all the labor, supervision, equipment, materials and sub-contractors necessary to replace the existing 200 Ton Chiller with a new owner furnished 250 ton capacity unit - Includes; removal/demolition of select infrastructure, modifications to the existing piping, electrical, control wiring, etc.

Perform as per this Statement of Work, General Requirements, Drawing's listed on Project Title Sheet (8740784 I 331 - G0-001, Sht. I, Rev. 0), Job Planning Package (JPP), Work Exposure Assessment (WEA) and other attached Contract Documents.

2. INQUIRIES & SUBMISSION OF BIDS

- 2.1. All inquiries shall be submitted in writing by mail or email.
- 2.2. Bids and modifications shall be submitted in sealed envelopes or packages.
- 2.3. Bids shall contain the following completed documents:
 - Solicitation, Offer & Award Form
 - Bid Detail Sheet
 - Representations & Certifications
 - Certificate of Liability Insurance
 - Copy of Bidder's Washington State Contractor's License
 - Bid Bond
 - Prime and all subcontractors must flow down HSSA. Provide documentation.
- 2.4. Failure to submit **all** of the above required documents with your bid shall cause your bid to be determined non-responsive.

3. COMMUNICATIONS

3.1. Submission of Bids.

- 3.1.1. Bids shall be received on or before the due date at the following Battelle address:

Battelle Memorial Institute, Pacific Northwest Division
Attention: Garrett Hyatt (RE: IFB Number: 337486)
902 Battelle Boulevard, Mail Stop: J2-05
Richland, Washington 99352

Or,

Sealed Bids may be hand delivered to the public bid opening, to be held on the closing date, April 8, 2016, at 10:00 AM PDT in the BSF, McClintock Conference Room No. 1016, badges are NOT required.

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3.1.2. Bids and bid modifications shall be submitted in sealed envelopes or packages.

3.1.3. Telegraphic, Facsimile, and Electronic bids will NOT be accepted.

3.2. **Inquiries:** All inquiries, whether by phone, fax, or written shall be addressed to:

Battelle Memorial Institute, Pacific Northwest Division
Attention: Garrett Hyatt (RE: IFB Number: 337486)
902 Battelle Boulevard, Mail Stop: J2-05
Richland, Washington 99352

Phone Numbers, Fax Number, and Email Address for the Contract Specialist are on Page 1.

3.3. **Requests for Clarification / Interpretation:** If the Bidder finds discrepancies, omissions, or is in doubt as to the true meaning of any part of the contract documents, *Bidder MUST submit a WRITTEN request* for clarification or interpretation using Request for Information (RFI) form at <http://www.pnnl.gov/contracts/contractdocuments.aspx> and address it to the Contract Specialist listed on Page 1, *no later than 1:00 p.m. PST; 04/01/2016*. Submittals *may not be considered if submitted after this time*.

Regards,



Sr. Contracting Professional

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1. NAICS Classification: 236220

NAICS is the abbreviation for “North American Industry Classification System”. NAICS was developed by the U.S., Canada, and Mexico in a joint effort to provide new comparability in statistics about business activity across North America. NAICS assigns codes to all economic activity within twenty broad sectors and is accepted and used by the Small Business Association (SBA) in determining size standards where eligibility as a small business is a factor or a consideration.

2. Commencement, Prosecution, and Completion of Work [Adapted from FAR 52.211-10 (Apr 1984)]

The Contractor shall be required to (a) commence Work under this Contract As Soon As Possible after the date the Contractor receives the Notice to Proceed, (b) prosecute the Work diligently, and (c) complete the entire Work ready for use not later than **04/28/2016**. It is anticipated that the successful contractor will receive the Award on or around **April 9, 2016**.

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3. Bid Guarantee [Adapted from FAR 52.228-1 (Sept 1996)]

- (a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.
- (b) The Bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to Battelle, postal money order, certified check, cashier's check, or irrevocable letter of credit. Battelle will return bid guarantees, other than bid bonds—
 - (a) To unsuccessful Bidders as soon as practicable after the opening of bids; and
 - (b) To the successful Bidder upon execution of Contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.
- (c) The amount of the bid guarantee shall be **20% percent of the bid price or \$3,000,000**, whichever is less.
- (d) If the successful Bidder, upon acceptance of its bid by Battelle within the period specified for acceptance, fails to execute all Contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the Bidder, Battelle may terminate the Contract for default.
- (e) In the event the Contract is terminated for default, the Bidder is liable for any cost of acquiring the Work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

4. Contractor Prequalification — Construction

- (a) Contractors must meet Battelle's minimum qualification requirements to be eligible to Contract with Battelle directly as a Prime Contractor, or participate as a Subcontractor to a Prime Contractor performing Work on-site. Battelle's Prime Contractor and Subcontractor qualification requirements are posted on our Acquisition website at <https://ebs.pnnl.gov>. Any required supporting documents should be attached electronically and submitted with the completed Qualification Statements. Contractors will be notified by email of the acceptability of their qualifications.
- (b) Bids will be solicited and accepted from pre-qualified sources ONLY.
- (c) Prior to performing any awarded Contract Work on-site, each Subcontractor to the Prime Contractor must be accepted as meeting Battelle's qualification requirements.

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5. Amendments to Invitations for Bids [Adapted from FAR 52.214-3 (Dec 1989)]

- (a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.
- (b) Bidders shall acknowledge receipt of any amendment to this solicitation by
- (1) signing and returning the amendment,
 - (2) identifying the amendment number and date in the space provided for this purpose on the form for submitting a bid,
 - (3) letter or telegram, or
 - (4) facsimile, if facsimile bids are authorized in the solicitation. Battelle must receive the acknowledgment by the time and at the place specified for receipt of bids.

6. False Statements in Bids [Adapted from 52.214-4 (Apr 1984)]

Bidders must provide full, accurate, and complete information as required by this solicitation and its attachments. The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

7. Submission of Bids [Adapted from FAR 52.214-5 (Mar 1997)]

- (a) Bids and bid modifications shall be submitted in sealed envelopes or packages (unless submitted by electronic means)—
- (1) Addressed to the office specified in the solicitation; and
 - (2) Showing the time and date specified for receipt, the solicitation number, and the name and address of the Bidder.
- (b) Bidders using commercial carrier services shall ensure that the bid is addressed and marked on the outermost envelope or wrapper as prescribed in paragraphs (a)(1) and (2) of this provision when delivered to the office specified in the solicitation.
- (c) Telegraphic bids will not be considered unless authorized by the solicitation; however, bids may be modified or withdrawn by written or telegraphic notice.
- (d) Facsimile bids, modifications, or withdrawals, will not be considered unless authorized by the solicitation.
- (e) Bids submitted by electronic commerce shall be considered only if the electronic commerce method was specifically stipulated or permitted by the solicitation.

8. Explanation to Prospective Bidders [Adapted from FAR 52.214-6 (Apr 1984)]

Any prospective Bidder desiring an explanation or interpretation of the solicitation, drawings, specifications, etc., must request it in writing soon enough to allow a reply to reach all prospective Bidders before the submission of their bids. Oral explanations or instructions given before the award of a Contract will not be binding. Any information given a prospective Bidder concerning a solicitation will be furnished promptly to all other prospective Bidders as an amendment to the solicitation, if that information is necessary in submitting bids or if the lack of it would be prejudicial to other prospective Bidders.

9. Late Submissions, Modifications, and Withdrawals of Bids [Adapted from FAR 52.214-7 (Nov 1999)]

(a) Bidders are responsible for submitting bids, and any modifications or withdrawals, so as to reach the Battelle office designated in the invitation for bids (IFB) by the time specified in the IFB. If no time is specified in the IFB, the time for receipt is 10:00 a.m., local time, for the designated Battelle office on the date that bids are due.

(b)(1) Any bid, modification, or withdrawal received at the Battelle office designated in the IFB after the exact time specified for receipt of bids is “late” and will not be considered unless it is received before award is made, the Contract Specialist determines that accepting the late bid would not unduly delay the acquisition; and—

(i) If it was transmitted through an electronic commerce method authorized by the IFB, it was received at the initial point of entry to the Battelle infrastructure not later than 5:00 p.m. one Working day prior to the date specified for receipt of bids; or

(ii) There is acceptable evidence to establish that it was received at the Battelle installation designated for receipt of bids and was under Battelle’s control prior to the time set for receipt of bids.

(2) However, a late modification of an otherwise successful bid that makes its terms more favorable to Battelle will be considered at any time it is received and may be accepted.

(c) Acceptable evidence to establish the time of receipt at the Battelle installation includes the time/date stamp of that installation on the bid wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Battelle personnel.

(d) If an emergency or unanticipated event interrupts normal Battelle processes so that bids cannot be received at the Battelle office designated for receipt of bids by the exact

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time specified in the IFB and urgent Battelle requirements preclude amendment of the IFB, the time specified for receipt of bids will be deemed to be extended to the same time of day specified in the solicitation on the first Work day on which normal Battelle processes resume.

(e) Bids may be withdrawn by written notice received at any time before the exact time set for receipt of bids. If the IFB authorizes facsimile bids, bids may be withdrawn via facsimile received at any time before the exact time set for receipt of bids, subject to the conditions specified in the Instruction to Bidders entitled “Facsimile Bids.” A bid may be withdrawn in person by a Bidder or its authorized representative if, before the exact time set for receipt of bids, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid.

10. Period for Acceptance of Bids [Adapted from FAR 52.214-15 (Apr 1984)]

In compliance with the solicitation, the Bidder agrees, if this bid is accepted within **90 calendar days** from the date specified in the solicitation for receipt of bids, to furnish any or all items upon which prices are bid at the price set opposite each item, delivered at the designated point(s), within the time specified in the Schedule.

11. Preparation of Bids—Construction [Adapted from FAR 52.214-18 (Apr 1984)]

(a) **Bids must be—**

- (1) Submitted on the forms furnished by Battelle or on copies of those forms, and
- (2) Manually signed. The person signing a bid must initial each erasure or change appearing on any bid form.

(b) The bid form may require Bidders to submit bid prices for one or more items on various bases, including—

- (1) Lump sum bidding;
- (2) Alternate prices;
- (3) Units of construction; or
- (4) Any combination of paragraphs (b)(1) through (b)(3) of this provision.

(c) If the solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, Bidders should insert the words “no bid” in the space provided for any item on which no price is submitted.

(d) Alternate bids will not be considered unless this solicitation authorizes their submission.

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(e) **Additional Proposal Requirements—**

- (1) **Bid Guarantee:** – *is required.*
- (2) **Representations and Certifications:** Bidder shall complete and submit company representations and certifications.
- (3) **Insurance:** Bidder shall submit verification of possession of the insurance coverage listed in the General Provisions.
- (4) **Permits and Licenses:** Bidder shall submit the Certificate of License number, which grants them the authority to Work as a Contractor in the State, County and/or Municipality where the Work is to be performed. If Bidder does not have such license or certificate, a copy of the application for it must be submitted with an estimate of time required to obtain it.
- (5) **HSSA/Davis Bacon:** General and Subs must flow down the HSSA for this project. Provide Documentation

12. Contract Award—Sealed Bidding—Construction [Adapted from FAR 52.214-19 (Aug 1996)]

- (a) Battelle will evaluate bids in response to this solicitation without discussions and will award a Contract to the responsible Bidder whose bid, conforming to the solicitation, will be most advantageous to Battelle, considering only price and the price-related factors specified elsewhere in the solicitation.
- (b) Battelle may reject any or all bids, and waive informalities or minor irregularities in bids received.
- (c) Battelle may accept any item or combination of items, unless doing so is precluded by a restrictive limitation in the solicitation or the bid.
- (d) Battelle may reject a bid as non-responsive if the prices bid are materially unbalanced between line items or sub-line items. A bid is materially unbalanced when it is based on prices significantly less than cost for some Work and prices which are significantly overstated in relation to cost for other Work, and if there is a reasonable doubt that the bid will result in the lowest overall cost to Battelle even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advance payment.

13. Pricing Conditions [Adapted from FAR 52.214-34 & 35 (Apr 1991)]

- (a) Offers submitted in response to this solicitation shall be in the English language. Offers received in other than English shall be rejected.

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(b) Offers submitted in response to this solicitation shall be in terms of U.S. dollars. Offers received in other than U.S. dollars shall be rejected.

(c) All pricing must be firm for the duration of this Contract.

(d) The quoted price(s) must include all costs to for materials, labor, equipment, testing and any and all items of expense, fees, taxes, duties, overhead and profit for full and complete performance of the Work.

14. Site Investigation and Conditions Affecting the Work [Adapted from FAR 52.236-3 (Apr 1984)]

(a) The Contractor must take steps reasonably necessary to ascertain the nature and location of the Work, and to investigate and satisfy itself as to the general and local conditions which can affect the Work or its cost, including but not limited to—

- (1) Conditions bearing upon transportation, disposal, handling, and storage of materials;
- (2) The availability of labor, water, electric power, and roads;
- (3) Uncertainties of weather, river stages, tides, or similar physical conditions at the site;
- (4) The conformation and conditions of the ground; and
- (5) The character of equipment and facilities needed preliminary to and during Work performance.

The Contractor must also satisfy itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory Work done by Battelle, as well as from the drawings and specifications made a part of this Contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the Work, or for proceeding to successfully perform the Work without additional expense to Battelle.

(b) Battelle assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by Battelle. Nor does Battelle assume responsibility for any understanding reached or representation made concerning conditions which can affect the Work by any of its officers or agents before the execution of this Contract, unless that understanding or representation is expressly stated in this Contract.

15. Flow-down of Contract Clauses

(a) Any Contract resulting from this solicitation, by and between Battelle and Contractor (including all subcontractors and suppliers), for services in connection with Battelle's

Management, Operation and Maintenance of the U.S. Department of Energy's Pacific Northwest Laboratory (PNNL) at Richland, Washington, under Contract DE-AC05-76RL01830 is subject to the terms and conditions of the General Provisions set forth in this solicitation. Contractor shall flow-down all terms and conditions in this solicitation in all its lower-tier subcontracts and supplier purchase orders. Clauses made inapplicable by the value, stated conditions, or type of Contract are self-deleting.

(b) The Contractor and its subcontractors at any tier are required to submit a fully executed SF 1413, Statement and Acknowledgment, upon award of each subcontract involving labor to acknowledge that the following clauses of the Contract have been included:

- 1. Contract Work Hours and Safety Standards Act – Overtime Compensation – Construction**
- 2. Davis-Bacon Act**
- 3. Withholding of Funds**
- 4. Payrolls and Basic Records**
- 5. Apprentices and Trainees**
- 6. Compliance with Copeland Act Requirements**
- 7. Subcontracts (Labor Standards)**
- 8. Contract Termination – Debarment**
- 9. Disputes Concerning Labor Standards**
- 10. Certification of Eligibility**
- 11. Hanford Site Stabilization Agreement (HSSA)**

16. PNNL Contractor Environmental Safety and Health (CESH) Documents

CESH documents, including the CESH Manual, the and miscellaneous CESH forms can be accessed online at:

<http://www.pnnl.gov/contracts/Forms.aspx?area=Procurement>.

Hoisting and Rigging Requirements must follow DOE-STD-1090 found at:

<http://energy.gov/ehss/downloads/doe-std-1090-2011>

REPRESENTATIONS AND CERTIFICATIONS

For the Pacific Northwest National Laboratory
Operated by Battelle Memorial Institute

Battelle Memorial Institute has executed and is engaged in the performance of Prime Contract DE-AC05-76RL01830 with the United States Department of Energy (DOE), for the management, operation, and maintenance of the Pacific Northwest National Laboratory (PNNL) in Richland, Washington. The following representations and certifications must be completed, and this form must be signed and returned with the Offeror's proposal.

Name and DUNS Number

Individual/Company Name _____

"Doing Business As" (DBA) _____

DUNS Number _____

Taxpayer Identification (cl. 405 - Oct 1998)

A. Definitions

"Common Parent," as used in this solicitation provision, means that corporation entity owns or controls an affiliated group of corporation that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

"Taxpayer Identification Number (TIN)," as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employee Identification Number.

B. All offerors must submit the information required in Paragraphs D through F of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M and implementing regulations issued by the IRS. If the resulting contract is subject to the reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

C. The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

D. Taxpayer Identification Number (TIN)

- TIN: _____
- TIN has been applied for.
- TIN is not required because _____
- Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States.
- Offeror is an agency or instrumentality of a foreign government
- Offeror is an agency or instrumentality of a Federal Government
- Other. State basis. _____

E. Type of Organization

- | | |
|------------------------------------------------------------|-------------------------------------------------------------------------|
| <input type="checkbox"/> Sole proprietorship | <input type="checkbox"/> Government entity (Federal, State, or local) |
| <input type="checkbox"/> Partnership | <input type="checkbox"/> Foreign government |
| <input type="checkbox"/> Corporate entity (not tax-exempt) | <input type="checkbox"/> International organization per 26 CFR 1.6049-4 |
| <input type="checkbox"/> Corporate entity (tax-exempt) | <input type="checkbox"/> Other _____ |

F. Common Parent

- Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.
- Name and TIN of common parent: Name _____ TIN _____
- Offeror, its parent company, or subsidiaries, is/has been owned or controlled by a foreign entity. If so, provide the following information:

Name of Parent Company _____

Main Office Address _____

G. Other

- Foreign organization is headquarter in _____ (country)
- Company is, is not publicly traded

Small Business Program Representations (cl. 407 - Oct 2011)

(Applicable if any performance will be inside the United States or its outlying areas.)

- A. 1. The North American Industry Classification System (NAICS) code for this acquisition is _____.
2. The small business size standard is _____.
3. The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

B. Representations.

1. The offeror represents as part of its offer that it is, is not a small business concern.
(Complete 2-8 below, as applicable, only if the offeror represented itself as a small business concern in paragraph B.1. of this provision.)
2. The offeror represents, for general statistical purposes, that it is, is not, a small disadvantaged business concern as defined in 13 CFR 124.1002. (If so, also complete the Small Disadvantaged Business Status representation, below.)
3. The offeror represents as part of its offer that it is, is not a women-owned small business concern.
4. [Complete only if the offeror represented itself as a women-owned small business concern in Paragraph B.3. of this provision.] Women-owned small business (WOSB) concern eligible under the WOSB Program.

The offeror represents as part of its offer that—

- a. It is, is not a WOSB concern eligible under the WOSB Program, has provided all the required documents to the WOSB Repository, and no change in circumstances or adverse decisions have been issued that affects its eligibility; and
- b. It is, is not a joint venture that complies with the requirements of 13 CFR part 127, and the representation in Paragraph B.4.a. of this provision is accurate in reference to the WOSB concern or concerns that are participating in the joint venture. [The offeror shall enter the name or names of the WOSB concern or concerns that are participating in the joint venture: _____.] Each WOSB concern participating in the joint venture shall submit a separate signed copy of the WOSB representation.
5. [Complete only if the offeror represented itself as a women-owned small business concern eligible under the WOSB Program in Paragraph B.4. of this provision.] Economically disadvantaged women-owned small business (EDWOSB) concern. The offeror represents as part of its offer that—
- a. It is, is not an EDWOSB concern eligible under the WOSB Program, has provided all the required documents to the WOSB Repository, and no change in circumstances or adverse decisions have been issued that affects its eligibility; and
- b. It is, is not a joint venture that complies with the requirements of 13 CFR part 127, and the representation in Paragraph B.5.a. of this provision is accurate in reference to the EDWOSB concern or concerns that are participating in the joint venture. [The offeror shall enter the name or names of the EDWOSB concern or concerns that are participating in the joint venture: _____.] Each EDWOSB concern participating in the joint venture shall submit a separate signed copy of the EDWOSB representation.
6. The offeror represents as part of its offer that it is, is not a veteran-owned small business concern.
7. The offeror represents as part of its offer that it is, is not a service-disabled veteran-owned small business concern.
8. The offeror represents, as part of its offer, that—
- a. It is, is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material change in ownership and control, principal office, or

HUBZone employee percentage have occurred since it was in accordance with 13 CFR part 126; and

- b. It is, is not a HUBZone joint venture that complies with the requirements of 13 CFR part 126, and the representation in paragraph B.6.a. of this provision is accurate for the HUBZone small business concern that are participating in the HUBZone joint venture.

[The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture: _____]

Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

C. *Definitions.* As used in this provision ...

"Economically disadvantaged women-owned small business (EDWOSB) concern" means a small business concern that is at least 51 percent directly and unconditionally owned by, and the management and daily business operations of which are controlled by, one or more women who are citizens of the United States and who are economically disadvantaged in accordance with 13 CFR part 127. It automatically qualifies as a women-owned small business concern eligible under the WOSB Program.

"Service-disabled veteran-owned small business concern"—

1. Means a small business concern (a) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and (b) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a service-disabled veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.
2. Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern" means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR part 121 and the size standard in Paragraph A of this provision.

"Veteran-owned small business concern" means a small business concern—

1. Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and
2. The management and daily business operations of which are controlled by one or more veterans.

"Women-owned small business concern" means a small business concern—

1. That is at least 51 percent owned by one or more women; or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and
2. Whose management and daily business operations are controlled by one or more women.

D. *Notice.*

1. If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.
2. Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to section 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall— (i) Be punished by imposition of fine, imprisonment, or both; (ii) Be subject to administrative remedies, including suspension and debarment; and (iii) Be ineligible for participation in programs conducted under the authority of the Act.

Alaska Native Corporation or Indian Tribe Representation (cl. 407A – Feb 2011)

In accordance with FAR 52.219-9(d)(1)(i), subcontracts awarded to an Alaska Native Corporation (ANC) or Indian tribe may be counted towards subcontracting goals for small business and small disadvantaged business concerns regardless of the size or Small Business Administration certification of the ANC or Indian tribe. As defined by FAR 52.219-9(b), the offeror represents that it –

- is is not an Alaska Native Corporation
- is is not an Indian tribe

Organizational Conflicts of Interest Disclosure—Advisory and Assistance Services (cl. 411 - June 1997)

- A. Organizational conflict of interest means that because of other activities or relationships with other persons, a person is unable or potentially unable to render impartial assistance or advice to the Government, or the person's objectivity in performing the contract work is or might be otherwise impaired, or a person has an unfair competitive advantage.
- B. An offeror notified that it is the apparent successful offeror shall provide the statement described in Paragraph C of this provision. For purposes of this provision, "apparent successful offeror" means the proposer selected for final negotiations or, where individual contracts are negotiated with all firms in the competitive range, it means all such firms.
- C. The statement must contain the following:
 - 1. A statement of any past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the statement of work. For contractual interests, such statement must include the name, address, telephone number of the client or client(s), a description of the services rendered to the previous client(s), and the name of a responsible officer or employee of the offeror who is knowledgeable about the services rendered to each client, if, in the 12 months preceding the date of the statement, services were rendered to the Government or any other client (including a foreign government or person) respecting the same subject matter of the instant solicitation, or directly relating to such subject matter. The agency and contract number under which the services were rendered must also be included, if applicable. For financial interests, the statement must include the nature and extent of the interest and any entity or entities involved in the financial relationship. For these and any other interests enough such information must be provided to allow a meaningful evaluation of the potential effect of the interest on the performance of the statement of work.
 - 2. A statement that no actual or potential conflict of interest or unfair competitive advantage exists with respect to the advisory and assistance services to be provided in connection with the instant contract or that any actual or potential conflict of interest or unfair competitive advantage that does or may exist with respect to the contract in question has been communicated as part of the statement required by Paragraph B of this provision.
- D. Failure of the offeror to provide the required statement may result in the offeror being determined ineligible for award. Misrepresentation or failure to report any fact may result in the assessment of penalties associated with false statements or such other provisions provided for by law or regulation.

Employment Eligibility Verification (cl. 421 – Oct 2011)

(Applicable to proposals exceeding \$3,000)

Offeror represents that—

- E-Verify is not applicable based on paragraph (e) of FAR 52.222-54 Employment Eligibility Verification.
- it is it is not currently enrolled in E-Verify.
- if not currently enrolled, it will enroll in E-Verify within 30 calendar days of subcontract award.
- it will include FAR 52.222-54 in applicable lower-tier subcontracts.

Affirmative Action Compliance (cl. 409 - Apr 1984)

The offeror represents that it –

- has developed and has on file,
- has not developed and does not have on file, at each establishment, affirmative action programs required by the rules and regulations of the Secretary of Labor (41 CFR 60-1 and 60-2); or
- has not previously had contracts subject to the written affirmative action programs requirement of the rules and regulations of the Secretary of Labor.

Compliance with Veterans' Employment Reporting Requirements (cl. 420 - Sep 2010)

By submission of its offer, the offeror represents that, if it is subject to the reporting requirements of [38 U.S.C. 4212\(d\)](#) (i.e., if it has any contract containing Federal Acquisition Regulation clause [52.222-37](#), Employment Reports on Veterans), it has submitted the most recent VETS-100A Report required by that clause.

Previous Contracts and Compliance Reports (cl. 408 - Feb 1999)

Offeror represents that it—

- has has not participated in a previous contract or subcontract subject the Equal Opportunity clause of this solicitation;
- Has has not filed all required compliance reports; and

Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

Representation of Limited Rights Data and Restricted Computer Software (cl. 415 - Dec 2007)

- A. This solicitation sets forth the Government’s known delivery requirements for data (as defined in the clause at FAR 52.227-14, Rights in Data—General). Any resulting contract may also provide the Government the option to order additional data under the Additional Data Requirements clause at FAR 52.227-16, if included in the contract. Any data delivered under the resulting contract will be subject to the Rights in Data—General clause at FAR 52.227-14 included in this contract. Under the latter clause, a Contractor may withhold from delivery data that qualify as limited rights data or restricted computer software, and deliver form, fit, and function data instead. The latter clause also may be used with its Alternates II and/or III to obtain delivery of limited rights data or restricted computer software, marked with limited rights or restricted rights notices, as appropriate. In addition, use of Alternate V with this latter clause provides the Government the right to inspect such data at the Contractor’s facility.
- B. By completing the remainder of this paragraph, the offeror represents that it has reviewed the requirements for the delivery of technical data or computer software and states [*offeror check appropriate block*]—
 - None of the data proposed for fulfilling the data delivery requirements qualifies as limited rights data or restricted computer software; or
 - Data proposed for fulfilling the data delivery requirements qualify as limited rights data or restricted computer software and are identified as follows:

- C. Any identification of limited rights data or restricted computer software in the offeror’s response is not determinative of the status of the data should a contract be awarded to the offeror.

Royalty Payment Certification (cl. 414 - Jan 1986)

In order that the U.S. Department of Energy may be informed regarding royalty payments to be made by a contractor in connection with any acquisition, construction, or operation where the amount of the royalty payment is reflected in the contract price, or is to be reimbursed by Battelle, check one of the following:

- The Contract price includes no amount representing the payment of royalty by the Offeror directly to others in connection with the performance of the contract.
- The Contract price includes an amount for royalty payment expected to be made in connection with the proposed award set forth below:
 1. the amount of each payment,
 2. the names of the licensor, and
 3. either the patent numbers involved or such other information as will permit identification of the patents and patent applications and the basis on which royalties will be paid.

Buy American Act Certificate (cl. 410 - Feb 2009)

- A. The offeror certifies that each end product, except those listed in Paragraph B of this provision, is a domestic end product and that for other than COTS items, the offeror has considered components of unknown origin to have been mined, produced, or manufactured outside the United States. The offeror shall list as foreign end products those end products manufactured in the United States that do not qualify as domestic end products, *i.e.*, an end product that is not a COTS item and does not meet the component test in Paragraph 2 of the definition of “domestic end product.” The terms “commercially available off-the-shelf (COTS) item,” “component,” “domestic end product,” “end product,” “foreign end product,” and “United States” are defined in the clause of this solicitation entitled “Buy American Act—Supplies.”
- B. Foreign End Products:

Line Item No.	Country of Origin

- C. Offers will be evaluated in accordance with the policies and procedures of [Part 25](#) of the Federal Acquisition Regulation.

Export Control (cl. 422 – July 2012)

(Required for all proposals of Equipment, Tools, Software or Technology)

The Offeror represents that the property has an Export Control requirement that is described in either of the following regulations:

A. An International Traffic in Arms Regulations (ITAR) United States Munitions List (USML) Category

Manufacturer Name _____
Model Number _____
Description _____
USML Category # _____

B. An Export Administrations Regulations (EAR) Export Control Classification Number (ECCN);

Manufacturer Name _____
Model Number _____
Description _____
ECCN # _____ (e.g. 1A001...NOT the Harmonizing Code)

Note: Prior to the delivery of equipment, tools, software or technology, the successful contractor must provide the ECCN for each item to the PNNL Property Office at pnnl.property@pnnl.gov.

Technical Data Certification (cl. 413 - Jan 1986)

The offeror certifies that it has not delivered or is not obligated to deliver to Battelle or to the Government under any contract or subcontract the same or substantially the same technical data included in its offer, except as set forth below:

- None
- Contract No. (and Subcontract No., if applicable), Agency name and place of delivery

Certification Regarding Responsibility Matters (cl. 419 - April 2010)

A. The Offeror certifies, to the best of its knowledge and belief, that—

1. The Offeror and/or any of its Principals—

- are are not presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;
- have have not within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, violating Federal criminal tax laws, or receiving stolen property;
- are are not presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in Paragraph A.1.a.ii. of this provision;
- have have not within a three-year period preceding this offer, been notified of any delinquent Federal taxes in an amount that exceeds \$3,000 for which the liability remains unsatisfied.

a. Federal taxes are considered delinquent if both of the following criteria apply:

- i. *The tax liability is finally determined.* The liability is finally determined if it has been assessed. A liability is not finally determined if there is a pending administrative or judicial challenge. In the case of a judicial challenge to the liability, the liability is not finally determined until all judicial appeal rights have been exhausted.
- ii. *The taxpayer is delinquent in making payment.* A taxpayer is delinquent if the taxpayer has failed to pay the tax liability when full payment was due and required. A taxpayer is not delinquent in cases where enforced collection action is precluded.

b. *Examples.*

- The taxpayer has received a statutory notice of deficiency, under I.R.C. § 6212, which entitles the taxpayer to seek Tax Court review of a proposed tax deficiency. This is not a delinquent tax because it is not a final tax liability. Should the taxpayer seek Tax Court review, this will not be a final tax liability until the taxpayer

has exercised all judicial appeal rights.

- The IRS has filed a notice of Federal tax lien with respect to an assessed tax liability, and the taxpayer has been issued a notice under I.R.C. § 6320 entitling the taxpayer to request a hearing with the IRS Office of Appeals contesting the lien filing, and to further appeal to the Tax Court if the IRS determines to sustain the lien filing. In the course of the hearing, the taxpayer is entitled to contest the underlying tax liability because the taxpayer has had no prior opportunity to contest the liability. This is not a delinquent tax because it is not a final tax liability. Should the taxpayer seek tax court review, this will not be a final tax liability until the taxpayer has exercised all judicial appeal rights.
- The taxpayer has entered into an installment agreement pursuant to I.R.C. § 6159. The taxpayer is making timely payments and is in full compliance with the agreement terms. The taxpayer is not delinquent because the taxpayer is not currently required to make full payment.
- The taxpayer has filed for bankruptcy protection. The taxpayer is not delinquent because enforced collection action is stayed under 11 U.S.C. 362 (the Bankruptcy Code).

c. The Offeror has, has not, within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

2. "Principal," for the purposes of this certification, means an officer, director, owner, partner, or a person having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment; and similar positions).

This Certification Concerns a Matter Within the Jurisdiction of an Agency of the United States and the Making of a False, Fictitious, or Fraudulent Certification May Render the Maker Subject to Prosecution Under Section 1001, Title 18, United States Code.

- B. The Offeror shall provide immediate written notice to the Battelle Contracts Representative if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.
- C. A certification that any of the items in Paragraph A of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Battelle Contracts Representative may render the Offeror nonresponsible.
- D. Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by Paragraph A of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.
- E. The certification in Paragraph A of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to Battelle, the Battelle Contracts Representative may terminate the contract resulting from this solicitation for default.

Patent Rights Representation (cl. 417 - Jan 1986)

Offeror represents that it—

- is is not A small business as defined at section 2 of Pub. L. 85-536 (15 USC 632) and the implementing regulations of the Administrator of the Small Business Administration, 13 CFR Part 121.
- is is not An organization of the type described in section 501(c)(3) of the Internal Revenue Code (26 USC 501(c)(3)) and exempt from taxation under section 501(a) of the Internal Revenue Code (26 USC 501(a)).
- is is not A nonprofit scientific or educational organization qualified under a State nonprofit organization statute.
- is is not A U.S. domestic university or other U.S. institution of higher education.

Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions (cl. 404 - Oct 2010)

(Applicable to proposals exceeding \$150,000)

- A. **Definitions.** As used in this provision—"Lobbying contact" has the meaning provided at [2 U.S.C. 1602\(8\)](#). The terms "agency," "influencing or attempting to influence," "officer or employee of an agency," "person," "reasonable compensation," and "regularly employed" are defined in the FAR clause of this solicitation entitled "Limitation on Payments to Influence Certain Federal Transactions" ([52.203-12](#)).
- B. **Prohibition.** The prohibition and exceptions contained in the FAR clause of this solicitation entitled "Limitation on Payments to Influence Certain Federal Transactions" ([52.203-12](#)) are hereby incorporated by reference in this provision.
- C. **Certification.** The offeror, by signing its offer, hereby certifies to the best of its knowledge and belief that no Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on its behalf in connection with the awarding of this contract.

- D. *Disclosure.* If any registrants under the Lobbying Disclosure Act of 1995 have made a lobbying contact on behalf of the offeror with respect to this contract, the offeror shall complete and submit, with its offer, OMB Standard Form LLL, Disclosure of Lobbying Activities, to provide the name of the registrants. The offeror need not report regularly employed officers or employees of the offeror to whom payments of reasonable compensation were made.
- E. *Penalty.* Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by [31 U.S.C. 1352](#). Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure required to be filed or amended by this provision, shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000, for each such failure.

Code of Business Ethics and Conduct (cl. 406 - Oct 2011)

By submission of this offer, the offeror certifies that it conducts its business fairly, impartially, and in an ethical and proper manner. The offeror also certifies that it maintains a Code of Business Ethics and Conduct and adheres to its terms. The offeror agrees, in consideration of the opportunity to propose on this requirement, that the offeror shall immediately report all unethical or improper conduct by the offeror or Buyer's agents in connection with this solicitation or the resulting contract to the U.S. Department of Energy, Office of Inspector General, and the Battelle Contracts Representative.

Cost Accounting Standards Notices and Certification (cl. 416 - Oct 2011)

Note: This notice does not apply to small businesses or foreign governments. This notice is in three parts, identified by Roman numerals I through III.

Offerors shall examine each part and provide the requested information in order to determine Cost Accounting Standards (CAS) requirements applicable to any resultant contract.

If the offeror is an educational institution, Part II does not apply unless the contemplated contract will be subject to full or modified CAS coverage pursuant to 48 CFR 9903.201-2(c)(5) or 9903.201-2(c)(6), respectively.

I. DISCLOSURE STATEMENT—COST ACCOUNTING PRACTICES AND CERTIFICATION

- A. Any contract in excess of \$700,000 resulting from this solicitation will be subject to the requirements of the Cost Accounting Standards Board (48 CFR Chapter 99), except for those contracts which are exempt as specified in 48 CFR 9903.201-1.
- B. Any offeror submitting a proposal which, if accepted, will result in a contract subject to the requirements of 48 CFR Chapter 99 must, as a condition of contracting, submit a Disclosure Statement as required by 48 CFR 9903.202. When required, the Disclosure Statement must be submitted as a part of the offeror's proposal under this solicitation unless the offeror has already submitted a Disclosure Statement disclosing the practices used in connection with the pricing of this proposal. If an applicable Disclosure Statement has already been submitted, the offeror may satisfy the requirement for submission by providing the information requested in paragraph (c) of Part I of this provision.

Caution: In the absence of specific regulations or agreement, a practice disclosed in a Disclosure Statement shall not, by virtue of such disclosure, be deemed to be a proper, approved, or agreed-to practice for pricing proposals or accumulating and reporting contract performance cost data.

- C. Check the appropriate box below:

- 1. *Certificate of Concurrent Submission of Disclosure Statement.* The offeror hereby certifies that, as a part of the offer, copies of the Disclosure Statement have been submitted as follows:
 - a. Original and one copy to the cognizant Administrative Contracting Officer (ACO) or cognizant Federal agency official authorized to act in that capacity (Federal official), as applicable; and
 - b. One copy to the cognizant Federal auditor.

(Disclosure must be on Form No. CASB DS-1 or CASB DS-2, as applicable. Forms may be obtained from the cognizant ACO or Federal official and/or from the loose-leaf version of the Federal Acquisition Regulation.)

Date of Disclosure Statement: _____

Name and Address of Cognizant ACO or Federal Official Where Filed: _____

The offeror further certifies that the practices used in estimating costs in pricing this proposal are consistent with the cost accounting practices disclosed in the Disclosure Statement.

- 2. *Certificate of Previously Submitted Disclosure Statement.* The offeror hereby certifies that the required Disclosure Statement was filed as follows:

Date of Disclosure Statement: _____

Name and Address of Cognizant ACO or Federal Official Where Filed: _____

The offeror further certifies that the practices used in estimating costs in pricing this proposal are consistent with the cost accounting practices disclosed in the applicable Disclosure Statement.

- 3. *Certificate of Monetary Exemption.* The offeror hereby certifies that the offeror, together with all divisions,

subsidiaries, and affiliates under common control, did not receive net awards of negotiated prime contracts and subcontracts subject to CAS totaling \$50 million or more in the cost accounting period immediately preceding the period in which this proposal was submitted. The offeror further certifies that if such status changes before an award resulting from this proposal, the offeror will advise the Contracting Officer immediately.

- 4. *Certificate of Interim Exemption.* The offeror hereby certifies that (i) the offeror first exceeded the monetary exemption for disclosure, as defined in (3) of this subsection, in the cost accounting period immediately preceding the period in which this offer was submitted and (ii) in accordance with 48 CFR 9903.202-1, the offeror is not yet required to submit a Disclosure Statement. The offeror further certifies that if an award resulting from this proposal has not been made within 90 days after the end of that period, the offeror will immediately submit a revised certificate to the Contracting Officer, in the form specified under Paragraph C.1. or C.2. of Part I of this provision, as appropriate, to verify submission of a completed Disclosure Statement.
- 5. *Certificate of Disclosure Statement Due Date by Educational Institution.* If the offeror is an educational institution that, under the transition provisions of 48 CFR 9903.202-1(f), is or will be required to submit a Disclosure Statement after receipt of this award, the offeror hereby certifies that (check one and complete):
 - A Disclosure Statement Filing Due Date of _____ has been established with the cognizant Federal agency.
 - The Disclosure Statement will be submitted within the 6-month period ending _____ months after receipt of this award.

Caution: Offerors currently required to disclose because they were awarded a CAS-covered prime contract or subcontract of \$50 million or more in the current cost accounting period may not claim this exemption (4). Further, the exemption applies only in connection with proposals submitted before expiration of the 90-day period following the cost accounting period in which the monetary exemption was exceeded.

II. COST ACCOUNTING STANDARDS—ELIGIBILITY FOR MODIFIED CONTRACT COVERAGE

If the offeror is eligible to use the modified provisions of 48 CFR 9903.201-2(b) and elects to do so, the offeror shall indicate by checking the box below. Checking the box below shall mean that the resultant contract is subject to the Disclosure and Consistency of Cost Accounting Practices clause in lieu of the Cost Accounting Standards clause.

- The offeror hereby claims an exemption from the Cost Accounting Standards clause under the provisions of 48 CFR 9903.201-2(b) and certifies that the offeror is eligible for use of the Disclosure and Consistency of Cost Accounting Practices clause because during the cost accounting period immediately preceding the period in which this proposal was submitted, the offeror received less than \$50 million in awards of CAS-covered prime contracts and subcontracts. The offeror further certifies that if such status changes before an award resulting from this proposal, the offeror will advise the Contracting Officer immediately.

Caution: An offeror may not claim the above eligibility for modified contract coverage if this proposal is expected to result in the award of a CAS-covered contract of \$50 million or more or if, during its current cost accounting period, the offeror has been awarded a single CAS-covered prime contract or subcontract of \$50 million or more.

III. ADDITIONAL COST ACCOUNTING STANDARDS APPLICABLE TO EXISTING CONTRACTS

The offeror shall indicate below whether award of the contemplated contract would, in accordance with Paragraph A.3. of the Cost Accounting Standards clause, require a change in established cost accounting practices affecting existing contracts and subcontracts.

Yes No

SIGNATURE

Note: A person authorized to make legally binding commitments on behalf of the offeror must sign below. Signature constitutes a representation that reasonable and prudent inquiry has been made to ascertain the true and accurate basis of all statements. Statements which a person knows or has reason to know are false, fictitious, or fraudulent may result in criminal or civil penalties, as prescribed in 18 USC 1001 and 31 USC 3802(a)(2). These Representations and Certifications shall remain in effect for a period of one (1) year from the date signed and shall satisfy any subsequent proposal requirements during that one-year period. The Offeror shall notify Battelle of any changes that occur in any of the representation or certifications during that period.

Authorized Signature _____

Signer's Name (Printed) _____

Title _____

Date _____

Solicitation, Offer and Award		Invitation For Bid Number: 337486	Date Issued: 03/23/2016	1 of	11
1. Description: 331 – 200 T Chiller Replacement		2. NAICS Code: 236220	3. Contract / Modification Number:		
5. Solicitation Method: <input checked="" type="checkbox"/> Invitation for Bid (IFB) - (Sealed Bid) <input type="checkbox"/> Request for Proposal (RFP) - (Negotiated)		6. Type of Contract: <input checked="" type="checkbox"/> Fixed Price <input type="checkbox"/> Labor-Hour / Time-and-Material <input type="checkbox"/> Cost Reimbursable <input type="checkbox"/> Indefinite Quantity			
4. This Solicitation has been set aside for Small Business Concerns: YES <input type="checkbox"/> NO <input checked="" type="checkbox"/>					

(a) SOLICITATION

Sealed offers for furnishing the supplies or services in the Schedule will be received at the place specified in box 7, or if hand-carried, delivered to the contact person in box 9 until 2:00 p.m. local time. In sealed bid solicitations "offer" and "offeror" mean "bid" and "bidder." All offers are subject to the terms and conditions in this solicitation.

<p>7. Address Offer to:</p> <p>Battelle Memorial Institute, Pacific Northwest Division 902 Battelle Boulevard Attn: Mail Stop: J2-05 Richland, Washington 99352</p>	<p align="center">10. TABLE OF CONTENTS</p> <p>Invitation for Bid <i>(self-deletes upon award)</i></p> <p>Instructions to Bidders <i>(self-deletes upon award)</i></p> <p align="center">Part I – The Schedule</p> <p><input checked="" type="checkbox"/> Section A (A) Contract Form (and Rate Sheets)</p> <p><input checked="" type="checkbox"/> Sections B - H (B) Supplies or Services, (C) Description of the Work, (D) Packaging and Marking, (E) Inspection and Acceptance, (F) Deliveries or Performance, (G) Contract Administration Data, (H) Special Contract Requirements</p> <p align="center">Part II – Contract Clauses</p> <p><input checked="" type="checkbox"/> Section I Contract Clauses</p> <p align="center">Part III - List of Documents, Exhibits and Attachments</p> <p><input checked="" type="checkbox"/> Section J Attachments & Representations and Certifications</p>
<p>8. Offer Due Date:</p> <p>04/08/2016, 10:00 PM PDT</p>	
<p>9. For Information Call:</p> <p>Garrett Hyatt Office Phone: 509-371-7591 E-Mail Address: garrett.hyatt@pnnl.gov</p>	

(b) OFFER (Completed by Offeror)

Period for Acceptance of Offers. In compliance with the above, the undersigned agrees, if this offer is accepted within 90 calendar days from the date of receipt of offers specified above, to furnish any or all items upon which prices are offered at the price set opposite each item, delivered at the designated point(s), within the time specified.

11. Acknowledgement of Amendments	1 2 3 4 5 6 7 8 9 10
The Offeror acknowledges receipt of Solicitation Amendment Numbers:	<input type="checkbox"/>
12. Company Name and Address:	13. Name and Title of Person Authorized to Sign Offer: Name: _____ Title: _____
14. Offer Amount: YES <input type="checkbox"/> NO <input type="checkbox"/> <i>Bid Summary Attached</i>	15. Authorized Signature of the Offeror: _____
Total Bid Price: \$	16. Offer Date: _____

(c) AWARD (Completed by Battelle)

17. Contract Price: \$	18. Contract Number:	19. Contract Term: Through 04/28/2016	20. Award Date:
21. Battelle Authorization: Your offer is hereby accepted as to the items listed above. This award consummates the contract which consists of the following documents: (a) the Battelle Solicitation, (b) your offer, and (c) this award/contract. No further contractual document is necessary.			
Garrett V. Hyatt <i>(Name of Sr. Contracts Professional)</i>		_____ <i>(Signature Authorizing Award)</i>	
		_____ <i>(Date)</i>	

331 – 200 T Chiller Replacement

B. SERVICES AND PRICES/COST

1. **LUMP SUM BID:** The following Contract Line Item Numbers (CLIN's) and Bid options shall be individually priced within the Contractor's Lump Sum Price:

CLIN 1: Replace 331 - 300 T Chiller

2. **CLIN 1:** The CLIN shall be individually priced and included with the Contractors proposal. Prices to be good for 90 days.

3. **BASIS OF AWARD:** Award shall be made on the basis of the bottom line, lump sum, lowest priced responsive bid from a responsible pre-qualified contractor, totaling CLIN 1 as a Single bid price.

C. DESCRIPTION OF THE WORK

1. **GENERAL.** Contractor shall perform all construction services, and provide all material, means and methods, equipment, tools and labor, necessary to complete the Work described in and reasonably inferable from the Contract Documents. The Work generally includes providing labor, materials, equipment, means and methods to complete the project.

2. **SPECIFIC.** The Work includes but is not limited to the specific scope elements listed in the Div. 1, Statement of Work and the drawings.

3. **SEQUENCING:** Work Sequencing and Interim Completion Milestones of identified portions of the Work shall be in accordance with the "Work Sequence" requirements of Division 1.

D. PACKAGING AND MARKING

(Reserved)

E. INSPECTION AND ACCEPTANCE

Battelle has the right to inspect and evaluate the Work performed or being performed under the Contract, and the premises where the Work is being performed, at all reasonable times and in a manner that will not unduly delay the Work. If Battelle performs inspection or evaluation on the premises of the Contractor or a Subcontractor, the Contractor shall furnish and shall require Subcontractors to furnish all reasonable facilities and assistance for the safe and convenient performance of these duties.

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F. PERIOD OF PERFORMANCE

1. **DATE OF COMMENCEMENT.** The Work shall commence as soon as possible upon Contractor's receipt of Notice to Proceed (NTP) unless the parties mutually agree otherwise in writing.

2. **CONTRACT COMPLETION.**

(a) **Work Sequencing/Interim Milestones.** Work Sequencing, Interim Milestones and/or Substantial Completion of identified portions of the Work shall be in accordance with the "Work Sequence" requirements of Division 1.

(b) **Final Completion.** **331 – 200 T Chiller Replacement Final Completion** to be not later than **04/28/2016**.

3. **TIME IS OF THE ESSENCE.** Battelle and Contractor mutually agree that time is of the essence with respect to the dates and times set forth in the Contract Documents.

G. CONTRACT ADMINISTRATION

1. **GENERAL.** The Contractor is solely responsible for strict compliance with all requirements of this Contract. No notice, communication or representation in any form or from any person other than a Battelle Contracts Representative shall be effective to relieve the Contractor of such obligation or to stop Battelle from enforcing the Contract exactly according to its written terms.

2. **CONTRACT AUTHORITY.** Contracting authority in Battelle is by formal delegation to named individuals. Contract authority for this Work has been delegated to:

Name: **Garrett Hyatt**
Title: **Sr. Contract Specialist**
Phone: **509-371-7591**
Cell Phone: **509-420-3051**
Email: garrett.hyatt@pnnl.gov

Notwithstanding any of the other provisions of the Contract, a named and authorized Battelle Contract Representative shall be the only individual on behalf of Battelle authorized to accept nonconforming Work; waive any requirement of this Contract; or take any action involving a change in the scope, price, terms, or conditions of this Contract.

3. **INTERPRETATION AND INTENT.** The Contract Documents are intended to permit the parties to complete the Work and all obligations required by the Contract Documents within the Contract Time(s) for the Contract Price. The Contract Documents are intended to be complementary and interpreted in harmony so as to avoid conflict, with words and phrases

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interpreted in a manner consistent with construction and design industry standards. In the event of any inconsistency, conflict, or ambiguity between or among the Contract Documents, the order of precedence shall be in accordance with the General Provisions.

The Contract Documents form the entire agreement between Battelle and Contractor and by incorporation herein are as fully binding on the parties as if repeated herein. No oral representations or other agreements have been made by the parties except as specifically stated in the Contract Documents.

4. **INVOICING AND PAYMENT.** Submit invoices electronically to ap.invoices@pnnl.gov. Invoices may not be submitted more frequently than monthly. Payments can be made electronically by wire (foreign payments) or ACH (domestic payments) by filling out the ACH form at <http://www.pnnl.gov/contracts/contractdocuments.aspx>. Failure to comply with electronic processing may result in a delay in payment. Payments Terms are Net 30 from the date received.

5. **TECHNICAL DIRECTION.** The Contractor's progress and compliance with the technical requirements of this Contract will be monitored for Battelle by a Technical Oversight Representative (TOR). The TOR is authorized to receive information, conduct inspections of Work in process and witness Contractor tests. He/she has no authority to: change or waive any provision of this Contract, including but not limited to Statements of Work, drawings, specifications and standards, whether attached or incorporated by reference; provide interpretations of any provision or requirement of this Contract; direct, advise, or recommend any particular course of conduct on the part of the Contractor; or create any legally binding commitment on behalf of Battelle. The TOR for this Work will be:

Name: **Dan Ryan**
Title: **Project Manager**
Phone: **509-371-7995**
Email: dan.ryan@pnnl.gov

H. SPECIAL REQUIREMENTS

1. BID GUARANTEE [*Adapted from FAR 52.228-1 (Sept 1996)*]

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to Battelle, postal money order, certified check, cashier's check, or irrevocable letter of credit. Battelle will return bid guarantees, other than bid bonds—

(1) To unsuccessful bidders as soon as practicable after the opening of bids; and

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- (2) To the successful bidder upon execution of Contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.
- (c) The amount of the bid guarantee shall be 20% percent of the bid price or **\$3,000,000, whichever is less.**
- (d) If the successful bidder, upon acceptance of its bid by Battelle within the period specified for acceptance, fails to execute all Contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, Battelle may terminate the Contract for default.
- (e) In the event the Contract is terminated for default, the bidder is liable for any cost of acquiring the Work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

2. CONTRACTOR PREQUALIFICATION

- (a) Contractors must meet Battelle's minimum qualification requirements to be eligible to Contract with Battelle directly as a Prime Contractor, or participate as a Subcontractor to a Prime Contractor performing Work on-site. Battelle's Prime Contractor and Subcontractor qualification requirements are posted on our Acquisition website at <https://ebs.pnnl.gov/>. Any required supporting documents should be attached electronically and submitted with the completed Qualification Statements. Contractors will be notified by email of the acceptability of their qualifications.
- (b) Bids will be accepted from pre-qualified Contractors ONLY.
- (c) Prior to any Subcontractor(s) performing Work on-site as a lower tier to a Contractor having a Contract with Battelle, the Subcontractor(s) must also be accepted as meeting Battelle's qualification requirements.

3. IMPLEMENTATION OF THE HANFORD SITE STABILIZATION AGREEMENT

- (a) The Hanford Site Stabilization Agreement (HSSA) for all construction work for the U. S. Department of Energy (DOE) at the Hanford Site, which is referenced in this Clause, consists of a Basic Agreement dated September 10, 1984, plus Appendix A, both of which may be periodically amended. The HSSA is hereby incorporated into this Contract by reference. The Contractor is responsible for obtaining the most current text from DOE.

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(b) This Clause applies to employees performing work under Contracts (or subcontracts) administered by DOE which are subject to the *Davis-Bacon Act*, in the classifications set forth in the HSSA for work performed at the Hanford Site.

(c) Contractors and subcontractors at all tiers who are parties to an agreement(s) for construction work with a Local Union having jurisdiction over DOE construction work performed at the Hanford Site, or who are parties to a national labor agreement for such construction work, shall become signatory to the HSSA and shall abide by all of its provisions, including its Appendix A. Subcontractors at all tiers who have subcontracts with a signatory Contractor or subcontractor shall become signatory to the HSSA and shall abide by all of its provisions, including its Appendix A.

(d) Contractors and subcontractors at all tiers who are not signatory to the HSSA and who are not required under paragraph (c) above to become signatory to the HSSA, shall pay not less and no more than the wages, fringe benefits, and other employee compensation set forth in Appendix A thereto and shall adhere, except as otherwise directed by the Contracting Officer, to the following provisions of the Agreement:

- (1) Article VII Employment (Section 2 only);
- (2) Article XII Non-Signatory Contractor Requirements;
- (3) Article XIII Hours of Work, Shifts, and Overtime;
- (4) Article XIV Holidays;
- (5) Article XV Wage Scales and Fringe Benefits (Sections 1 and 2 only);
- (6) Article XVII Payment of Wages-Checking In and Out (Section 3 only);
- (7) Article XX General Working Conditions; and
- (8) Article XXI Safety and Health.

(e) The Contractor agrees to make no contributions in connection with this Contract to Industry Promotion Funds, or similar funds, except with the prior approval of the Contracting Officer.

(f) The obligation of the Contractor and its subcontractors to pay fringe benefits shall be discharged by making payments required by this Contract in accordance with the provisions of the amendments to the *Davis-Bacon Act* contained in the Act of July 2, 1964 (Public Law 88-349-78 Statutes 238-239), and U.S. Department of Labor regulations in implementation thereof (Code of Federal Regulations Title 29 Parts 1 and 5).

(g) The Contracting Officer may direct the Contractor to pay amounts for wages, fringe benefits, and other employee compensation if the HSSA, including its Appendix A, is modified by the involved parties.

(h) In the event of failure to comply with paragraphs (c) (d) (e) (f) and (g), or failure to perform any of the obligations imposed upon the Contractor and its subcontractors hereunder, the Contracting Officer may withhold any payments due to the Contractor and may terminate the Contract for default.

(i) The rights and remedies of the Government provided in this Clause shall not be exclusive and are in addition to any other rights and remedies of the Government provided by law or under this Contract.

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(j) The requirements of this Clause are in addition to, and shall not relieve the Contractor of, any obligation imposed by other Clauses of this Contract, including Section I Clauses entitled, *FAR 52.222-4, Contract Work Hours and Safety Standards Act—Overtime Compensation, FAR 52.222-6, Davis-Bacon Act, FAR 52.222-7, Withholding of Funds, FAR 52.222-8, Payrolls and Basic Records, FAR 52.222-10, Compliance with Copeland Act Requirements, and FAR 52.222-12, Contract Termination – Debarment.*

(k) The Contractor agrees to maintain its bid or proposal records showing rates and amounts used for computing wages and other compensation, and its payroll and personnel records during the course of work subject to this Clause, and to preserve such records for a period of three (3) years thereafter, for all employees performing such work. Such records will contain the name and address of each such employee, his/her correct classification, rate of pay, daily and weekly number of hours worked, and dates and hours of the day within which work was performed, deductions made, and amounts for wages and other compensation covered by paragraphs (c) (d) (e) (f) and (g) hereof. The Contractor agrees to make these records available for inspection by the Contracting Officer and will permit him/her to interview employees during working hours on the job.

(l) The Contractor agrees to insert the provisions of this Clause including this paragraph

(k) In all subcontracts for the performance of work subject to the *Davis-Bacon Act*.

A copy of the *Hanford Site Stabilization Agreement* is located at: <http://www.hanford.gov>

The U.S. Department of Labor wage determinations for the *Davis-Bacon Act* and *Service Contract Act* are located at: <http://www.wdol.gov>

4. Environment, Safety, and Health Requirements – PNNL F&O Sponsored Work Sites (JPP/WEA/JSA) (cl. 3113b – Apr 2015)

- A. In performing any work under this contract on property or facilities owned or controlled by Battelle that are identified as PNNL Work Sites (hereinafter “onsite”), the Contractor shall comply with all applicable federal, state and local environment, safety, and health laws and regulations. The Contractor shall also comply with 10 CFR 851, DOE Worker Safety and Health Program, and DEAR 970.5223-1, Integration of Environment, Safety and Health (ES&H) into Work Planning and Execution (Dec. 2000). In order to comply with the requirements of 10 CFR 851 and DEAR 970.5223-1, the Contractor shall be guided by the principles set forth below.
- B. The Contractor shall perform work safely and in a manner that ensures adequate protection for employees, the public, and the environment, and shall be accountable for the safe performance of work. The Contractor shall exercise a degree of care commensurate with the work and the associated hazards. The Contractor shall ensure that management of ES&H functions and activities becomes an integral but visible part of the Contractor’s work planning and execution processes. The Contractor shall, in the performance of work, ensure that—

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1. Line management is responsible for the protection of employees, public, and the environment. Line management includes those contractor and subcontractor employees managing and supervising employees performing work.
 2. Clear and unambiguous lines of authority and responsibility for ensuring (ES&H) are established and maintained at all organizational levels.
 3. Personnel possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities, and shall retain records respecting such competency and qualifications, making them available upon request.
 4. Resources are effectively allocated to address ES&H, programmatic, and operational considerations. Protecting employees, the public, and the environment is a priority whenever activities are planned and performed.
 5. Before work is performed, the associated hazards are evaluated and a set of ES&H standards and requirements are established which, if properly implemented, provide adequate assurance that employees, the public, and the environment are protected from adverse consequences.
 6. Administrative and engineering controls to prevent and mitigate hazards are tailored to the work being performed and associated hazards. Emphasis should be on designing the work and/or controls to reduce or eliminate the hazards and to prevent accidents and unplanned releases and exposures.
- c. The Contractor, relative to the Statement of Work and contract specifications, shall be able to demonstrate through documentation and work practices that its performance of work under this contract—
1. Fulfilled the scope of work as outlined in this contract
 2. Identified and analyzed specific, task-level hazards associated with the work
 3. Developed and implemented hazard controls related to the hazards
 4. Allowed the performance of work within the controls
 5. Provided feedback to Battelle and Contractor employees on adequacy of hazard controls
- d. The Contractor shall perform work in accordance with a DOE-approved Worker Safety and Health Program (also referred to in the DEAR as a Safety Management Plan) as described below:
1. The Contractor shall demonstrate well-established safety protocols applicable to the scope of work and consistent with the required elements stated in this clause. Prior to the initiation of any onsite work, the Contractor shall either—
 - a. Accept and incorporate Battelle's PNNL Contractor Environment Safety and Health (CES&H) Manual as its own. The Battelle Contracts Representative can provide a hard copy of the manual upon request. In those cases where the Contractor's onsite activities are limited to an office or meeting

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environment, with no additional or unusual hazards, the CES&H Manual requirements can be met through review of the Visitor Orientation Pamphlet. Both the CES&H Manual and the Visitor Orientation Pamphlet are available on-line at <http://www.pnnl.gov/contracts/Forms.aspx?area=Procurement>.

- b. Submit its own 10 CFR 851 and DEAR 970.5223-1 compliant Worker Safety and Health Program (WSHP) document to the Battelle Contracts Representative. The Battelle Contracts Representative will coordinate the review and approval of the program document by DOE. The Contractor will be notified by the Battelle Contracts Representative of the program document's approval by DOE. Acceptance of the Contractor's program document will be at the sole discretion of DOE.
2. The Contractor will be provided a completed Job Planning Package (JPP) and Workplace Exposure Assessment (WEA) in the Invitation for Bid (IFB) or Request for Proposal (RFP). The completed JPP and WEA, which are a part of this contract, incorporate elements of effective job planning and hazard identification. Elements include identifying: the scope of work to be performed; facility operating requirements; potential hazards to Battelle and Contractor staff, the public and environment created by the work performed; hazard control methods and mitigation; and mechanisms to evaluate the adequacy of those controls. The JPP and WEA are key control processes in the safe conduct of work at Battelle. The Contractor is expected to develop their work sequence and job safety analysis (JSA) including information provided within the JPP and WEA in order to access Battelle property or facilities and initiate work.
- E. The Contractor shall perform the following additional hazard identification tasks consistent with an approved WSHP:
 1. The Contractor shall be responsible for identifying all potential occupational exposures that its employees and the employees of its lower-tier subcontractors will be exposed to while performing any work under this
 2. The Contractor shall assure that its employees and those of any lower-tiered subcontractor are medically qualified to perform work associated with any potential occupational exposures that have been identified. Medical qualification and medical surveillance programs are the sole responsibility of the Contractor. In addition, the Contractor is responsible for maintaining any records associated with the administration of these programs.
 3. For each of its employees and each of its lower-tier subcontract employees that the Contractor has identified as having potential occupational exposures that require enrollment in a medical surveillance or medical qualification program, the Contractor shall provide its Occupational Medical provider with the following information:
 - a. Current information about actual or potential work-related site hazards (chemical, radiological, physical, biological, or ergonomic);

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- b. Employee job-task and hazard analysis information, including essential job functions;
 - c. Actual or potential work-site exposures of each employee; and
 - d. Personnel actions resulting in a change of job functions such that a change of hazards, or exposures results.
4. For each of its employees and each of its lower-tier subcontract employees, a copy of the exposure information provided to the Contractor's occupational medical provider shall be submitted to the Battelle Contracts Representative and approved by Battelle before any of these employees begin work under this contract.
- F. The Contractor shall notify the Battelle Contracts Representative immediately of any OSHA-recordable injuries/illnesses, any "off-normal occurrences," or Government property damaged, that the Contractor determines to have occurred in the course of operations onsite and shall furnish such further information as the Battelle Contracts Representative may require. An "off-normal occurrence" is any unplanned or unexpected event, including near misses, or the discovery of a deficiency in a procedure, plan, or system that has real or potentially undesirable consequences to personnel, equipment, facilities, the environment, and/or programs.
- G. The Contractor's onsite ES&H activities will be subject to review by the Technical Oversight Representative of this contract. Other representatives of Battelle may conduct periodic inspections of the Contractor's equipment, work and storage areas for compliance with the applicable ES&H requirements. The Battelle Contracts Representative will notify the Contractor by a written Notice of Non-compliance of any observed non-compliance with applicable ES&H requirements. The Contractor shall immediately take appropriate corrective action. The Contractor shall advise the Battelle Contracts Representative, in writing, within five (5) working days of the corrective action taken on any safety non-compliance noted on the written Notice of Non-compliance. If the Contractor fails or refuses to correct the safety non-compliance, Battelle may perform, or cause to be performed, the necessary corrective work and unilaterally charge the Contractor for the cost thereof. Such charges will be deducted from payments otherwise due the Contractor under this contract.
- H. The Contractor shall promptly evaluate and resolve any non-compliance with applicable ES&H requirements. If the Contractor fails to provide resolution or if, at any time, the Contractor's acts or failure to act causes substantial harm or an imminent danger to the environment, or health and safety of employees or the public, the Battelle Contracts Representative may issue an order stopping work in whole or in part and the Contractor shall be liable for the delay and any costs thereby incurred. Any stop-work order issued by Battelle under this clause (or issued by the Contractor to a subcontractor in accordance with this clause) shall be without prejudice to any other legal or contractual rights of Battelle. In the event that the Battelle Contracts Representative issues a stop-work order, an order authorizing the resumption of the work may be issued at the discretion of the Battelle Contracts Representative. The

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Contractor shall not be entitled to an extension of time, or additional cost or fee, or damages by reason of, or in connection with, any work stoppage ordered in accordance with this clause.

i. Employee Concerns Program

1. The Contractor, its agents, employees or subcontractors, are entitled to use the Battelle Employee Concerns Program and Hotline (509) 375-3999. The Hotline operates 24 hours per day, 7 days a week. Messages may be left anonymously, and all concerns are handled with confidentiality to the maximum extent possible. Employee concerns may also be submitted in writing to the Battelle Employee Concerns Office, Battelle, Pacific Northwest National Laboratory, P.O. Box 999, K1-42, Richland, Washington, 99352, or in person at the Staff Concerns Office, Battelle's Research Operation Building during normal business hours, Monday through Friday 7:30 a.m. to 4:30 p.m.
2. For the purpose of this document, allegations, concerns, and complaints are handled in a like manner and are referred to collectively as "employee concerns." A concern can consist of a declaration, statement, or assertion of impropriety or inadequacy on the part of one's employer or others at a DOE Site that has affected (or threatens to affect) aspects of operations, such as the environment, health, safety, quality, or security, and may include fraud, mismanagement, waste, or abuse of authority.
3. No retaliation or retribution shall be taken toward any individual as a result of filing an employee concern consistent with 10 CFR 708.

j. Civil Penalties and Indemnification

1. The 2002 Bob Stump National Defense Authorization Act amended the Atomic Energy Act by adding section 234C "Worker Health and Safety Rules for Department of Energy Nuclear Facilities." It required DOE to promulgate a worker safety and health rule, published in the Federal Register on February 9, 2006, as 10 CFR 851. It establishes worker safety and health requirements that govern the conduct of contractor activities at both nuclear and non-nuclear DOE Sites. Contractors that fail to comply with the Rule are subject to civil penalties or contract penalties.
 2. The Contractor assumes full responsibility and shall indemnify, hold harmless, and defend Battelle, its directors, officers, and employees from any civil or contractual liability under section the implementing regulations, arising out of the activities of the Contractor, its subcontractors, suppliers, agents, employees, and their officers, or directors. The Contractor's obligation to indemnify and hold harmless shall expressly include attorney fees and other reasonable costs of defending any action or proceeding instituted under section 234C or DOE's implementing regulations.
- k. Contractor is responsible to ensure that its direct hired and Subcontractor employees who will work on the Site be free of physical or cognitive impairment resulting from the use of alcohol or drugs, including legal drugs, when working or involved in any activity**



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on Battelle/PNNL premises. In order to achieve the federal Drug Free Workplace Act standards, Battelle/PNNL prohibits its non-staff and subcontractors from illegally manufacturing, distributing, selling, possessing, or using illegal drugs, including marijuana, or being under the influence of alcohol while on Battelle/PNNL premises or during PNNL activities. Individuals suspected of being under the influence of any substance, legal or illegal, that may impair their ability to perform their duties are subject to termination of their work agreements and/or having access to the Battelle/PNNL premises revoked. If Battelle, or the Contractor or Subcontractor believes that a Contractor or Subcontractor employee's job performance is being adversely affected by drug or substance (including alcohol) use, Battelle may direct the Contractor to remove the employee. Examples of behavior or circumstances indicating possible drug or substance abuse are observed use, possession, sale or delivery, or credible information that an individual is using suspected of being impaired by drugs or abusing alcohol, or an accident or injury.

- L. The Contractor is responsible for its subcontractors' compliance with the ES&H requirements of this contract. The Contractor shall include a clause substantially the same as this clause in lower-tier subcontracts involving work at on property or facilities owned or controlled by Battelle that are identified as PNNL Work Sites. Such subcontracts shall provide for the right to stop work under the conditions described herein.

****** END OF SECTION ******

Environment, Safety, and Health Requirements – PNNL F&O Sponsored Work Sites (JPP/WEA/JSA) (cl. 3113b – Feb. 2012)

- A. In performing any work under this contract on property or facilities owned or controlled by Battelle that are identified as PNNL Work Sites (hereinafter "onsite"), the Contractor shall comply with all applicable federal, state and local environment, safety, and health laws and regulations. The Contractor shall also comply with 10 CFR 851, DOE Worker Safety and Health Program, and DEAR 970.5223-1, Integration of Environment, Safety and Health (ES&H) into Work Planning and Execution (Dec. 2000). In order to comply with the requirements of 10 CFR 851 and DEAR 970.5223-1, the Contractor shall be guided by the principles set forth below.
- B. The Contractor shall perform work safely and in a manner that ensures adequate protection for employees, the public, and the environment, and shall be accountable for the safe performance of work. The Contractor shall exercise a degree of care commensurate with the work and the associated hazards. The Contractor shall ensure that management of ES&H functions and activities becomes an integral but visible part of the Contractor's work planning and execution processes. The Contractor shall, in the performance of work, ensure that—
1. Line management is responsible for the protection of employees, public, and the environment. Line management includes those contractor and subcontractor employees managing and supervising employees performing work.
 2. Clear and unambiguous lines of authority and responsibility for ensuring (ES&H) are established and maintained at all organizational levels.
 3. Personnel possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities, and shall retain records respecting such competency and qualifications, making them available upon request.
 4. Resources are effectively allocated to address ES&H, programmatic, and operational considerations. Protecting employees, the public, and the environment is a priority whenever activities are planned and performed.
 5. Before work is performed, the associated hazards are evaluated and a set of ES&H standards and requirements are established which, if properly implemented, provide adequate assurance that employees, the public, and the environment are protected from adverse consequences.
 6. Administrative and engineering controls to prevent and mitigate hazards are tailored to the work being performed and associated hazards. Emphasis should be on designing the work and/or controls to reduce or eliminate the hazards and to prevent accidents and unplanned releases and exposures.
- C. The Contractor, relative to the Statement of Work and contract specifications, shall be able to demonstrate through documentation and work practices that its performance of work under this contract—
1. Fulfilled the scope of work as outlined in this contract
 2. Identified and analyzed specific, task-level hazards associated with the work
 3. Developed and implemented hazard controls related to the hazards
 4. Allowed the performance of work within the controls
 5. Provided feedback to Battelle and Contractor employees on adequacy of hazard controls
- D. The Contractor shall perform work in accordance with a DOE-approved Worker Safety and Health Program (also referred to in the DEAR as a Safety Management Plan) as described below:
1. The Contractor shall demonstrate well-established safety protocols applicable to the scope of work and consistent with the required elements stated in this clause. Prior to the initiation of any onsite work, the Contractor shall either—
 - a. Accept and incorporate Battelle's PNNL Contractor Environment Safety and Health Manual (<http://www.pnl.gov/contracts/esh-procedures/>) as its own. The Battelle Contracts Representative can provide a hard copy of the manual upon request. In those cases where the Contractor's onsite activities are limited to an office or meeting environment, with no additional or unusual hazards, the CES&H Manual requirements can be met through review of the Visitor Orientation Pamphlet, available on-line at <http://www.pnl.gov/contracts/esh-procedures/>.
 - b. Submit its own 10 CFR 851 and DEAR 970.5223-1 compliant Worker Safety and Health Program (WSHP) document to the Battelle Contracts Representative. The Battelle Contracts Representative will coordinate the review and approval of the program document by DOE. The Contractor will be notified by the Battelle Contracts Representative of the program document's approval by DOE. Acceptance of the Contractor's program document will be at the sole discretion of DOE.
 2. The Contractor will be provided a completed Job Planning Package (JPP) and Workplace Exposure Assessment (WEA) in the Invitation for Bid (IFB) or Request for Proposal (RFP). The completed JPP and WEA, which are a part of this contract, incorporate elements of effective job planning and hazard identification. Elements include identifying: the scope of work to be performed; facility operating requirements; potential hazards to Battelle and Contractor staff, the public and environment created by the work performed; hazard control methods and mitigation; and mechanisms to evaluate the adequacy of those controls. The JPP and WEA are key control processes in the safe conduct of work at Battelle. The Contractor is expected to develop their work sequence and job safety analysis (JSA) including information provided within the JPP and WEA in order to access Battelle property or facilities and initiate work.
- E. The Contractor shall perform the following additional hazard identification tasks consistent with an approved WSHP:
1. The Contractor shall be responsible for identifying all potential occupational exposures that its employees and the employees of its lower-tier subcontractors will be exposed to while performing any work under this contract.

2. The Contractor shall assure that its employees and those of any lower-tiered subcontractor are medically qualified to perform work associated with any potential occupational exposures that have been identified. Medical qualification and medical surveillance programs are the sole responsibility of the Contractor. In addition, the Contractor is responsible for maintaining any records associated with the administration of these programs.
 3. For each of its employees and each of its lower-tier subcontract employees that the Contractor has identified as having potential occupational exposures that require enrollment in a medical surveillance or medical qualification program, the Contractor shall provide its Occupational Medical provider with the following information:
 - a. Current information about actual or potential work-related site hazards (chemical, radiological, physical, biological, or ergonomic);
 - b. Employee job-task and hazard analysis information, including essential job functions;
 - c. Actual or potential work-site exposures of each employee; and
 - d. Personnel actions resulting in a change of job functions such that a change of hazards, or exposures results.
 4. For each of its employees and each of its lower-tier subcontract employees, a copy of the exposure information provided to the Contractor's occupational medical provider shall be submitted to the Battelle Contracts Representative and approved by Battelle before any of these employees begin work under this contract.
- F. The Contractor shall notify the Battelle Contracts Representative immediately of any OSHA-recordable injuries/illnesses, any "off-normal occurrences," or Government property damaged, that the Contractor determines to have occurred in the course of operations onsite and shall furnish such further information as the Battelle Contracts Representative may require. An "off-normal occurrence" is any unplanned or unexpected event, including near misses, or the discovery of a deficiency in a procedure, plan, or system that has real or potentially undesirable consequences to personnel, equipment, facilities, the environment, and/or programs.
- G. The Contractor's onsite ES&H activities will be subject to review by the Technical Administrator of this contract. Other representatives of Battelle may conduct periodic inspections of the Contractor's equipment, work and storage areas for compliance with the applicable ES&H requirements. The Battelle Contracts Representative will notify the Contractor by a written Notice of Non-compliance of any observed non-compliance with applicable ES&H requirements. The Contractor shall immediately take appropriate corrective action. The Contractor shall advise the Battelle Contracts Representative, in writing, within five (5) working days of the corrective action taken on any safety non-compliance noted on the written Notice of Non-compliance. If the Contractor fails or refuses to correct the safety non-compliance, Battelle may perform, or cause to be performed, the necessary corrective work and unilaterally charge the Contractor for the cost thereof. Such charges will be deducted from payments otherwise due the Contractor under this contract.
- H. The Contractor shall promptly evaluate and resolve any non-compliance with applicable ES&H requirements. If the Contractor fails to provide resolution or if, at any time, the Contractor's acts or failure to act causes substantial harm or an imminent danger to the environment, or health and safety of employees or the public, the Battelle Contracts Representative may issue an order stopping work in whole or in part and the Contractor shall be liable for the delay and any costs thereby incurred. Any stop-work order issued by Battelle under this clause (or issued by the Contractor to a subcontractor in accordance with this clause) shall be without prejudice to any other legal or contractual rights of Battelle. In the event that the Battelle Contracts Representative issues a stop-work order, an order authorizing the resumption of the work may be issued at the discretion of the Battelle Contracts Representative. The Contractor shall not be entitled to an extension of time, or additional cost or fee, or damages by reason of, or in connection with, any work stoppage ordered in accordance with this clause.
- I. Employee Concerns Program
1. The Contractor, its agents, employees or subcontractors, are entitled to use the Battelle Employee Concerns Program and Hotline (509) 375-3999. The Hotline operates 24 hours per day, 7 days a week. Messages may be left anonymously, and all concerns are handled with confidentiality to the maximum extent possible. Employee concerns may also be submitted in writing to the Battelle Employee Concerns Office, Battelle, Pacific Northwest National Laboratory, P.O. Box 999, K1-42, Richland, Washington, 99352, or in person at the Staff Concerns Office, Battelle's Research Operation Building during normal business hours, Monday through Friday 7:30 a.m. to 4:30 p.m.
 2. For the purpose of this document, allegations, concerns, and complaints are handled in a like manner and are referred to collectively as "employee concerns." A concern can consist of a declaration, statement, or assertion of impropriety or inadequacy on the part of one's employer or others at a DOE Site that has affected (or threatens to affect) aspects of operations, such as the environment, health, safety, quality, or security, and may include fraud, mismanagement, waste, or abuse of authority.
 3. No retaliation or retribution shall be taken toward any individual as a result of filing an employee concern consistent with 10 CFR 708.
- J. Civil Penalties and Indemnification
1. The 2002 Bob Stump National Defense Authorization Act amended the Atomic Energy Act by adding section 234C "Worker Health and Safety Rules for Department of Energy Nuclear Facilities." It required DOE to promulgate a worker safety and health rule, published in the Federal Register on February 9, 2006, as 10 CFR 851. It establishes worker safety and health requirements that govern the conduct of contractor activities at both nuclear and non-nuclear DOE Sites. Contractors that fail to comply with the Rule are subject to civil penalties or contract penalties.
 2. The Contractor assumes full responsibility and shall indemnify, hold harmless, and defend Battelle, its directors, officers, and employees from any civil or contractual liability under section 234C of the Atomic Energy Act of 1954, as amended, or

the implementing regulations, arising out of the activities of the Contractor, its subcontractors, suppliers, agents, employees, and their officers, or directors. The Contractor's obligation to indemnify and hold harmless shall expressly include attorney fees and other reasonable costs of defending any action or proceeding instituted under section 234C or DOE's implementing regulations.

- K. The Contractor is responsible for its subcontractors' compliance with the ES&H requirements of this contract. The Contractor shall include a clause substantially the same as this clause in lower-tier subcontracts involving work at on property or facilities owned or controlled by Battelle that are identified as PNNL Work Sites. Such subcontracts shall provide for the right to stop work under the conditions described herein.



GENERAL PROVISIONS
Fixed Price Construction Contracts
For the Pacific Northwest National Laboratory
Operated by Battelle Memorial Institute

Battelle Memorial Institute has executed and is engaged in the performance of Prime Contract DE-AC05-76RL01830 with the United States Department of Energy (DOE), for the management, operation, and maintenance of the Pacific Northwest National Laboratory (PNNL) in Richland, Washington. This contract is entered into in furtherance of the performance of the work provided in the Prime Contract, and is subject to the following general provisions:

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GENERAL

1. Introduction

- A. The construction covered by this Contract shall be furnished subject to the terms and conditions set forth herein.
- B. This Contract is the complete and exclusive statement of the terms of the agreement between Contractor and Battelle.
- C. No modification of this Contract (including any addition, deletion, or other modification proposed in Contractor's acceptance) shall be binding on Battelle unless agreed to by an authorized Battelle Contracts representative in writing.
- D. If any of the clauses included or incorporated into these General Provisions do not apply to the Contract Work, such clauses are considered to be self-deleting.

2. Definitions

As used throughout this Contract, the following terms shall have the meaning set forth below:

- A. "Battelle" means Battelle Memorial Institute, in the performance of its prime Contract with The United States of America and includes any duly authorized representative thereof acting within authorized limits.
- B. "Contracting Officer" means the Battelle Contracts Representative.
- C. "Contractor" means the entity under Contract with Battelle responsible for execution of all construction work described within the Contract documents.
- D. "Construction worksite," "Site of the work," and "Site" are equivalent terms for purpose of this Contract and have the meaning given in 10 CFR 851 for Construction worksite as follows:
- E. "Construction worksite is the area within the limits necessary to perform the work described in the construction procurement or authorization document. It includes the facility being constructed or renovated along with all necessary staging and storage areas, as well as adjacent areas subject to project hazards."
- F. "DOE" means U. S. Department of Energy or any duly authorized representative thereof.
- G. "DEAR" means Department of Energy Acquisition Regulation, including all amendments and changes thereto in effect on the date of issuance of this Contract.
- H. "FAR" means Federal Acquisition Regulation, including all amendments and changes thereto in effect on the date of issuance of this Contract.
- I. "Government" means The United States of America, and shall include Battelle to the extent necessary to enable Battelle to administer this Contract and to perform its obligations under its Government prime Contract.
- J. "Subcontract(s)" and "Subcontractor(s)" includes this Contract when used in a FAR or DEAR clause referring to a prime and Subcontractor relationship. Otherwise, it means Contractor's lower tier Subcontract(s) and Subcontractor(s), respectively. The term "Subcontract" includes purchase orders and

changes, modifications, or amendments to Subcontracts and purchase orders.

3. Acceptance of Contract Terms and Conditions (cl 302 – October 2008)

The Contractor, by signing this Contract or performing the services and/or delivering the supplies identified herein, agrees to comply with all the terms and conditions and all specifications and other documents that this Contract incorporates by reference or attachment. Battelle hereby objects to any terms and conditions contained in any acknowledgment of this Contract that are different from or in addition to those mentioned in this document. Failure of Battelle to enforce any of the provisions of this Contract shall not be construed as evidence to interpret the requirements of this Contract, nor a waiver of any requirements, nor of the right of Battelle to enforce each and every provision. All rights and obligations shall survive final performance of this Contract.

4. Order of Precedence - Construction

Any inconsistency in this solicitation or Contract shall be resolved by giving precedence in the following order:

- A. Contract Agreement (excluding specifications)
- B. Representations and other instructions
- C. General Provisions
- D. Division 1 Administrative Requirements
- E. Specifications
- F. Drawings

5. Assignment (cl 357 - Jan 2003)

Battelle may assign this Contract to the U.S. Department of Energy (DOE) or a designee of DOE. Upon receipt by the Contractor of written notice that DOE or its designee has been assigned this Contract, Battelle shall be relieved of all responsibility hereunder, and the Contractor shall thereafter look solely to the assignee for performance of Battelle's obligations. The Contractor shall not assign this Contract or any interest therein, nor claims thereunder without the prior written consent of Battelle or Battelle's assignee. Any assignment, by operation of law or otherwise, without prior written consent of Battelle or Battelle's assignee shall be void.

6. Pacific Northwest National Laboratory or Battelle Name (cl 374 – October 2008)

The Contractor agrees not to use Pacific Northwest National Laboratory's or Battelle's name or identifying characteristics for advertising, sales promotion, raising of capital, recommending investments or other publicity purposes that implies endorsement by the Pacific Northwest National Laboratory or Battelle without the prior written consent of Battelle. This clause shall survive the termination or expiration of this contract.

7. Insurance - Construction

- A. The Contractor shall, at its sole cost, obtain and maintain in force for the duration of the Contract (including the Guarantee period) insurance of the following types, with limits not less than those set forth below.

B. Schedule of Minimum Insurance Types and Amounts.

1. Workers Compensation Insurance shall be at a minimum as indicated below or per the statutory limits of the State where the work is to be performed, whichever is higher:
 - (i) \$1,000,000 Minimum per accident;
 - (ii) \$1,000,000 minimum per employee for bodily injury and disease.
2. General Liability Insurance:
 - (i) \$2,000,000 general aggregate limit;
 - (ii) \$1,000,000 per occurrence for bodily injury and property damage;
 - (iii) \$1,000,000 per occurrence for personal and advertising injury liability;
 - (iv) \$1,000,000 per occurrence for products / completed operations liability. The products / completed operations liability insurance shall be maintained in full force and effect for not less than three years following completion of Contractor's services.
3. Vehicle Liability Insurance:

\$1,000,000 combined single limit of liability for bodily injury and property damage per occurrence, covering the use of all owned, non-owned, and hired automobiles.
4. Tools and Equipment Insurance (Equipment Floater Insurance)

Contractor shall carry and maintain Tools and Equipment Insurance during performance of its services under the Contract, covering physical damage to or loss of all major tools and equipment, construction office trailers, and their contents, and vehicles for which Contractor is responsible.
5. Builders Risk Insurance:

Contractor shall carry and maintain Builder's Risk Insurance covering loss or damage to materials and equipment furnished by Contractor that is incorporated into the completed facility. Contractor shall be responsible for the payment of the applicable deductible (which will not exceed \$5,000 per occurrence) for each loss to such materials or equipment which are in the care, custody and control of the Contractor.

C. Proof of Insurance. Before commencing work, the Contractor shall furnish written proof to Battelle that the required insurance has been obtained. The policies evidencing the required insurance shall contain an endorsement to the effect that any cancellation or material change affecting Government or Battelle's interests shall not be effective for such period as the laws of the State in which this Contract is to be performed specify or until 30 days after the insurer or the Contractor gives written notice to Battelle, whichever period is longer.

D. Subcontractor's Commercial General Liability Insurance and Vehicle Liability Insurance. The Contractor shall insert the substance of this clause,

including this paragraph, in Subcontracts under this Contract that require work on either a Battelle or Government installation, and shall require Subcontractors to provide and maintain the kinds and minimum amounts of insurance required in the Schedule. The Contractor shall maintain a copy of all Subcontractors' proofs of required insurance, and shall make copies available to Battelle upon request.

E. Waiver of Subrogation. The Contractor hereby releases the Government and Battelle, including their directors and employees, and shall cause Contractor's Insurers to waive their rights of subrogation against such released parties, for losses or claims for bodily injury, property damage or other insured claims arising out of Contractor's performance under the Contract.

F. Claims. In the event that claims in excess of the insured amounts provided are filed by reason of any operations under the services provided by the Contractor, the amount of excess of such claims, or any portion thereof, may be withheld from payment due until such time as the Contractor shall furnish such additional security covering such claims as may be determined by Battelle.

8. Labor Harmony

- A. Battelle maintains a neutral position regarding Project Labor Agreements. This Contract Work does not mandate nor preclude participation in a Project Labor Agreement if said participation promotes the economy and efficiency in Federal procurement ascribed by Executive Order titled, "Use of Project Labor Agreements for Federal Construction Projects," dated 2/6/09.
- B. In accordance with applicable prior labor agreements, laws, regulations, codes and standards, the Contractor shall furnish labor that can work in harmony with all other elements of labor employed or to be employed on the work. Without limiting the generality of the foregoing, Labor Harmony shall include the provision of labor that will not cause, cause to be threatened or give rise to either directly or indirectly, any work disruption, slowdowns or stoppages by employees of other Contractors, while performing any work or activities incidental thereto.
- C. Award of any construction Contract is contingent upon the Contractor having an acceptable Plan for harmonizing labor on the Battelle Work site.
- D. The Contractor agrees to insert the substance of this clause, including paragraph (c), in every Subcontract issued in performance of this Contract.

9. Registration, Representations & Certifications

- A. All Contractors shall be registered in the governments Central Contractor Registration (CCR) database. Offerors and Contractors may obtain information on registration and annual confirmation requirements via the internet at <http://www.ccr.gov> or by calling 1-888-227-2423, or 269-961-5757.
 1. By submission of an offer, the offeror acknowledges the requirement to be registered in the CCR database prior to award, during performance, and through final payment of any Contract, basic agreement, basic ordering agreement, or blanket purchasing agreement

resulting from this solicitation.

2. Failure to register shall be grounds for rejection of Contractor bids and proposals.
- B. The Contractor is responsible for the accuracy and completeness of the data within the CCR database, and for any liability resulting from Battelle's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the Contractor is required to review and update on an annual basis from the date of initial registration or subsequent updates its information in the CCR database to ensure it is current, accurate and complete. Updating information in the CCR does not alter the terms and conditions of this Contract and is not a substitute for a properly executed Contractual document.
- C. In addition to registering in CCR, the offeror must also complete an annual representations and certifications electronically via the Online Representations and Certifications Application (ORCA) website at <http://orca.bpn.gov>. The Contractor is required to review and verify prior to submission of any offer that the representations and certifications currently posted electronically have been entered or updated within the last 12 months, and are current, accurate, complete, and applicable to this solicitation (including the business size standard applicable to the North American Industry Classification Code [NAICS] referenced for this solicitation), as of the date of this offer.

10. Limitations on Subcontracting (FAR 52.219-14, Nov 2011)

- A. This clause does not apply to the unrestricted portion of a partial set-aside.
- B. *Applicability.* This clause applies only to—
1. Contracts that have been set aside or reserved for small business concerns or 8(a) concerns;
 2. Part or parts of a multiple-award contract that have been set aside for small business concerns or 8(a) concerns; and
 3. Orders set aside for small business or 8(a) concerns under multiple-award contracts as described in 8.405-5 and 16.505(b)(2)(i)(F).
- C. By submission of an offer and execution of a contract, the Offeror/Contractor agrees that in performance of the contract in the case of a contract for—
1. Services (except construction). At least 50 percent of the cost of contract performance incurred for personnel shall be expended for employees of the concern.
 2. Supplies (other than procurement from a non-manufacturer of such supplies). The concern shall perform work for at least 50 percent of the cost of manufacturing the supplies, not including the cost of materials.
 3. General construction. The concern will perform at least 15 percent of the cost of the contract, not including the cost of materials, with its own employees.
 4. Construction by special trade contractors. The concern will perform at least 25 percent of the

cost of the contract, not including the cost of materials, with its own employees.

11. Performance and Payment Bonds—Construction (FAR 52.228-15, Oct 2010)

A. *Definitions.* As used in this clause—

“Original contract price” means the award price of the contract; or, for requirements contracts, the price payable for the estimated total quantity; or, for indefinite-quantity contracts, the price payable for the specified minimum quantity. Original contract price does not include the price of any options, except those options exercised at the time of contract award.

B. *Amount of required bonds.* Unless the resulting contract price is \$150,000 or less, the successful offeror shall furnish performance and payment bonds to the Contracting Officer as follows:

1. Performance bonds (Standard Form 25). The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract price.
2. Payment Bonds (Standard Form 25A). The penal amount of payment bonds at the time of contract award shall be 100 percent of the original contract price.
3. Additional bond protection.
 - (i) The Government may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.
 - (ii) The Government may secure the additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.

C. *Furnishing executed bonds.* The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified in the Bid Guarantee provision of the solicitation, or otherwise specified by the Contracting Officer, but in any event, before starting work.

D. *Surety or other security for bonds.* The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the *Federal Register* or may be obtained from the:

U.S. Department of the Treasury
Financial Management Service
Surety Bond Branch
3700 East West Highway, Room 6F01
Hyattsville, MD 20782.
Or via the internet at
<http://www.fms.treas.gov/c570/>.

- E. *Notice of subcontractor waiver of protection (40 U.S.C. 3133(c)).* Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

12. Federal, State, and Local Taxes (FAR 52.229-3, Apr 2003)

- A. As used in this clause—

“After-imposed Federal tax” means any new or increased Federal excise tax or duty, or tax that was exempted or excluded on the contract date, but whose exemption was later revoked or reduced during the contract period on the transactions or property covered by this contract that the Contractor is required to pay or bear as the result of legislative, judicial, or administrative action taking effect after the contract date. It does not include social security tax or other employment taxes.

“After-relieved Federal tax” means any amount of Federal excise tax or duty, except social security or other employment taxes, that would otherwise have been payable on the transactions or property covered by this contract, but which the Contractor is not required to pay or bear, or for which the Contractor obtains a refund or drawback, as the result of legislative, judicial, or administrative action taking effect after the contract date.

“All applicable Federal, State, and local taxes and duties” means all taxes and duties, in effect on the contract date, that the taxing authority is imposing and collecting on the transactions or property covered by this contract.

“Contract date” means the date set for bid opening or, if this is a negotiated contract or a modification, the effective date of this contract or modification.

“Local taxes” includes taxes imposed by a possession or territory of the United States, Puerto Rico, or the Northern Mariana Islands, if the contract is performed wholly or partly in any of those areas.

- B. The contract price includes all applicable Federal, State, and local taxes and duties.
- C. The contract price shall be increased by the amount of any after-imposed Federal tax, provided the Contractor warrants in writing that no amount for such newly imposed Federal excise tax or duty or rate increase was included in the contract price, as a contingency reserve or otherwise.
- D. The contract price shall be decreased by the amount of any after-relieved Federal tax.
- E. The contract price shall be decreased by the amount of any Federal excise tax or duty, except social security or other employment taxes, that the Contractor is required to pay or bear, or does not obtain a refund of, through the Contractor’s fault, negligence, or failure to follow instructions of the Contracting Officer.
- F. No adjustment shall be made in the contract price under this clause unless the amount of the adjustment exceeds \$250.
- G. The Contractor shall promptly notify the Contracting Officer of all matters relating to any Federal excise tax or duty that reasonably may be expected to result in either an increase or decrease in the contract price

and shall take appropriate action as the Contracting Officer directs.

- H. The Government shall, without liability, furnish evidence appropriate to establish exemption from any Federal, State, or local tax when the Contractor requests such evidence and a reasonable basis exists to sustain the exemption.

13. Payments – Construction

- A. **Payment of Price.** Battelle shall pay the Contractor the Contract price as provided in this Contract. Unless otherwise provided in the Contract Schedule, the terms of payment shall be thirty (30) days after receipt of the Contractor’s properly submitted invoice.

- B. **Progress Payments.** Battelle shall make progress payments monthly as the work proceeds based on estimates of work accomplished which meets the standards of quality established under the Contract, as approved by Battelle.

1. The Contractor shall furnish a breakdown of the total Contract price showing the amount included therein for each principal category of the work, consistent with the “Schedule of Values”, which shall substantiate the payment amount requested in order to provide a basis for determining progress payments, in such detail as requested by Battelle.
2. In the preparation of estimates Battelle may authorize material delivered on the site and preparatory work done to be taken into consideration. Material delivered to the Contractor at locations other than the site will not be approved for progress payments.
3. As part of the request for payment, the Contractor shall submit a report summarizing the month’s injuries, illnesses, property damage, fires, “near misses”, etc. The summary report should be formatted to include the following items:
 - (i) Average number of employees during the month,
 - (ii) Total Contractor hours worked on this Contract,
 - (iii) Number of sub-tier Contractors,
 - (iv) Number of sub-tier Contractor employees by sub-tier Contractor, and
 - (v) Total sub-tier Contractor hours (by sub-tier Contractor) worked on this Contract.
4. Submit an electronic invoice in an acceptable format to Battelle at: ap.invoices@pnnl.gov. The electronic invoice shall be integrated with the Contract scheduling requirements and tied to the Contract schedule of values. If electronic transmittal is not possible, submit the invoice and all supporting documentation via mail to:

Battelle, Pacific Northwest Division
ATTN: ACCOUNTS PAYABLE
PO Box 999, MSIN: J1-04
Richland, WA 99352

C. **Contractor Certification.** Along with each request for progress payments, the Contractor shall furnish the following certification, or payment shall not be made:

I hereby certify, to the best of my knowledge and belief, that:

1. The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the Contract;
2. Payments to Subcontractors and suppliers have been made from previous payments received under the Contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with sub-Contract agreements; and
3. This request for progress payments does not include any amounts that the Contractor intends to withhold or retain from a Subcontractor or supplier in accordance with the terms and conditions of the sub-Contract.

D. **Refund of unearned amounts.** If the Contractor, after making a certified request for progress payments, discovers that a portion or all of such request constitutes a payment for performance by the Contractor that fails to conform to the specifications, terms, and conditions of this Contract (hereinafter referred to as the "unearned amount"), the Contractor shall:

1. Notify Battelle of such performance deficiency; and
2. Be obligated to pay Battelle an amount (computed by Battelle in the manner provided in 31 U.S.C. 3903 (c) (1)) equal to interest on the unearned amount from the date of receipt of the unearned amount until:
 - (i) The date the Contractor notifies Battelle that the performance deficiency has been corrected; or
 - (ii) The date the Contractor reduces the amount of any subsequent certified request for progress payments by an amount equal to the unearned amount.

E. **Retainage.** In making progress payments, there shall be retained 10 percent of the estimated amount until final completion and acceptance of the Contract work. However, if Battelle finds that satisfactory progress was achieved during any period for which a progress payment is to be made, Battelle may authorize a reduction in retention. When the work is substantially complete, Battelle shall retain from previously withheld funds and future progress payments that amount it considers adequate for protection of Battelle and the Government and shall release to the Contractor all the remaining withheld funds. Also, on completion and acceptance of each separate building, public work, or other division of the Contract, for which the price is stated separately in the Contract, payment shall be made for the completed work without retention of a percentage.

F. **Title, liability, and reservation of rights.** All material and work covered by progress payments made shall, at the time of payment, become the sole

property of Battelle, but this shall not be construed as:

1. Relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or
2. Waiving the right of Battelle to require the fulfillment of all of the terms of the Contract.

G. **Reimbursement for bond premiums.** If performance or payment bonds are required under this Contract, Battelle shall pay to the Contractor that portion of the Contract price equal to the total premiums paid by the Contractor to obtain bonds. This payment shall be paid at one time to the Contractor together with the first progress payment otherwise due after the Contractor has:

1. furnished the bonds;
2. furnished evidence of full payment to the surety; and
3. submitted a request for such payment. Payments for bond premiums shall not be made as increments of individual progress payments. The retainage provisions in paragraph (e) of this clause shall not apply to that portion of a progress payment attributable to bond premiums.

H. **Final payment.** Upon completion and acceptance of all work, the amount due the Contractor under this Contract shall be paid upon the presentation of a properly executed invoice and after the Contractor shall have furnished Battelle with a release of all claims against Battelle and the Government arising by virtue of this Contract, other than claims in stated amounts that the Contractor has specifically excepted from the operation of the release.

I. **Limitation because of undefinitized work.** Notwithstanding any provision of this Contract, progress payments shall not exceed 80 percent on work accomplished on undefinitized Contract actions. A "Contract action" is any action resulting in a Contract, as defined in FAR Subpart 2.1.

14. Suspension of Work (FAR 52.242-14, Apr 1984)

A. The Contracting Officer may order the Contractor, in writing, to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the Government.

B. If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified in this contract (or within a reasonable time if not specified), an adjustment shall be made for any increase in the cost of performance of this contract (excluding profit) necessarily caused by the unreasonable suspension, delay, or interruption, and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of

the Contractor, or for which an equitable adjustment is provided for or excluded under any other term or condition of this contract.

- C. A claim under this clause shall not be allowed—
1. For any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order); and
 2. Unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

15. Stop-Work Order (FAR 52.242-15, Aug 1989)

- A. The Contracting Officer may, at any time, by written order to the Contractor, require the Contractor to stop all, or any part, of the work called for by this contract for a period of 90 days after the order is delivered to the Contractor, and for any further period to which the parties may agree. The order shall be specifically identified as a stop-work order issued under this clause. Upon receipt of the order, the Contractor shall immediately comply with its terms and take all reasonable steps to minimize the incurrence of costs allocable to the work covered by the order during the period of work stoppage. Within a period of 90 days after a stop-work is delivered to the Contractor, or within any extension of that period to which the parties shall have agreed, the Contracting Officer shall either—
1. Cancel the stop-work order; or
 2. Terminate the work covered by the order as provided in the Default, or the Termination for Convenience of the Government, clause of this contract.
- B. If a stop-work order issued under this clause is canceled or the period of the order or any extension thereof expires, the Contractor shall resume work. The Contracting Officer shall make an equitable adjustment in the delivery schedule or contract price, or both, and the contract shall be modified, in writing, accordingly, if—
1. The stop-work order results in an increase in the time required for, or in the Contractor's cost properly allocable to, the performance of any part of this contract; and
 2. The Contractor asserts its right to the adjustment within 30 days after the end of the period of work stoppage; provided that, if the Contracting Officer decides the facts justify the action, the Contracting Officer may receive and act upon the claim submitted at any time before final payment under this contract.
- C. If a stop-work order is not canceled and the work covered by the order is terminated for the convenience of the Government, the Contracting Officer shall allow reasonable costs resulting from the stop-work order in arriving at the termination settlement.
- D. If a stop-work order is not canceled and the work

covered by the order is terminated for default, the Contracting Officer shall allow, by equitable adjustment or otherwise, reasonable costs resulting from the stop-work order.

16. Changes (FAR 52.243-4, June 2007)

- A. The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes—
1. In the specifications (including drawings and designs);
 2. In the method or manner of performance of the work;
 3. In the Government-furnished property or services; or
 4. Directing acceleration in the performance of the work.
- B. Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; Provided, that the Contractor gives the Contracting Officer written notice stating—
1. The date, circumstances, and source of the order; and
 2. That the Contractor regards the order as a change order.
- C. Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.
- D. If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.
- E. The Contractor must assert its right to an adjustment under this clause within 30 days after (1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) of this clause.
- F. No proposal by the Contractor for an equitable

adjustment shall be allowed if asserted after final payment under this contract.

17. Pricing of Adjustments - Construction

- A. **General.** When costs are a factor in any determination of a Contract price adjustment pursuant to the "Changes" clause or any other provision of this Contract, such costs shall be in accordance with the Contract cost principles and procedures, in Subpart 31 of the FAR, as supplemented or modified by DEAR Part 931 in effect on the Effective Date of the Contract, except as otherwise provided in this Contract with respect to facilities capital cost of money (CAS 414).
- B. **Requests for Equitable Adjustment.** Contractor shall submit any request for equitable adjustment pursuant the Changes clause within 10 working days after receipt of a notice of a change. The request for equitable adjustment shall include a detailed estimate with supporting calculations and pricing for the change together with any required adjustments in the schedule.
- C. **Net Cost of Change.** For adjustments that either increase or decrease the amount of the Contract Price, the application of markups for overhead and profit shall be on the net change in direct costs for the performance of the changed work.
- D. **Allowable Markups.** Allowable markup percentages on changes will not exceed the following:
 - 1. **Changes < \$100,000.** Work performing Contractor's actual overhead rate as established by audit within the last 12 months, not-to-exceed 15 percent on total direct costs, plus a negotiated allowance for profit, not-to-exceed 10 percent;
 - 2. **Changes > \$100,000.** Work performing Contractor's actual overhead rate as established by audit within the last 12 months, not-to-exceed 10% on total direct costs, plus a negotiated allowance for profit using the DEAR weighted guideline method, not to exceed 5 percent;
 - 3. **Markups on Lower Tiers.** No more than three mark-ups, one overhead, one profit/fee applied by the Work performing Contractor, and one commission or markup inclusive of overhead and profit by the General Contractor not-to-exceed 10 percent will be allowed regardless of the number of tiers of Subcontractors or the Subcontract instrument (i.e., purchase order, Contract, etc.).
- E. **Premium Adjustments.** Costs of premium adjustments, consequent upon changes ordered, for Payment and Performance Bonds are allowable for the prime Contractor only.
- F. **Consumables.** Consumables shall not be considered on a percentage of cost bases.
- G. **Small Tools.** Consideration for Small tools is allowable at a rate *not to exceed* 3 percent of net labor cost regardless of Contractor assertions of actual cost or independent audit determinations.
- H. **Safety.** Additional costs for safety must be supported as an actual cost necessary for performance of the changed work and will not be allowed as a percentage of net labor costs.

- I. **Equipment.** Rates for rental of Contractor or Subcontractor owned equipment shall be fair and equitable. Actual cost data shall be used when such data can be determined for both ownership and operating costs for each piece of equipment or groups of similar equipment from the Contractor's accounting records. When such costs cannot be so determined, the "Rental Rate Blue Book for Construction Equipment" published by Dataquest, Inc. will be utilized for Contractor equipment in operation or on standby, provided such rental rate is reviewed by Battelle to ensure factors included within the rental rate exclude unallowable or unacceptable costs in accordance with FAR 31.105.

18. Termination for Convenience of the Government (Fixed-Price) (FAR 52.249-2, May 2004)

- A. The Government may terminate performance of work under this contract in whole or, from time to time, in part if the Contracting Officer determines that a termination is in the Government's interest. The Contracting Officer shall terminate by delivering to the Contractor a Notice of Termination specifying the extent of termination and the effective date.
- B. After receipt of a Notice of Termination, and except as directed by the Contracting Officer, the Contractor shall immediately proceed with the following obligations, regardless of any delay in determining or adjusting any amounts due under this clause:
 - 1. Stop work as specified in the notice.
 - 2. Place no further subcontracts or orders (referred to as subcontracts in this clause) for materials, services, or facilities, except as necessary to complete the continued portion of the contract.
 - 3. Terminate all subcontracts to the extent they relate to the work terminated.
 - 4. Assign to the Government, as directed by the Contracting Officer, all right, title, and interest of the Contractor under the subcontracts terminated, in which case the Government shall have the right to settle or to pay any termination settlement proposal arising out of those terminations.
 - 5. With approval or ratification to the extent required by the Contracting Officer, settle all outstanding liabilities and termination settlement proposals arising from the termination of subcontracts; the approval or ratification will be final for purposes of this clause.
 - 6. As directed by the Contracting Officer, transfer title and deliver to the Government—
 - (i) The fabricated or un-fabricated parts, work in process, completed work, supplies, and other material produced or acquired for the work terminated; and
 - (ii) The completed or partially completed plans, drawings, information, and other property that, if the contract had been completed, would be required to be furnished to the Government.
 - 7. Complete performance of the work not terminated.

8. Take any action that may be necessary, or that the Contracting Officer may direct, for the protection and preservation of the property related to this contract that is in the possession of the Contractor and in which the Government has or may acquire an interest.
9. Use its best efforts to sell, as directed or authorized by the Contracting Officer, any property of the types referred to in paragraph (b)(6) of this clause; provided, however, that the Contractor (i) is not required to extend credit to any purchaser and (ii) may acquire the property under the conditions prescribed by, and at prices approved by, the Contracting Officer. The proceeds of any transfer or disposition will be applied to reduce any payments to be made by the Government under this contract, credited to the price or cost of the work, or paid in any other manner directed by the Contracting Officer.
- C. The Contractor shall submit complete termination inventory schedules no later than 120 days from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 120-day period.
- D. After expiration of the plant clearance period as defined in Subpart [49.001](#) of the Federal Acquisition Regulation, the Contractor may submit to the Contracting Officer a list, certified as to quantity and quality, of termination inventory not previously disposed of, excluding items authorized for disposition by the Contracting Officer. The Contractor may request the Government to remove those items or enter into an agreement for their storage. Within 15 days, the Government will accept title to those items and remove them or enter into a storage agreement. The Contracting Officer may verify the list upon removal of the items, or if stored, within 45 days from submission of the list, and shall correct the list, as necessary, before final settlement.
- E. After termination, the Contractor shall submit a final termination settlement proposal to the Contracting Officer in the form and with the certification prescribed by the Contracting Officer. The Contractor shall submit the proposal promptly, but no later than 1 year from the effective date of termination, unless extended in writing by the Contracting Officer upon written request of the Contractor within this 1-year period. However, if the Contracting Officer determines that the facts justify it, a termination settlement proposal may be received and acted on after 1 year or any extension. If the Contractor fails to submit the proposal within the time allowed, the Contracting Officer may determine, on the basis of information available, the amount, if any, due the Contractor because of the termination and shall pay the amount determined.
- F. Subject to paragraph (e) of this clause, the Contractor and the Contracting Officer may agree upon the whole or any part of the amount to be paid or remaining to be paid because of the termination. The amount may include a reasonable allowance for profit on work done. However, the agreed amount, whether under this paragraph (f) or paragraph (g) of this clause, exclusive of costs shown in paragraph (g)(3) of this clause, may not exceed the total contract price as reduced by (1) the amount of payments previously made and (2) the contract price of work not terminated. The contract shall be modified, and the Contractor paid the agreed amount. Paragraph (g) of this clause shall not limit, restrict, or affect the amount that may be agreed upon to be paid under this paragraph.
- G. If the Contractor and Contracting Officer fail to agree on the whole amount to be paid the Contractor because of the termination of work, the Contracting Officer shall pay the Contractor the amounts determined as follows, but without duplication of any amounts agreed upon under paragraph (f) of this clause:
1. For contract work performed before the effective date of termination, the total (without duplication of any items) of—
 - (i) The cost of this work;
 - (ii) The cost of settling and paying termination settlement proposals under terminated subcontracts that are properly chargeable to the terminated portion of the contract if not included in subdivision (g)(1)(i) of this clause; and
 - (iii) A sum, as profit on subdivision (g)(1)(i) of this clause, determined by the Contracting Officer under 49.202 of the Federal Acquisition Regulation, in effect on the date of this contract, to be fair and reasonable; however, if it appears that the Contractor would have sustained a loss on the entire contract had it been completed, the Contracting Officer shall allow no profit under this subdivision (g)(1)(iii) and shall reduce the settlement to reflect the indicated rate of loss.
 2. The reasonable costs of settlement of the work terminated, including—
 - (i) Accounting, legal, clerical, and other expenses reasonably necessary for the preparation of termination settlement proposals and supporting data;
 - (ii) The termination and settlement of subcontracts (excluding the amounts of such settlements); and
 - (iii) Storage, transportation, and other costs incurred, reasonably necessary for the preservation, protection, or disposition of the termination inventory.
- H. Except for normal spoilage, and except to the extent that the Government expressly assumed the risk of loss, the Contracting Officer shall exclude from the amounts payable to the Contractor under paragraph (g) of this clause, the fair value, as determined by the Contracting Officer, of property that is destroyed, lost, stolen, or damaged so as to become undeliverable to the Government or to a buyer.
- I. The cost principles and procedures of [Part 31](#) of the Federal Acquisition Regulation, in effect on the date of this contract, shall govern all costs claimed, agreed to, or determined under this clause.
- J. The Contractor shall have the right of appeal, under the Disputes clause, from any determination made by the Contracting Officer under paragraph (e), (g), or

- (l) of this clause, except that if the Contractor failed to submit the termination settlement proposal or request for equitable adjustment within the time provided in paragraph (e) or (l), respectively, and failed to request a time extension, there is no right of appeal.
- K. In arriving at the amount due the Contractor under this clause, there shall be deducted—
1. All un-liquidated advance or other payments to the Contractor under the terminated portion of this contract;
 2. Any claim which the Government has against the Contractor under this contract; and
 3. The agreed price for, or the proceeds of sale of, materials, supplies, or other things acquired by the Contractor or sold under the provisions of this clause and not recovered by or credited to the Government.
- L. If the termination is partial, the Contractor may file a proposal with the Contracting Officer for an equitable adjustment of the price(s) of the continued portion of the contract. The Contracting Officer shall make any equitable adjustment agreed upon. Any proposal by the Contractor for an equitable adjustment under this clause shall be requested within 90 days from the effective date of termination unless extended in writing by the Contracting Officer.
- M. (1) The Government may, under the terms and conditions it prescribes, make partial payments and payments against costs incurred by the Contractor for the terminated portion of the contract, if the Contracting Officer believes the total of these payments will not exceed the amount to which the Contractor will be entitled.
- (2) If the total payments exceed the amount finally determined to be due, the Contractor shall repay the excess to the Government upon demand, together with interest computed at the rate established by the Secretary of the Treasury under 50 U.S.C. App. 1215(b)(2). Interest shall be computed for the period from the date the excess payment is received by the Contractor to the date the excess is repaid. Interest shall not be charged on any excess payment due to a reduction in the Contractor's termination settlement proposal because of retention or other disposition of termination inventory until 10 days after the date of the retention or disposition, or a later date determined by the Contracting Officer because of the circumstances.
- N. Unless otherwise provided in this contract or by statute, the Contractor shall maintain all records and documents relating to the terminated portion of this contract for 3 years after final settlement. This includes all books and other evidence bearing on the Contractor's costs and expenses under this contract. The Contractor shall make these records and documents available to the Government, at the Contractor's office, at all reasonable times, without any direct charge. If approved by the Contracting Officer, photographs, microphotographs, or other authentic reproductions may be maintained instead of original records and documents.
- 19. Default (Fixed-Price Construction) (FAR 52.249-10, Apr 1984)**
- A. If the Contractor refuses or fails to prosecute the work or any separable part, with the diligence that will insure its completion within the time specified in this contract including any extension, or fails to complete the work within this time, the Government may, by written notice to the Contractor, terminate the right to proceed with the work (or the separable part of the work) that has been delayed. In this event, the Government may take over the work and complete it by contract or otherwise, and may take possession of and use any materials, appliances, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the Government resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the Government in completing the work.
- B. The Contractor's right to proceed shall not be terminated nor the Contractor charged with damages under this clause, if—
1. The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include—
 - (i) Acts of God or of the public enemy,
 - (ii) Acts of the Government in either its sovereign or contractual capacity,
 - (iii) Acts of another Contractor in the performance of a contract with the Government,
 - (iv) Fires,
 - (v) Floods,
 - (vi) Epidemics,
 - (vii) Quarantine restrictions,
 - (viii) Strikes,
 - (ix) Freight embargoes,
 - (x) Unusually severe weather, or
 - (xi) Delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and
 2. The Contractor, within 10 days from the beginning of any delay (unless extended by the Contracting Officer), notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, the time for completing the work shall be extended. The findings of the Contracting Officer shall be final and conclusive on the parties, but subject to appeal under the Disputes clause.
- C. If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not

in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been issued for the convenience of the Government.

- D. The rights and remedies of the Government in this clause are in addition to any other rights and remedies provided by law or under this contract.

20. Failure to Perform - Construction

- A. Subject to the Excusable Delays clause, if the Contractor fails to perform this Contract under its terms, Battelle shall give the Contractor written notice stating the failure. Thereafter, regardless of any other provision of this Contract, the Contractor shall not be entitled to an equitable adjustment under either this Contract or any related Contract, to the extent the equitable adjustment arises from the Contractor's failure to perform or from any reasonable remedial action taken by Battelle based upon the failure.
- B. The failure of Battelle to insist, in one or more instances, upon the performance of any term of this Contract is not a waiver of Battelle's right to future performance of such term, and the Contractor's obligation for future performance of such term shall continue in effect.
- C. The rights and remedies of Battelle in this clause are in addition to any other rights and remedies provided by law or under this Contract.

21. Excusable Delays (FAR 52.249-14, Apr 1984)

- A. Except for defaults of subcontractors at any tier, the Contractor shall not be in default because of any failure to perform this contract under its terms if the failure arises from causes beyond the control and without the fault or negligence of the Contractor. Examples of these causes are (1) acts of God or of the public enemy, (2) acts of the Government in either its sovereign or contractual capacity, (3) fires, (4) floods, (5) epidemics, (6) quarantine restrictions, (7) strikes, (8) freight embargoes, and (9) unusually severe weather. In each instance, the failure to perform must be beyond the control and without the fault or negligence of the Contractor. "Default" includes failure to make progress in the work so as to endanger performance.
- B. If the failure to perform is caused by the failure of a subcontractor at any tier to perform or make progress, and if the cause of the failure was beyond the control of both the Contractor and subcontractor, and without the fault or negligence of either, the Contractor shall not be deemed to be in default, unless—
 - 1. The subcontracted supplies or services were obtainable from other sources;
 - 2. The Contracting Officer ordered the Contractor in writing to purchase these supplies or services from the other source; and
 - 3. The Contractor failed to comply reasonably with this order.
- C. Upon request of the Contractor, the Contracting Officer shall ascertain the facts and extent of the failure. If the Contracting Officer determines that any failure to perform results from one or more of the causes above, the completion time shall be revised, subject to the rights of the Government under the

termination clause of this contract.

22. Disputes (FAR 52.233-1, July 2002)

- A. This contract is subject to the Contract Disputes Act of 1978, as amended (41 U.S.C. 601-613).
- B. Except as provided in the Act, all disputes arising under or relating to this contract shall be resolved under this clause.
- C. "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to this contract. However, a written demand or written assertion by the Contractor seeking the payment of money exceeding \$100,000 is not a claim under the Act until certified. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim under the Act. The submission may be converted to a claim under the Act, by complying with the submission and certification requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.
- D. (1) A claim by the Contractor shall be made in writing and, unless otherwise stated in this contract, submitted within 6 years after accrual of the claim to the Contracting Officer for a written decision. A claim by the Government against the Contractor shall be subject to a written decision by the Contracting Officer.
 - (2)(i) The Contractor shall provide the certification specified in paragraph (d)(2)(iii) of this clause when submitting any claim exceeding \$100,000.
 - (ii) The certification requirement does not apply to issues in controversy that have not been submitted as all or part of a claim.
 - (iii) The certification shall state as follows: "I certify that the claim is made in good faith; that the supporting data are accurate and complete to the best of my knowledge and belief; that the amount requested accurately reflects the contract adjustment for which the Contractor believes the Government is liable; and that I am duly authorized to certify the claim on behalf of the Contractor."
 - (3) The certification may be executed by any person duly authorized to bind the Contractor with respect to the claim.
- E. For Contractor claims of \$100,000 or less, the Contracting Officer must, if requested in writing by the Contractor, render a decision within 60 days of the request. For Contractor-certified claims over \$100,000, the Contracting Officer must, within 60 days, decide the claim or notify the Contractor of the date by which the decision will be made.
- F. The Contracting Officer's decision shall be final unless the Contractor appeals or files a suit as provided in the Act.
- G. If the claim by the Contractor is submitted to the Contracting Officer or a claim by the Government is presented to the Contractor, the parties, by mutual consent, may agree to use alternative dispute

resolution (ADR). If the Contractor refuses an offer for ADR, the Contractor shall inform the Contracting Officer, in writing, of the Contractor's specific reasons for rejecting the offer.

- H. The Government shall pay interest on the amount found due and unpaid from (1) the date that the Contracting Officer receives the claim (certified, if required); or (2) the date that payment otherwise would be due, if that date is later, until the date of payment. With regard to claims having defective certifications, as defined in FAR 33.201, interest shall be paid from the date that the Contracting Officer initially receives the claim. Simple interest on claims shall be paid at the rate, fixed by the Secretary of the Treasury as provided in the Act, which is applicable to the period during which the Contracting Officer receives the claim and then at the rate applicable for each 6-month period as fixed by the Treasury Secretary during the pendency of the claim.
- I. The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under the contract, and comply with any decision of the Contracting Officer.

23. Indemnity (cl. 351C – Aug 2009)

Contractor shall indemnify and save harmless Battelle from and against any and all liabilities and losses for injury (including death) to persons (including but not limited to Contractor's employees) or damage to property to the extent caused by a negligent act or omission or willful misconduct of the Contractor, its agents, or employees that occur during the performance of this contract, including any and all expense, legal or otherwise, incurred in the investigation or defense of any claim.

This indemnification shall not include such injuries to any person or persons or damage to or destruction of any property to the extent caused by the negligence or omission of Battelle or its employees.

In no event shall either Contractor or Battelle be liable for any special, incidental, or consequential damages of any type or nature.

24. Public Release of Information

Information, data, photographs, sketches, and advertising relating to the work under this contract, which Contractor desires to release or publish, shall be submitted to Battelle for approval 60 days prior to the desired release date. As part of the approval request, Contractor shall identify the specific media to be used as well as other pertinent details of the proposed release. All releases, regardless of tier or supplier, must have Battelle's prior approval. Contractor shall include all provisions of this clause, including this sentence, in all lower-tier subcontracts under this contract.

25. Rights to Proposal Data

Except for the technical data contained on those pages of Contractor's proposal, which are specifically identified in this contract with specific reference to this clause and asserted by Contractor as being proprietary data, it is agreed that, as a condition of the award of this contract and notwithstanding the provisions of any notice appearing on the proposal or elsewhere, Battelle and the Government shall have the right to use, duplicate, disclose

and have others do so, for any purpose whatsoever, the technical data contained in the proposal upon which this contract is based.

26. Bankruptcy (cl. 318 - Nov 2008)

If the Contractor enters into any proceeding related to bankruptcy, it shall give written notice to the Battelle Contracts Representative via certified mail within five days of initiation of the proceeding. The notification shall include the date on which the proceeding was filed, the identity and location of the court, and a listing of the Battelle purchase orders, contracts, or agreements affected.

MATERIAL REQUIREMENTS AND QUANTITIES

27. Material Requirements (FAR 52.211-5, Aug 2000)

A. Definitions.

As used in this clause—

"New" means composed of previously unused components, whether manufactured from virgin material, recovered material in the form of raw material, or materials and by-products generated from, and reused within, an original manufacturing process; *provided* that the supplies meet contract requirements, including but not limited to, performance, reliability, and life expectancy.

"Reconditioned" means restored to the original normal operating condition by readjustments and material replacement.

"Recovered material" means waste materials and by-products recovered or diverted from solid waste, but the term does not include those materials and by-products generated from, and commonly reused within, an original manufacturing process.

"Remanufactured" means factory rebuilt to original specifications.

"Virgin material" means—

1. Previously unused raw material, including previously unused copper, aluminum, lead, zinc, iron, other metal or metal ore; or
 2. Any undeveloped resource that is, or with new technology will become, a source of raw materials.
- B. Unless this contract otherwise requires virgin material or supplies composed of or manufactured from virgin material, the Contractor shall provide supplies that are new, reconditioned, or remanufactured, as defined in this clause.
- C. A proposal to provide unused former Government surplus property shall include a complete description of the material, the quantity, the name of the Government agency from which acquired, and the date of acquisition.
- D. A proposal to provide used, reconditioned, or remanufactured supplies shall include a detailed description of such supplies and shall be submitted to the Contracting Officer for approval.
- E. Used, reconditioned, or remanufactured supplies, or unused former Government surplus property, may be used in contract performance if the Contractor has proposed the use of such supplies, and the

Contracting Officer has authorized their use.

28. Brand Name or Equal (FAR 52.211-6, Aug 1999)

- A. If an item in this solicitation is identified as "brand name or equal," the purchase description reflects the characteristics and level of quality that will satisfy the Government's needs. The salient physical, functional, or performance characteristics that "equal" products must meet are specified in the solicitation.
- B. To be considered for award, offers of "equal" products, including "equal" products of the brand name manufacturer, must—
 - 1. Meet the salient physical, functional, or performance characteristic specified in this solicitation;
 - 2. Clearly identify the item by—
 - (i) Brand name, if any; and
 - (ii) Make or model number;
 - 3. Include descriptive literature such as illustrations, drawings, or a clear reference to previously furnished descriptive data or information available to the Contracting Officer; and
 - 4. Clearly describe any modifications the offeror plans to make in a product to make it conform to the solicitation requirements. Mark any descriptive material to clearly show the modifications.
- C. The Contracting Officer will evaluate "equal" products on the basis of information furnished by the offeror or identified in the offer and reasonably available to the Contracting Officer. The Contracting Officer is not responsible for locating or obtaining any information not identified in the offer.
- D. Unless the offeror clearly indicates in its offer that the product being offered is an "equal" product, the offeror shall provide the brand name product referenced in the solicitation.

29. Variation in Estimated Quantity (FAR 52.211-18, Apr 1984)

If the quantity of a unit-priced item in this contract is an estimated quantity and the actual quantity of the unit-priced item varies more than 15 percent above or below the estimated quantity, an equitable adjustment in the contract price shall be made upon demand of either party. The equitable adjustment shall be based upon any increase or decrease in costs due solely to the variation above 115 percent or below 85 percent of the estimated quantity. If the quantity variation is such as to cause an increase in the time necessary for completion, the Contractor may request, in writing, an extension of time, to be received by the Contracting Officer within 10 days from the beginning of the delay, or within such further period as may be granted by the Contracting Officer before the date of final settlement of the contract. Upon the receipt of a written request for an extension, the Contracting Officer shall ascertain the facts and make an adjustment for extending the completion date as, in the judgment of the Contracting Officer, is justified.

ENVIRONMENTAL SAFETY AND HEALTH

30. Environment, Safety, and Health Requirements - Offsite (cl. 3113e – May 2012)

- A. In performing work under this contract at its own facilities or any other location that is not a DOE-owned or leased facility, the Contractor shall comply with all applicable federal, state, and local environment, safety, and health laws and regulations. The Contractor shall also perform work safely, in a manner that ensures adequate protection for employees, the public, and the environment, and shall be accountable for the safe performance of work. The Contractor shall exercise a degree of care commensurate with the work and the associated hazards. The Contractor shall ensure that management of environment, safety, and health functions and activities becomes an integral but visible part of the Contractor's work planning and execution processes.
- B. The Contractor is responsible for its subcontractors' compliance with the environment, safety, and health requirements of this contract.

31. Environment, Safety, and Health Requirements (10 CFR 851)

Contractor shall refer to the Contract Schedule for any other Environment, Safety, and Health requirements pertaining to 10 CFR 851, and shall comply with such requirements, when performing any work under this contract on property or facilities owned or controlled by Battelle that are identified as PNNL Work Sites or on property or facilities owned or controlled by the United States Department of Energy (DOE), other than PNNL.

32. Notifications and Investigations

A. Emergency Notifications

- 1. For onsite emergencies (police, fire, rescue, hazmat) call 509-375-2400.
- 2. For offsite emergencies (police, fire, rescue, hazmat) call 911.

B. Event Notification

The Contractor shall notify the Battelle Construction Manager or Battelle Contracts Representative immediately of any OSHA-recordable injuries/illnesses, any "off-normal occurrences," or Government property damaged that the Contractor determines to have occurred in the course of operations onsite and shall furnish such further information as the Battelle Construction Manager or Battelle Contracts Representative may require. An "off-normal occurrence" is any unplanned or unexpected event, or the discovery of a deficiency in a procedure, plan, or system that has real or potentially undesirable consequences to personnel, equipment, facilities, the environment, and/or programs.

C. Accident Investigation

- 1. The Contractor shall cooperate in the conduct of accident investigations which result in recordable injury/illness, property damage, fire, radiation event, and fatality.
- 2. When a Contractor employee is involved in a serious event or accident, the Contractor shall implement the following actions:
 - A. Secure the event scene from disturbance and

unauthorized entry pending arrival of Battelle Representatives.

- B. Keep equipment or articles involved in the event from being operated, moved, or otherwise altered or repaired.

33. Solid Waste Management

A. Solid Waste Management. The Contractor is responsible to manage solid waste in accordance with all applicable Federal, State and local laws. The Contractor shall follow Battelle's Standards Based Management System requirements for accumulation, interim storage and final disposal of the following types of solid waste:

1. Hazardous waste including soil or debris contaminated with hazardous waste.
2. Radioactive contaminated waste, materials and equipment.
3. Materials containing asbestos.
4. Materials containing polychlorinated biphenyls (PCBs).
5. Unused residual construction materials, not the property of Battelle, may be retained by the Contractor for future use or disposal by the Contractor. Such materials must otherwise be managed in accordance with Battelle's SBMS requirements while on Battelle managed property.

B. Environmental Permits / Notifications. The Contractor shall coordinate the preparation of environmental permit applications / notifications with Battelle's ES&H Organization for the purpose of integrating new and existing environmental approvals. The Contractor shall Notify Battelle, prior to commencing construction, in the following circumstances:

1. Clean Air Act Permits.
 - (i). Notice of Intent to Remove Asbestos. The Contractor shall contact Battelle before proceeding with work that could disturb asbestos and materials containing asbestos. A representative from Battelle's ES&H organization will assist the Contractor in preparing the Notice of Intent to remove asbestos for submittal to the appropriate regulatory agency.
 - (ii). Construction / Demolition activities which could disturb / disperse radioactive contamination (e.g. excavation of contaminated soils or demolition of contaminated structures)
2. Clean Water Act Permits. The Contractor shall notify Battelle prior to commencing construction activities which may require clean water act permits including but not limited to:
 - (i). Disturbing greater than one acre of land
 - (ii). Construction of ground water wells
 - (iii). Discharge of liquid effluent (to ground; or existing sewer systems)
 - (iv). Installation of temporary or permanent septic systems

(v). Placement or installation of above-ground tanks for fuel storage

3. Underground Storage Tanks. The Contractor shall notify Battelle prior to commencing construction activities to install or remove any underground storage tank.

C. Spills and Releases. The Contractor shall manage hazardous substances (as defined by State of Washington regulations, including petroleum) in accordance with regulatory requirements and in a manner that prevents accidental spillage or release to the environment. In the event of a spill or release, the Contractor shall immediately:

1. Notify the Battelle Construction Manager of the spill; and
2. Respond to, control, and remediate any spill or release of hazardous substances or hazardous waste, managing spill residues in accordance with applicable Federal, DOE, State and Local regulations and requirements.

34. Waste Reduction Program (FAR 52.223-12, May 2011)

A. *Definitions.* As used in this clause—

"Recycling" means the series of activities, including collection, separation, and processing, by which products or other materials are recovered from the solid waste stream for use in the form of raw materials in the manufacture of products other than fuel for producing heat or power by combustion.

"Waste prevention" means any change in the design, manufacturing, purchase, or use of materials or products (including packaging) to reduce their amount or toxicity before they are discarded. Waste prevention also refers to the reuse of products or materials.

"Waste reduction" means preventing or decreasing the amount of waste being generated through waste prevention, recycling, or purchasing recycled and environmentally preferable products.

B. Consistent with the requirements of section 3(e) of Executive Order 13423, the Contractor shall establish a program to promote cost-effective waste reduction in all operations and facilities covered by this contract. The Contractor's programs shall comply with applicable Federal, State, and local requirements, specifically including Section 6002 of the Resource Conservation and Recovery Act ([42 U.S.C. 6962](#), *et seq.*) and implementing regulations (40 CFR Part 247).

35. Accident Prevention (FAR 52.236-13 Nov 1991)

A. The Contractor shall provide and maintain work environments and procedures which will—

1. Safeguard the public and Government personnel, property, materials, supplies, and equipment exposed to Contractor operations and activities;
2. Avoid interruptions of Government operations and delays in project completion dates; and
3. Control costs in the performance of this contract.

B. For these purposes on contracts for construction or dismantling, demolition, or removal of improvements,

the Contractor shall—

1. Provide appropriate safety barricades, signs, and signal lights;
 2. Comply with the standards issued by the Secretary of Labor at 29 CFR Part 1926 and 29 CFR Part 1910; and
 3. Ensure that any additional measures the Contracting Officer determines to be reasonably necessary for the purposes are taken.
- C. If this contract is for construction or dismantling, demolition or removal of improvements with any Department of Defense agency or component, the Contractor shall comply with all pertinent provisions of the latest version of U.S. Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, in effect on the date of the solicitation.
- D. Whenever the Contracting Officer becomes aware of any noncompliance with these requirements or any condition which poses a serious or imminent danger to the health or safety of the public or Government personnel, the Contracting Officer shall notify the Contractor orally, with written confirmation, and request immediate initiation of corrective action. This notice, when delivered to the Contractor or the Contractor's representative at the work site, shall be deemed sufficient notice of the noncompliance and that corrective action is required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not be entitled to any equitable adjustment of the contract price or extension of the performance schedule on any stop work order issued under this clause.
- E. The Contractor shall insert this clause, including this paragraph (e), with appropriate changes in the designation of the parties, in subcontracts.

36. Sustainable Acquisition Requirements (cl. 381 – March 2012)

Battelle is committed to managing its operations in a sustainable manner which promotes the natural environment and protects the health and well-being of its employees and contractor service providers. In the performance of work under this contract, the Contractor shall provide products that comply with Federal law as follows (regardless of any notations on the respective websites):

Recycled Content as designated by the Environmental Protection Agency (EPA) - <http://www.epa.gov/epawaste/consERVE/tools/cpg/products/index.htm>

Biobased Products as designated by the United States Department of Agriculture (USDA) - <http://www.biopreferred.gov/ProposedAndFinalItemDesignations.aspx>

Energy-Efficient Products such as Energy Star certified and FEMP-designated products - http://www.energystar.gov/index.cfm?c=product_specs.product_specs and http://www1.eere.energy.gov/femp/technologies/eep_purchasing_specs.html

Water-Efficient Products as designated by the EPA for their WaterSense® label program - <http://www.epa.gov/watersense/products/index.html>

Environmentally preferable and energy efficient electronics, including desktop computers, laptops and monitors, as specified at the Green Electronics Council's Electronic Products Environmental Assessment Tool (EPEAT) registry- <http://www2.epeat.net/searchoptions.aspx>

Non-Ozone Depleting Alternative Products as designated by the EPA - <http://www.epa.gov/ozone/snap/index.html>

Low-Emitting Volatile Organic Compounds (VOC) Materials as designated by the Federal Leadership in High Performance and Sustainable Buildings [Guiding Principles](#) (including adhesives, sealants, paints, carpet systems, and furnishings) for building modifications, maintenance, and cleaning

QUALITY ASSURANCE

37. Quality Assurance

The Contractor shall assure that all work (e.g., submittals, products, manufacture, fabrication, installation of products and components, workmanship, inspection, and testing) performed by it or its Subcontractors and suppliers is in compliance with all contract documents (i.e., technical specifications, drawings, and Division 1). Work may include products and services (e.g., welding, nondestructive examination, soldering workmanship, manufacturer of radiation calibration standards, and equipment) that necessitate additional or special Quality Assurance / Quality Control, requirements, including the need for a documented Quality Assurance program. When such requirements are applicable to the Contractor's work, they will be identified specifically in the contract documents. The Contractor shall require, in writing, Subcontractors of all tiers to comply with all applicable contractual requirements.

38. Suspect / Counterfeit Items

- A. Battelle's Suspect / Counterfeit Items (S/CI) program responds to the S/CI requirements in the following documents:
1. DOE Order 414.1C, —Quality Assurance Attachment 3, addresses the requirement for the S/CI prevention process and the control of S/CIs;
 2. DOE G 414.1-3, —Suspect/Counterfeit Items Guide for Use with 10 CFR 830, Subpart A, Energy/Nuclear Safety Management/Quality Assurance Requirements and DOE O 414.1B, Quality Assurance;
 3. DOE Order 231.1A Change 1, —Environment, Safety, and Health Reporting, and DOE Order 221.1, —Reporting Fraud, Waste, and Abuse to the Office of Inspector General addresses reporting requirements for discovery of S/CIs.
- B. S/CIs may pose immediate and potential threats to the safety of Battelle, DOE and contractor workers, the public, and the environment. Failure of a safety or mission critical system due to an S/CI could also have security implications at DOE facilities. The most common S/CIs found at Battelle and DOE facilities have been threaded fasteners fraudulently marked as high-strength bolts, and refurbished electrical circuit breakers sold and distributed under false

certifications. Falsified documentation has also misled purchasers into accepting S/CIs that do not conform to specified requirements. Forms of misrepresentation include the following:

1. Falsified product sources (counterfeits);
 2. Falsified or modified quality records;
 3. False marking as to class, type, or grade;
 4. Mixing of unmarked with marked materials;
 5. False labeling as to qualification or acceptance by testing/certifying organizations; and
 6. Used products misrepresented as new products.
- C. S/CI Awareness Training Manual developed by DOE-Office of Corporate Safety Analysis (HS-30) that can help to identify and disposition S/CI's discovered at Battelle and DOE facilities can be accessed at the following link http://energy.gov/sites/prod/files/2014/06/f16/SC1_Training_Manual.pdf.
- D. The Contractor shall assure that all products delivered on this contract do not contain S/CI parts. If S/CI parts are discovered, notify Battelle for further direction. All discrepant part(s)/product(s) will be replaced at the Contractor's expense.

39. Contractor Inspection Requirements (FAR 52.246-1, Apr 1984)

The Contractor is responsible for performing or having performed all inspections and tests necessary to substantiate that the supplies or services furnished under this contract conform to contract requirements, including any applicable technical requirements for specified manufacturers' parts. This clause takes precedence over any Government inspection and testing required in the contract's specifications, except for specialized inspections or tests specified to be performed solely by the Government.

40. Inspection of Construction (FAR 52.246-12, Aug 1996)

- A. *Definition.* "Work" includes, but is not limited to, materials, workmanship, and manufacture and fabrication of components.
- B. The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. The Contractor shall maintain complete inspection records and make them available to the Government. All work shall be conducted under the general direction of the Contracting Officer and is subject to Government inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.
- C. Government inspections and tests are for the sole benefit of the Government and do not—
1. Relieve the Contractor of responsibility for providing adequate quality control measures;
 2. Relieve the Contractor of responsibility for damage to or loss of the material before acceptance;
 3. Constitute or imply acceptance; or

4. Affect the continuing rights of the Government after acceptance of the completed work under paragraph (i) of this section.
- D. The presence or absence of a Government inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specification without the Contracting Officer's written authorization.
- E. The Contractor shall promptly furnish, at no increase in contract price, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The Government may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes re-inspection or retest necessary. The Government shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.
- F. The Contractor shall, without charge, replace or correct work found by the Government not to conform to contract requirements, unless in the public interest the Government consents to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.
- G. If the Contractor does not promptly replace or correct rejected work, the Government may—
1. By contract or otherwise, replace or correct the work and charge the cost to the Contractor; or
 2. Terminate for default the Contractor's right to proceed.
- H. If, before acceptance of the entire work, the Government decides to examine already completed work by removing it or tearing it out, the Contractor, on request, shall promptly furnish all necessary facilities, labor, and material. If the work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray the expenses of the examination and of satisfactory reconstruction. However, if the work is found to meet contract requirements, the Contracting Officer shall make an equitable adjustment for the additional services involved in the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.
- I. Unless otherwise specified in the contract, the Government shall accept, as promptly as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the Government's rights under any warranty or guarantee.

41. Responsibility for Supplies (FAR 52.246-16, Apr 1984)

- A. Title to supplies furnished under this contract shall

pass to the Government upon formal acceptance, regardless of when or where the Government takes physical possession, unless the contract specifically provides for earlier passage of title.

- B. Unless the contract specifically provides otherwise, risk of loss of or damage to supplies shall remain with the Contractor until, and shall pass to the Government upon—
 - 1. Delivery of the supplies to a carrier, if transportation is f.o.b. origin; or
 - 2. Acceptance by the Government or delivery of the supplies to the Government at the destination specified in the contract, whichever is later, if transportation is f.o.b. destination.
- C. Paragraph (b) of this clause shall not apply to supplies that so fail to conform to contract requirements as to give a right of rejection. The risk of loss of or damage to such nonconforming supplies remains with the Contractor until cure or acceptance. After cure or acceptance, paragraph (b) of this clause shall apply.
- D. Under paragraph (b) of this clause, the Contractor shall not be liable for loss of or damage to supplies caused by the negligence of officers, agents, or employees of the Government acting within the scope of their employment.

42. Warranty of Construction (FAR 52.246-21, Mar 1994)

- A. In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (i) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or design furnished, or workmanship performed by the Contractor or any subcontractor or supplier at any tier.
- B. This warranty shall continue for a period of 1 year from the date of final acceptance of the work. If the Government takes possession of any part of the work before final acceptance, this warranty shall continue for a period of 1 year from the date the Government takes possession.
- C. The Contractor shall remedy at the Contractor's expense any failure to conform, or any defect. In addition, the Contractor shall remedy at the Contractor's expense any damage to Government-owned or controlled real or personal property, when that damage is the result of—
 - 1. The Contractor's failure to conform to contract requirements; or
 - 2. Any defect of equipment, material, workmanship, or design furnished.
- D. The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for 1 year from the date of repair or replacement.
- E. The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect, or damage.
- F. If the Contractor fails to remedy any failure, defect,

or damage within a reasonable time after receipt of notice, the Government shall have the right to replace, repair, or otherwise remedy the failure, defect, or damage at the Contractor's expense.

- G. With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall—
 - A. Obtain all warranties that would be given in normal commercial practice;
 - B. Require all warranties to be executed, in writing, for the benefit of the Government, if directed by the Contracting Officer; and
 - C. Enforce all warranties for the benefit of the Government, if directed by the Contracting Officer.
- H. In the event the Contractor's warranty under paragraph (b) of this clause has expired, the Government may bring suit at its expense to enforce a subcontractor's, manufacturer's, or supplier's warranty.
- I. Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defects of material or design furnished by the Government nor for the repair of any damage that results from any defect in Government-furnished material or design.
- J. This warranty shall not limit the Government's rights under the Inspection and Acceptance clause of this contract with respect to latent defects, gross mistakes, or fraud.

CONSTRUCTION

43. Site Access Control

- A. Any person performing work in Battelle facilities is required to wear a security badge identifying him/her. Only individuals possessing proof of valid United States Citizenship may be issued a security badge. Individuals requiring a badge for access where the presentation of identification (ID) is required must either present a driver's license or ID card from a [REAL ID compliant state](#), or an alternate acceptable form of ID, before "unescorted" access will be given. If work is performed on site, but not within a facility then a security badge is not required.
- B. Contractor shall be responsible for controlling access to the Site and ensuring that all Contractor personnel including Subcontractor personnel, delivery drivers and vendors have received adequate and appropriate security and site orientation. Visible symbols such as hard hat stickers, badges, etc., shall be used to indicate the person has Contractor authorization to be on the Site.
- C. Unless Battelle issued badges are identified elsewhere in the contract documents as a condition of site access, Contractor shall have general use of areas designated in the contract documents for construction operations during the contract performance period.
- D. Personnel protective equipment (PPE) requirements shall be appropriate to the identified hazards present and shall be as indicated in the General and

Administrative Requirements for the Work (Division I Requirements) and on the Contractors approved Job Safety Analysis (JSA).

- E. Contractor is responsible to ensure that it's direct hired and Subcontractor employees who will work on the Site and are newly hired for the Work, present proof of a negative drug screen dated within the last three (3) months prior to authorizing initial site access. Contractor employees hired prior to the start of this Work and now assigned to this Work must present proof of a negative drug screen dated within the last 12 months.
1. Only drug tests by a Substance Abuse and Mental Health Services (SAMHSA) certified laboratory will be considered acceptable as proof of a negative drug screen.
 2. A confirmed positive will deny employee access to the Site for a minimum of one (1) year.
 3. Suspect Behavior or Circumstances. If Battelle, or the Contractor or Subcontractor believes that a Contractor or Subcontractor employee's job performance is being adversely affected by drug or substance (including alcohol) use, Battelle may direct the Contractor to remove the employee from the Site and require the employee to submit to drug testing at Contractor's expense. Examples of behavior or circumstances indicating possible drug or substance abuse are possession, sale or delivery, or credible information that an individual is using drugs or abusing alcohol, or an accident or injury.

F. **Disciplinary Policy and Suspension of Access**

1. General. It is the Contractor's responsibility to implement a policy which provides for discipline of unacceptable behaviors. Disciplinary policy should categorize the severity of the misconduct with a graded approach to implementing the disciplinary actions that result.
2. Contractor may adopt Battelle's model disciplinary policy or submit for approval a Contractor plan.
3. If the Contractor or its Subcontractors fail to have or enforce an approved plan or fail to take appropriate disciplinary action(s) as a result of identified employee misconduct, Battelle will respond to misconduct using a graded approach, considering the nature and severity of the misconduct in accordance with the following general guidelines.
 - (i). First Infraction. A first infraction could result in actions ranging from a verbal reprimand to denying the employee further access to the site for the remainder of the work.
 - (ii). II. Second Infraction. A second infraction, not necessarily of the same type, could result in actions ranging from a written reprimand to denying the employee further access to the site for the remainder of the work.
 - (iii). III. Third Infraction. A third infraction could result in suspension from the site ranging from 3-days to 365 days, or the remainder of the work, whichever is longer.

G. **Battelle Issued Badges**

1. If a Battelle issued badge is required for persons performing work on the Site, Battelle's Badging office is located in the Environmental Technology Building (ETB), Room 1104. The ETB Building address is 3200 Q Avenue, Richland WA 99352. Badges may be picked up between the hours of 7:30 A.M. to 4:00 P.M. Monday through Friday (excluding holidays).
2. Employee Termination / Completion of the Work. Upon termination of employment or completion of the Contractors work, and before final payment shall be made, all badges and dosimeters issued to Contractor employees shall be returned to the issuing office.
3. Lost badges and/or dosimeter shall be reported immediately upon discovery to Battelle. Battelle will charge Contractor \$100 for each badge or dosimeter not returned. The charge shall be deducted from payments otherwise due the Contractor. Refund of charges, previously collected for badges and/or dosimeters subsequently found will not be made after the date of final payment to the Contractor.
4. Training required for a Battelle issued Badge
 - (i). GERT / LAB Orientation. If Contractor employees are required to successfully complete General Employee Radiation Training (GERT) / Battelle Laboratory (LAB) Orientation, GERT / LAB Orientation is estimated to take four (4) hours. The employee cost of the orientation shall be by the Contractor.
 - (ii). Vendor/Contractor Orientation for non-Battelle personnel. If Contractor employees are required to successfully complete Vendor/Contractor Orientation, it is estimated to take 2 ½ hours. The employee cost of the orientation shall be by the Contractor.
 - (iii). Other Required Training. Other Battelle sponsored training identified as required for performance of the contract work will be provided to the Contractor at no cost for the trainer and/or course fees. Contractor shall be responsible for the cost of the employee's time to attend. Contractor shall allow Battelle two (2) weeks to schedule the training after proper notification.
 - (iv). Failed Training / Tests and Contractor —No-Shows. Contractor shall be responsible for the trainer / classroom costs associated with Contractor employees that have either failed to successfully complete a required training or have failed to show up for a scheduled training date. Costs to be charged the Contractor for retaking failed training or rescheduling due to no-shows is: \$352.25 (each) for Radiation Worker I and/or II including GAP and refresher training; Lock & Tag training is \$348.85; Respiratory Protection Worker training is \$352.25; Asbestos Awareness, Hot Work Fire Watch and Lock-Out-Tag-Out Gap training are all

\$350.75, all other Battelle sponsored training is \$32.11.

- (v). Offsite Training. Contractor shall be responsible for all offsite training as required for performance of the contract work. Training offered at the HAMMER facility is considered offsite, therefore the Contractor shall be responsible for course registration and payment of any fees. Quantitative Mask-Fit or additional respiratory training conducted at the HAMMER facility is considered offsite training, therefore the Contractor shall be responsible for course registration and payment of any fees.

44. Prohibited Articles

- A. Prohibited Articles Anywhere. The following are Prohibited Articles anywhere on the Site and offsite locations under the cognizance of Battelle or the DOE:
 - 1. Dangerous weapons
 - 2. Explosives, ammunition, and incendiary devices
 - 3. Controlled substances and drug paraphernalia
 - 4. Alcoholic beverages
 - 5. Contraband (includes other items prohibited by law).
- B. Exclusion, Limited and/or Protected Areas. The following are Prohibited Articles within Exclusion, Limited and/or Protected Areas:
 - 1. All items listed above, and
 - 2. Privately owned recording equipment
 - 3. Privately owned cameras (still, motion, video)
 - 4. Privately owned computers and associated media (including palm pilots)
 - 5. Privately owned cellular telephones
 - 6. Privately owned radio transmitters.

45. Work Limitations, Restrictions & Requirements

- A. **Time**. "Time," if stated as a number of days, is calculated using calendar days, unless otherwise specified, and will include Saturdays, Sundays, and legal holidays. If the last day of the Contract period of performance falls on a Saturday, Sunday, or legal holiday, then the period shall include the next working day. The following holidays shall be non-work days under this Contract unless otherwise directed by Battelle:
 - New Year's Day
 - Memorial Day
 - Independence Day
 - Labor Day
 - Thanksgiving Day and the day after
 - Christmas Eve and Christmas Day
- B. **Working Hours**. Unless identified otherwise in the Division 1 General Requirements for the contract work, normal working hours are Monday through Friday from 7:00am to 3:30pm. The Contractor shall not perform work at the Site other than during

normal working hours without prior written approval. The Contractor shall give Battelle at least two (2) hours prior notice if its employees are to be working after the normal shift period Monday through Friday. The Contractor shall give Battelle notice on the prior working day if its employees will be working before normal shift hours, Monday through Friday, or will be working at any time on Saturday, Sunday, or holidays. The notice shall include the type of work to be performed, location of work, date and hours of work, and description of any heavy equipment to be used. Battelle advance approval is required any time work is to be performed at other than normal shift periods.

- C. **Overhead Work Restrictions**. Under no conditions shall the Contractor operate or move cranes, hoists or similar equipment within 20 feet of overhead electrical conductors, guy wires, or substations, unless prior authorization for such operations is obtained from Battelle, giving full details of the method of equipment operations. Authorization from Battelle shall also be obtained when transporting materials, machinery, or other equipment, which establishes a height exceeding 15 feet from the road and/or ground surface.
- D. **Oversize Loads**. An Oversize Load permit is required when the vehicle or load exceeds: Width -8'-6" x Height -14ft x Length -40ft (single unit), or 48ft (single trailing unit). Contact Battelle to obtain the permit.
- E. **Moving Heavy Equipment**. The Contractor shall notify Battelle at least two (2) working days prior to the date it proposes to move any heavy equipment into or from the Worksite and shall not move any such equipment into or from the Worksite until receipt of written approval from Battelle. Heavy equipment will not be allowed to travel across existing paved roadways unless rubber tires or other adequate protection such as heavy planking protects such roadway. Movement of heavy equipment equipped with crawler-type treads on existing paved surfaces is forbidden and such equipment must be transported to the Worksite on rubber-tired trailers. Upon completion of the Work, the equipment shall be promptly removed from the Worksite.
- F. **System Outages**. Work, which requires any existing building utility system (including fire protection) to be taken out of service, shall be scheduled and performed so that the length of time the utility is out of service is held to a minimum. All material for the alteration and tie-in work shall be on hand when each utility service interruption is scheduled. The Contractor shall notify Battelle not less than five (5) working days prior to each required utility shutdown. All tie-in work shall be scheduled and performed so that the shutdown time will not exceed four (4) hours for water and two (2) hours for electrical or fire alarm. Battelle shall approve methods of performing the tie-in work prior to any utility system outage. Prior approval must be obtained for connection to and use of existing fire hydrants.
- G. **Excavation Requirements**.
 - 1. Definition: "Excavations include any operation in which earth, rock, or other material in the ground (below existing grade) is moved, removed, or otherwise displaced by means or use of any hand

tools, mechanical equipment or explosives.”

2. Excavation permitting is required when grading, trenching, digging, ditching, drilling, tunneling, scraping, pipe plowing, and driving ground rods or posts, at a depth of 12 inches or greater.
3. Where required, the Contractor shall provide an adequate supporting mechanism to prevent undermining or movement of any load bearing concrete slabs or footings. All excavations shall comply with OSHA and DOSH regulations.
4. In the event any underground pipe line, conduit or other object not shown on the drawings or otherwise indicated in the Specifications is encountered, the Contractor shall immediately stop work and notify Battelle.
5. Except as otherwise specified, protection (and restoration) of existing facilities shall be as specified in section titled “Protection of Existing Utilities.” All underground piping, conduits, ducts, and other utilities shall be satisfactorily shored, braced and/or guyed as specified in the above referenced section.
6. Contractors shall hand-dig within five (5) feet of all known utilities.

H. **Blind Penetration Requirements.**

1. All “Blind Penetrations” where the Contractor must penetrate into or through a wall, ceiling, floor or similar obstruction and the path of the penetration is not visible requires a Battelle Permit. The Contractor shall notify Battelle five (5) days in advance of any planned Blind Penetrations to allow Battelle time to issue the permit.
2. The Contractor shall perform a sub-surface scan using penetrating radar of the surface to be blind penetrated. The Contractor shall physically mark the location of any suspected embedment and do not proceed without release by Battelle if a suspected embedment is marked within 8 inches of the planned penetration.
3. All potentially energized circuits or sources in the proximity of the penetration shall be locked out and tagged by the Contractor in a de-energized condition.
4. All energized Contractor equipment used in blind penetrations shall be equipped with a “kill switch” or “drill stop” to effectively stop the Contractor equipment when the drill or energized penetrating equipment comes in contact with any metallic object.
5. Contractor shall notify Battelle immediately upon hitting an obstruction and/or the kill switch de-energizes the penetrating equipment. Disengaging the kill switch requires Battelle concurrence.
6. In addition to whatever other PPE the Contractor considers necessary for a Blind Penetration, the worker performing the penetration operation shall wear class 00, 500 volt rated, insulated gloves or insulated gloves rated for the voltage potential during the penetrating activity.

I. **Adverse Weather Conditions.** To insure worker safety, work or portions of work may be temporarily and incrementally shut down due to high winds, lighting, or other inclement weather as determined by Battelle. Contractor will not be additionally compensated in terms of cost or schedule for weather related shutdowns. Battelle will issue weather warnings via radio, telephone, public announcement, or in person. The Contractor shall ensure that all contractor and subcontractor personnel are apprised of the warnings and take the required actions as stated below.

1. Sustained winds greater than 15 mph – the necessity for crane operations will be closely scrutinized
2. Sustained winds greater than 25 mph and/or gusts greater than 40 mph – all crane activities must cease and be secured. All loose outdoor material shall be secured. The Contractor’s Safety Supervisor shall evaluate work on roofs or elevated work surfaces before continuing. All personnel working outdoors are required to wear safety goggles. Depending on dust hazards, work may be stopped. Personnel may be directed to shelter.
3. Sustained winds greater than 30 mph and/or gusts greater than 45 mph – all outdoor work activities may be stopped. Personnel may be directed to shelter.
4. Sustained winds greater than 50 mph – outdoor work activities will be curtailed and limited to those approved by Battelle and Contractor’s Safety Supervisor. Personnel will be directed to shelter. Site closure may be implemented and all work activities ceased.
5. Thunderstorm/lighting advisory based on lighting activity within a 30 mile radius of the site – Contractor personnel shall not work on roofs or elevated surfaces. Personnel shall stay away from equipment such as drilling rigs, cranes, boom trucks, or elevated work platforms. The “30-30 Rule” states, when you see lightning, count the time until you hear thunder. If this time is 30 seconds or less go immediately to a safe location. These protective measures shall remain in place until Battelle cancels the warning. The Hanford Weather Station (373-2716) or the National Weather Service Office (NWSO) located in Pendleton (541 276-7832) can be used to detect, locate, and determine if the hazardous weather pattern has dissipated or moved past the 30 mile radius.
6. Contractor shall be responsible to provide snow removal and ensure safe walking and transfer conditions for walkways and access points around all site offices and work areas and the job-site within the project boundaries.
7. In response to winter storm conditions, Battelle may close or delay the site operation. If so, Battelle will make appropriate announcements and coordinate closures or early dismissals. Battelle’s inclement weather hotline phone number is 509 375-2124.
8. Access to PNNL facility roofs during inclement

weather may be restricted or delayed until the appropriate mitigation of snow, ice, or frost can be eliminated. Authorization to access facility roofs are controlled by the Building Manager.

46. Performance of Work by the Contractor (FAR 52.236-1, Apr 1984)

The Contractor shall perform on the site, and with its own organization, work equivalent to at least fifteen percent [15%] of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

47. Differing Site Conditions (FAR 52.236-2, Apr 1984)

- A. The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of—
 - 1. Subsurface or latent physical conditions at the site which differ materially from those indicated in this contract; or
 - 2. Unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.
- B. The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.
- C. No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; *provided*, that the time prescribed in paragraph (a) of this clause for giving written notice may be extended by the Contracting Officer.
- D. No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

48. Site Investigation and Conditions Affecting the Work (FAR 52.236-3, Apr 1984)

- A. The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads; (3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of

surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site, including all exploratory work done by the Government, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the Government.

- B. The Government assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the Government. Nor does the Government assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

49. Physical Data (FAR 52.236-4, Apr 1984)

Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

50. Material and Workmanship (FAR 52.236-5, Apr 1984)

- A. All equipment, material, and articles incorporated into the work covered by this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the specifications to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.
- B. The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. When directed to do so, the Contractor shall submit samples for approval at the Contractor's expense, with all shipping charges prepaid. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.
- C. All work under this contract shall be performed in a

skillful and workmanlike manner. The Contracting Officer may require, in writing, that the Contractor remove from the work any employee the Contracting Officer deems incompetent, careless, or otherwise objectionable.

51. Superintendence by the Contractor (FAR 52.236-6, Apr 1984)

At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the worksite a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

52. Permits and Responsibilities (FAR 52.236-7, Nov 1991)

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

53. Other Contracts (FAR 52.236-8, Apr 1984)

The Government may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with Government employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by Government employees.

54. Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements (FAR 52.236-9, Apr 1984)

- A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.
- B. The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site, and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this

contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

55. Operations and Storage Areas (FAR 52.236-10, Apr 1984)

- A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.
- B. Temporary buildings (*e.g.*, storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.
- C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

56. Use and Possession Prior to Completion (FAR 52.236-11, Apr 1984)

- A. The Government shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the Government intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The Government's possession or use shall not be deemed an acceptance of any work under the contract.
- B. While the Government has such possession or use, the Contractor shall be relieved of the responsibility for the loss of or damage to the work resulting from the Government's possession or use, notwithstanding the terms of the clause in this contract entitled "Permits and Responsibilities." If prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

57. Cleaning Up (FAR 52.236-12 Apr 1984)

The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. Before completing the work, the Contractor shall remove from the work and premises any rubbish, tools, scaffolding, equipment, and materials that are not the property of the Government. Upon completing the work, the Contractor shall leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer.

58. Availability and Use of Utility Services (FAR 52.236-14, Apr 1984)

- A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.
- B. The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

59. Schedules for Construction Contracts (FAR 52.236-15, Apr 1984)

- A. The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring materials, plant, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments until the Contractor submits the required schedule.
- B. The Contractor shall enter the actual progress on the chart as directed by the Contracting Officer, and upon doing so shall immediately deliver three copies of the annotated schedule to the Contracting Officer. If, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the Government. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or

schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

- C. Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the default terms of this contract.

60. Layout of Work (FAR 52.236-17, Apr 1984)

The Contractor shall lay out its work from Government established base lines and bench marks indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at its own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through its negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

61. Organization and Direction of the Work (FAR 52.236-19, Apr 1984)

- A. When this contract is executed, the Contractor shall submit to the Contracting Officer a chart showing the general executive and administrative organization, the personnel to be employed in connection with the work under this contract, and their respective duties. The Contractor shall keep the data furnished current by supplementing it as additional information becomes available.
- B. Work performance under this contract shall be under the full-time resident direction of (1) the Contractor, if the Contractor is an individual; (2) one or more principal partners, if the Contractor is a partnership; or (3) one or more senior officers, if Contractor is a corporation, association, or similar legal entity. However, if the Contracting Officer approves, the Contractor may be represented in the direction of the work by a specific person or persons holding positions other than those identified in this paragraph.

62. Specifications and Drawings for Construction (FAR 52.236-21, Feb 1997)

- A. The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications,

the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

- B. Wherever in the specifications or upon the drawings the words "directed," "required," "ordered," "designated," "prescribed," or words of like import are used, it shall be understood that the "direction," "requirement," "order," "designation," or "prescription," of the Contracting Officer is intended and similarly the words "approved," "acceptable," "satisfactory," or words of like import shall mean "approved by," or "acceptable to," or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.
- C. Where "as shown," "as indicated," "as detailed," or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place," that is "furnished and installed."
- D. Shop drawings means drawings, submitted to the Government by the Contractor, subcontractor, or any lower tier subcontractor pursuant to a construction contract, showing in detail (1) the proposed fabrication and assembly of structural elements, and (2) the installation (*i.e.*, fit, and attachment details) of materials or equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the contractor to explain in detail specific portions of the work required by the contract. The Government may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.
- E. If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the Government's reasons therefor. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) of this clause.
- F. If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Contracting Officer approves any such variation, the Contracting Officer shall issue an appropriate contract modification, except that, if the variation is minor or does not

involve a change in price or in time of performance, a modification need not be issued.

- G. The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the Contracting Officer and one set will be returned to the Contractor. Upon completing the work under this contract, the Contractor shall furnish a complete set of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted.

63. Back-Charges

- A. When costs are sustained by Battelle or the Government as a result of Contractor failure in whole or in part to execute its responsibility under the terms of this Agreement, such costs are considered the responsibility of the Contractor and will be "back-charged." Contractor actions having potential to result in back-charges include:
 - 1. Environmental, safety, health, or quality assurance violations;
 - 2. Rework necessary to meet Contract requirements;
 - 3. Support of Contractor's recovery schedule;
 - 4. Inspections by Battelle not performed, as scheduled, due to incomplete or inadequate status of the work for which Contractor is at fault;
 - 5. Inspections that must be repeated by Battelle due to errors, omissions, mismanagement or any fault of Contractor;
 - 6. Vendor data review and processing as a result of re-submittals in excess of three (3), which are attributable to inadequate Contractor coordination or preparation;
 - 7. Contractor's failure to restore all Battelle and/or Government-owned property, facilities, utilities, or systems, including replacement of survey stakes, to "like-for-like" condition after use or damage by Contractor;
 - 8. Contractor's failure to adequately repair and/or replace property of a third party damaged by Subcontractor;
 - 9. Subcontractor's failure to maintain the cleanliness and orderly arrangement of the work site during construction and at final acceptance, within reason, to the satisfaction of Contractor;
 - 10. Subcontractor's failure to return or transfer to another project all security badges will result in a charge to the Subcontractor in the amount of \$250.00 per badge; and
 - 11. Hazardous or environmentally detrimental spills caused by Subcontractor with clean-up performed by Contractor will be charged to Subcontractor.
- B. Notification

Upon identification of an actual or anticipated back-charge, Battelle will provide Contractor a written notice which shall describe the work to be performed, the schedule for performance, and the cost to be charged the Contractor. The cost may include:

1. actual labor cost,
2. actual material cost including transportation, and
3. taxes, levies, duties and assessments.

C. Contractor Acceptance

Contractor is required to accept the back-charge or re-perform work at Contractor's cost. In the event Contractor refuses to accept or agrees to performance of the work within 24 hours after receipt of Battelle's notice, Battelle may elect to proceed with the back-charge work and withhold (set-off) the cost from Contractor's payment. Battelle has the right to set-off such cost against any amount payable to the Contractor whether or not in connection with this Agreement.

64. Vendor Data Requirements

- A. Contractor shall furnish to Battelle copies of required data for disposition sufficiently in advance of the date that the material/equipment is required to be installed to meet the accepted construction schedule. The Vendor Data Schedule (VDS) (also called a "submittal log") summarizes the submittal requirements of the Subcontract and generally specifies the timing for each required submittal. Vendor data for all material and equipment requiring a disposition shall be submitted, reviewed, assigned a disposition code by Battelle and returned to Contractor.
- B. Contractor shall perform no work for which the vendor data has not been reviewed and dispositioned. Any delay caused by Contractor's failure to submit vendor data in a timely manner for Battelle review will not be excusable or compensable. If submitted vendor data items are unacceptable, no excusable delay shall accrue there from, regardless of the number of re-submittals made by Contractor or lower- tiers.
- C. Battelle's vendor data disposition will not affect or relieve Contractor from responsibility for performance of work in compliance with the Contract. Vendor data causing any change to design details, layouts, calculations, analyses, test methods, procedures or any other Contract requirement shall be submitted with a written description of the affected change.
- D. Contractor shall submit, concurrent with each invoice, an updated Construction Vendor Data Submittal Log (CVDSL). Failure to submit the CVDSL may result in withholding of payment until CVDSL receipt. Information provided on the CVDSL shall correlate with Contractor's accepted construction schedule to assure prosecution of the work in accordance with the said construction schedule. The CVDSL shall clearly indicate expected or actual submittal dates and the disposition status of all submitted data.
- E. Substitutions require Battelle approval. Refer to the clause title "Brand Name or Equal."
- F. Samples.
1. When samples are required, they shall be furnished at Contractor's expense in accordance

with the clause entitled "Material and Workmanship." Samples shall be submitted within the time specified, or if no time is specified, within a reasonable time before use to permit inspection and testing. Samples shall be shipped prepaid, delivered as directed by Battelle, and shall be properly marked to show the name of the material, trademark of manufacturer, place of origin, number and name of work where the material represented by the sample will be used, and the name of the Contractor submitting the sample.

2. Samples not subject to destructive testing may be retained by Battelle until completion of the construction. If requested in writing by the Contractor at the time of submission, samples will be returned at Contractor's expense upon completion of the construction. Failure of any samples to pass specified requirements will be sufficient cause for refusal to consider further any samples from the same manufacturer whose materials failed to pass testing requirements.

65. Cooperation with Others

- A. Contractor may undertake or award other subcontracts at or near the site of the work under the Subcontract. Subcontractor shall fully cooperate with the other Subcontractors and with Contractor employees and shall carefully adapt scheduling and performing the work under the Subcontract to accommodate the work by others, heeding any direction that may be provided by Contractor. Subcontractor shall not commit or permit any act that shall interfere with the performance of work by any other Subcontractor or Contractor employees.
- B. Concurrent Work and Interface Responsibilities
1. When portions of the construction work under the Subcontract are performed near active operating areas, Subcontractor shall plan its construction work so as not to interfere with the operation of these facilities and shall maintain free and clear access to same for routine operational and maintenance activities performed by Contractor.
 2. In addition, Subcontractor shall carefully coordinate all construction activities with Contractor so as to avoid conflicts and unnecessary delays in construction. Except for authorized shutdowns for the tie-in of newly constructed facilities, construction activities shall not disrupt normal operation of existing plant facilities.

LABOR STANDARDS

66. Davis-Bacon Act (FAR 52.222-6, July 2005)

- A. Definition.—"Site of the work"—
1. Means—
 - (i). The primary site of the work. The physical place or places where the construction called for in the contract will remain when work on it is completed; and
 - (ii). The secondary site of the work, if any. Any other site where a significant portion of the building or work is constructed, provided that such site is—

- a. Located in the United States; and
 - b. Established specifically for the performance of the contract or project;
2. Except as provided in paragraph (3) of this definition, includes any fabrication plants, mobile factories, batch plants, borrow pits, job headquarters, tool yards, etc., provided—
 - (i). They are dedicated exclusively, or nearly so, to performance of the contract or project; and
 - (ii). They are adjacent or virtually adjacent to the “primary site of the work” as defined in paragraph (a)(1)(i), or the “secondary site of the work” as defined in paragraph (a)(1)(ii) of this definition;
 3. Does not include permanent home offices, branch plant establishments, fabrication plants, or tool yards of a Contractor or subcontractor whose locations and continuance in operation are determined wholly without regard to a particular Federal contract or project. In addition, fabrication plants, batch plants, borrow pits, job headquarters, yards, etc., of a commercial or material supplier which are established by a supplier of materials for the project before opening of bids and not on the Project site, are not included in the “site of the work.” Such permanent, previously established facilities are not a part of the “site of the work” even if the operations for a period of time may be dedicated exclusively or nearly so, to the performance of a contract.
- B. (1) All laborers and mechanics employed or working upon the site of the work will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, or as may be incorporated for a secondary site of the work, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Any wage determination incorporated for a secondary site of the work shall be effective from the first day on which work under the contract was performed at that site and shall be incorporated without any adjustment in contract price or estimated cost. Laborers employed by the construction Contractor or construction subcontractor that are transporting portions of the building or work between the secondary site of the work and the primary site of the work shall be paid in accordance with the wage determination applicable to the primary site of the work.
- (2) Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (e) of this clause; also, regular

contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such period.

(3) Such laborers and mechanics shall be paid not less than the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in the clause entitled Apprentices and Trainees. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided that the employer's payroll records accurately set forth the time spent in each classification in which work is performed.

(4) The wage determination (including any additional classifications and wage rates conformed under paragraph (c) of this clause) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the primary site of the work and the secondary site of the work, if any, in a prominent and accessible place where it can be easily seen by the workers.

- C. (1) The Contracting Officer shall require that any class of laborers or mechanics which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. The Contracting Officer shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met:
- (i). The work to be performed by the classification requested is not performed by a classification in the wage determination.
 - (ii). The classification is utilized in the area by the construction industry.
 - (iii). The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.
- (2) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and the Contracting Officer agree on the classification and wage rate (including the amount designated for fringe benefits, where appropriate), a report of the action taken shall be sent by the Contracting Officer to the Administrator of the:
- Wage and Hour Division
Employment Standards Administration
U.S. Department of Labor
Washington, DC 20210
- The Administrator or an authorized representative will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.
- (3) In the event the Contractor, the laborers or mechanics to be employed in the classification, or

their representatives, and the Contracting Officer do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), the Contracting Officer shall refer the questions, including the views of all interested parties and the recommendation of the Contracting Officer, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise the Contracting Officer or will notify the Contracting Officer within the 30-day period that additional time is necessary.

(4) The wage rate (including fringe benefits, where appropriate) determined pursuant to paragraphs (c)(2) and (c)(3) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in the classification.

- D. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.
- E. If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

67. Withholding of Funds (FAR 52.222-7, Feb 1988)

The Contracting Officer shall, upon his or her own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same Prime Contractor, or any other federally assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same Prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, all or part of the wages required by the contract, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

68. Payrolls and Basic Records (FAR 52.222-8, June 2010)

- A. Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the

work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under paragraph (d) of the clause entitled Davis-Bacon Act, that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

- B. (1) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under paragraph (a) of this clause, except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose and may be obtained from the U.S. Department of Labor Wage and Hour Division website at <http://www.dol.gov/whd/forms/wh347.pdf>. The Prime Contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the Contracting Officer, the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a Prime Contractor to require a subcontractor to provide addresses and social security numbers to the Prime Contractor for its own records, without weekly submission to the Contracting Officer.
2. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify—
- (i). That the payroll for the payroll period contains the information required to be

maintained under paragraph (a) of this clause and that such information is correct and complete;

- (ii). That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in the Regulations, 29 CFR Part 3; and
 - (iii). That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.
3. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by paragraph (b)(2) of this clause.
 4. The falsification of any of the certifications in this clause may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.
- C. The Contractor or subcontractor shall make the records required under paragraph (a) of this clause available for inspection, copying, or transcription by the Contracting Officer or authorized representatives of the Contracting Officer or the Department of Labor. The Contractor or subcontractor shall permit the Contracting Officer or representatives of the Contracting Officer or the Department of Labor to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit required records or to make them available, the Contracting Officer may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

69. Apprentices and Trainees (FAR 52.222-9, July 2005)

A. Apprentices.

1. An apprentice will be permitted to work at less than the predetermined rate for the work performed when employed—
 - A. Pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer, and Labor Services (OATELS) or with a State Apprenticeship Agency recognized by the OATELS; or
 - B. In the first 90 days of probationary

employment as an apprentice in such an apprenticeship program, even though not individually registered in the program, if certified by the OATELS or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice.

2. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program.
 3. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in paragraph (a)(1) of this clause, shall be paid not less than the applicable wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed.
 4. Where a Contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination.
 5. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination.
 6. In the event OATELS, or a State Apprenticeship Agency recognized by OATELS, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.
- ##### **B. Trainees.**
1. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer, and Labor Services (OATELS). The ratio of trainees to journeymen on the job site shall not be greater

than permitted under the plan approved by OATELS.

2. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the OATELS shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed.
3. In the event OATELS withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.
- C. Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

70. Compliance with Copeland Act Requirements (FAR 52.222-10, Feb 1988)

The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

71. Subcontracts (Labor Standards) (FAR 52.222-11, July 2005)

- A. Definition. "Construction, alteration or repair," as used in this clause, means all types of work done by laborers and mechanics employed by the construction Contractor or construction subcontractor on a particular building or work at the site thereof, including without limitation—
 1. Altering, remodeling, installation (if appropriate) on the site of the work of items fabricated off-site;
 2. Painting and decorating;
 3. Manufacturing or furnishing of materials, articles, supplies, or equipment on the site of the building or work;
 4. Transportation of materials and supplies between the site of the work within the meaning of paragraphs (a)(1)(i) and (ii) of the "site of the

work" as defined in the FAR clause at 52.222-6, Davis-Bacon Act of this contract, and a facility which is dedicated to the construction of the building or work and is deemed part of the site of the work within the meaning of paragraph (2) of the "site of work" definition; and

5. Transportation of portions of the building or work between a secondary site where a significant portion of the building or work is constructed, which is part of the "site of the work" definition in paragraph (a)(1)(ii) of the FAR clause at 52.222-6, Davis-Bacon Act, and the physical place or places where the building or work will remain (paragraph (a)(1)(i) of the FAR clause at 52.222-6, in the "site of the work" definition).
- B. The Contractor shall insert in any subcontracts for construction, alterations and repairs within the United States the clauses entitled—
 1. Davis-Bacon Act;
 2. Contract Work Hours and Safety Standards Act—Overtime Compensation (if the clause is included in this contract);
 3. Apprentices and Trainees;
 4. Payrolls and Basic Records;
 5. Compliance with Copeland Act Requirements;
 6. Withholding of Funds;
 7. Subcontracts (Labor Standards);
 8. Contract Termination—Debarment;
 9. Disputes Concerning Labor Standards;
 10. Compliance with Davis-Bacon and Related Act Regulations; and
 11. Certification of Eligibility.
- C. The prime Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor performing construction within the United States with all the contract clauses cited in paragraph (b).
- D. (1) Within 14 days after award of the contract, the Contractor shall deliver to the Contracting Officer a completed Standard Form (SF) 1413, Statement and Acknowledgment, for each subcontract for construction within the United States, including the subcontractor's signed and dated acknowledgment that the clauses set forth in paragraph (b) of this clause have been included in the subcontract.
 2. Within 14 days after the award of any subsequently awarded subcontract the Contractor shall deliver to the Contracting Officer an updated completed SF 1413 for such additional subcontract.
- E. The Contractor shall insert the substance of this clause, including this paragraph (e) in all subcontracts for construction within the United States.

72. Contract Termination—Debarment (FAR 52.222-12, Feb 1988)

A breach of the contract clauses entitled Davis-Bacon Act, Contract Work Hours and Safety Standards Act—Overtime Compensation, Apprentices and Trainees, Payrolls and

Basic Records, Compliance with Copeland Act Requirements, Subcontracts (Labor Standards), Compliance with Davis-Bacon and Related Act Regulations, or Certification of Eligibility may be grounds for termination of the contract, and for debarment as a Contractor and subcontractor as provided in 29 CFR 5.12.

73. Compliance with Davis-Bacon and Related Act Regulations (FAR 52.222-13, Feb 1988)

All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR parts 1, 3, and 5 are hereby incorporated by reference in this contract.

74. Disputes Concerning Labor Standards (FAR 52.222-14, Feb 1988)

The United States Department of Labor has set forth in 29 CFR parts 5, 6, and 7 procedures for resolving disputes concerning labor standards requirements. Such disputes shall be resolved in accordance with those procedures and not the Disputes clause of this contract. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives.

75. Notice of Labor Disputes (cl. 359 - Feb 1997)

If the Contractor has knowledge that any actual or potential labor dispute is delaying or threatens to delay the timely performance of this contract, the Contractor shall immediately give notice, including all relevant information, to the Battelle Contracts Representative.

76. Certification of Eligibility (FAR 52.222-15, Feb 1988)

- A. By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).
- B. No part of this contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).
- C. The penalty for making false statements is prescribed in the U.S. Criminal Code, [18 U.S.C. 1001](#).

77. Compliance with Contractor Code of Business Ethics and Conduct (FAR 52.203-13)

The Contractor shall comply with the requirements of FAR 52.203-13, which are hereby incorporated by reference in this contract. This clause applies if the contract value exceeds \$5,000,000 and the performance period is 120 days or more.

CLAUSES INCORPORATED BY REFERENCE

This Contract incorporates one or more FAR and DEAR provisions/clauses by reference with the same force and effect as if they were given in full text. Such provisions/clauses are identified below and elsewhere in this Contract by their title, effective date, and reference where they appear in the FAR and/or DEAR. The FAR and DEAR may be obtained from the Superintendent of Documents, US Government Printing Office and is available for viewing/downloading at <http://www.acquisition.gov/far/> and <http://farsite.hill.af.mil>.

A. Applicable to all Contracts:

1. FAR 52.223-3, Hazardous Material Identification and Material Safety Data (JAN 1997) (Alt I, JUL 1995)
2. DEAR 952.211-71, Priorities and Allocations (APR 2008)
3. FAR 52.204-9 Personal Identity Verification of Contractor Personnel (JAN 2011)
4. FAR 52.227-4, Patent Indemnity—Construction Contracts (DEC 2007)
5. FAR 52.247-64, Preference For Privately Owned U.S.-Flag Commercial Vessels (FEB 2006)
6. DEAR 952.204-71 Sensitive Foreign Nations Control (MAR 2011)
7. DEAR 952.217-70 Acquisition of Real Property (Apr 1984)
8. FAR 52.232-39 Unenforceability of Unauthorized Obligations (Jun 2013)

B. Applicable to Subcontracts Under This Contract For Commercial Items:

1. FAR 52.244-6, Subcontracts For Commercial Items (DEC 2010)
2. FAR 52.222-50 Combating Trafficking in Persons (FEB 2009)
3. FAR 52.223-15 Energy Efficiency in Energy-Consuming Products (DEC 2007)

C. Applicable if Contract identifies specific items to be accorded duty-free entry into a customs territory of the United States. Also applicable where other foreign supplies in excess of \$15,000 may be imported to a customs territory of the United States.

1. FAR 52.225-8, Duty-Free Entry (OCT 2010)

D. Applicable if Contract exceeds \$2,500:

1. FAR 52.225-9, Buy American Act—Construction Materials (FEB 2009)
(Note: The fill-in for paragraph (b) (2) of this clause is "None.")
2. FAR 52.225-13, Restrictions on Certain Foreign Purchases (JUNE 2008)

E. Applicable if Contract Exceeds \$3,000:

1. FAR 52.222-54, Employment Eligibility Verification (Jan 2009) – applies for (a) commercial or noncommercial services (except for commercial services that are part of the purchase of a COTS item (or an item that would be a COTS item, but for minor modifications), performed by the COTS provider, and are normally provided for that COTS item) and (b) construction services; only applies for work performed in the United States.

F. Applicable if Contract exceeds \$10,000:

1. FAR 52.222-21, Prohibition of Segregated Facilities (FEB 1999)
2. FAR 52.222-23, Notice of Requirement for

Affirmative Action to Ensure Equal Employment Opportunity for Construction (FEB 1999) (The term "Covered Area" referred to in this FAR clause includes the Missouri Counties of Clay, Platte, Jackson, Ray, and Cass; and the Kansas Counties of Wyandotte and Johnson. Goals for minority and female participation in each trade are 12.7% and 6.9%, respectively.)

3. FAR 52.222-26, Equal Opportunity (MAR 2007) - The Equal Employment Opportunity Act Poster referenced in paragraph (c)(3) of the above clause may be downloaded from the U.S. Department of Labor website at www.dol.gov/elaws/posters.htm
4. FAR 52.222-27, Affirmative Action Compliance Requirements for Construction (FEB 1999)
5. FAR 52.222-29, Notification of Visa Denial (June 2003) – *applies when the Equal Opportunity clause is used and when the work is required to be performed in a foreign country.*

G. Applicable if Contract exceeds \$15,000:

1. FAR 52.222-36, Affirmative Action for Workers with Disabilities (OCT 2010)

H. Applicable if Contract exceeds \$25,000:

1. FAR 52.204-10, Reporting Executive Compensation and First-Tier Subcontract Awards (Jul 2013) – *Contractor agrees to provide such information to Battelle or to maintain it for a period of not less than three years following contract completion and to provide it to the Government upon request.*

I. Applicable if Contract exceeds \$30,000:

1. FAR 52.209-6, Protecting the Government's Interest When Subcontracting with Contractors Debarred, Suspended, or Proposed for Debarment (Dec 2010)

J. Applicable if Contract exceeds \$100,000:

1. FAR 52.222-35, Equal Opportunity for Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans (SEP 2010)
2. FAR 52.222-37, Employment Reports on Special Disabled Veterans, Veterans of the Vietnam Era, and Other Eligible Veterans (SEP 2010)
3. DEAR 970.5227-5, Notice and Assistance Regarding Patent and Copyright Infringement (AUG 2002)

K. Applicable if Contract exceeds \$150,000:

1. FAR 52.203-6, Restrictions on Subcontractor Sales to the Government (SEP 2006)
2. FAR 52.203-7, Anti-Kickback Procedures, (OCT 2010) – excluding paragraph (c)(1)
3. FAR 52.203-17, Contractor Employee Whistleblower Rights and Requirement to Inform Employees of Whistleblower Rights (SEP 2013)
4. FAR 52.219-8, Utilization of Small Business Concerns (JAN 2011)
5. FAR 52.227-1, Authorization and Consent (DEC 2007) – applies without Alternate I if this

Contract is for supplies or services, including construction, architect-engineer services, and materials, supplies, models, samples, and design or testing services.

L. Applicable if Contract exceeds \$100,000 and its performance involves international air transportation of personnel, including their personal effects or property.

1. FAR 52.247-63, Preference for U.S.-Flag Air Carriers (JUN 2003)

M. Applicable if Contract exceeds \$150,000 unless exempt per the provisions of FAR 22.305:

1. FAR 52.222-4, Contract Work Hours and Safety Standards Act--Overtime Compensation (JUL 2005)

N. Applicable if Contractor, as a part of its' quote or proposal, submitted the certification entitled "Certification of Toxic Chemical Release Reporting," and the amount of this Contract, inclusive of option amounts, exceeds \$100,000:

1. FAR 52.223-14, Toxic Chemical Release Reporting (AUG 2003)

O. Applicable If Work Is Performed On DOE Site:

1. DEAR 970.5223-1, Integration of Environment, Safety, and Health into Work Planning and Execution (DEC 2000)
2. DEAR 970.5223-4, Workplace Substance Abuse Programs at DOE Sites, (DEC 2010)
3. DEAR 952.203-70, Whistleblower Protection For Contractor Employees (DEC 2000)

P. Applicable if work is performed on DOE site or if Contractor or its Subcontractors have access to classified information:

1. DEAR 952.204-2, Security (AUG 2009)
2. DEAR 952.204-70, Classification/Declassification (SEP 1997)
3. DEAR 952.204-73, Facility Clearance (MAY 2002)

Q. Applicable if this Contract exceeds \$150,000 and is for advisory and assistance services as those terms are defined at FAR 37.201:

1. DEAR 952.209-72, Organizational Conflicts of Interest, Alt. I, (AUG 2009)

R. Applicable if this Contract exceeds \$500,000:

1. DEAR 952.226-74 Displaced Employee Hiring Preference (JUN 1997)
2. DEAR 970.5226-2, Workforce Restructuring Under Section 3161 of the National Defense Authorization Act for Fiscal Year 1993 (DEC 2000)

S. Applicable if this Contract exceeds \$650,000:

1. FAR 52.219-9, Small Business Subcontracting Plan (JAN 2011) – applies if the Contractor is a large business concern

- T. Applicable to Contracts which require printing (as that term is defined in Title I of the U.S. Government Printing Regulations):**
1. DEAR 970.5208-1, Printing (DEC 2000)
- U. Applicable if this Contract involves the design, development, or operation of a system of records on individuals to accomplish a DOE function per the requirements of FAR 24.1:**
1. FAR 52.224-1, Privacy Act Notification (APR 1984)
 2. FAR 52.224-2, Privacy Act (APR 1984)
- V. Applicable if Battelle requires a Certificate of Current Cost or Pricing Data in connection with the initial award or subsequent modification of this Contract pursuant to the requirements of FAR 15.403-1 through 15.403-5:**
1. FAR 52.215-10, Price Reduction for Defective Cost or Pricing Data (AUG 2011)
 2. FAR 52.215-11, Price Reduction for Defective Cost or Pricing Data—Modifications (AUG 2011)
 3. FAR 52.215-12, Subcontractor Cost or Pricing Data (OCT 2010)
 4. FAR 52.215-13, Subcontractor Cost or Pricing Data—Modifications (OCT 2010)
- W. Applicable if costs incurred are a factor in determining the amount payable to Contractor under this Contract, or if the Contractor furnished Battelle a Certificate of Current Cost or Pricing Data as specified above:**
1. DEAR 970.5232-3, Accounts, Records, and Inspection (DEC 2010)
- X. Applicable if Battelle furnishes Government property to the Contractor in the performance of this purchase order/Contract, including Contractor acquired property to which title vests in the government under this purchase order/Contract:**
1. FAR 52.245-1, Government Property (AUG 2010)
- Y. Applicable if royalties exceeding \$250 were included in the price of this Contract:**
1. DEAR 970.5227-8, Refund of Royalties (AUG 2002)
- Z. Applicable if foreign travel is required in the performance of this Contract.**
1. DEAR 952.247-70, Foreign Travel (AUG 2009)
- AA. Applicable to all Contracts which include the design or operation of any plants or facilities or specially designed equipment for such plants or facilities.**
1. DEAR 970.5227-1 Rights in Data – Facilities (DEC 2000) [included in Contracts for support services, involving the design or operation of any plants or facilities or specially designed equipment for such plants or facilities that are managed or operated under an M&O Contract under 48 CFR 970 with DOE.]
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GENERAL PROVISIONS SUPPLEMENT
Nuclear Hazards Indemnity Agreement and
Price-Anderson Amendments Act
For the Pacific Northwest National Laboratory
Operated by Battelle Memorial Institute

This General Provisions Supplement is in addition to the General Provision provided with this contract. This Supplement is provided because work to be performed or goods to be delivered under this contract have been identified by Battelle as qualifying for certain liability protections under the Atomic Energy Act, as well as certain responsibilities under the Price-Anderson Amendments Act. This Supplement is incorporated into the contract with the same force and effect as all other general provisions applicable to this contract.

Nuclear Hazards Indemnity Agreement (cl. 3110C – Mar. 2009)

This clause applies when the Contract may involve risk of public liability from a nuclear incident.

- A. Authority. This clause is incorporated into this Contract pursuant to the authority contained in subsection 170d of the Atomic Energy Act of 1954, as amended (hereinafter called the Act).
- B. Definitions. The definitions set out in the Act shall apply to this clause.
- C. Financial Protection. Except as hereafter permitted or required in writing by the Department of Energy (DOE), the Contractor will not be required to provide or maintain, and will not provide or maintain at Government expense, any form of financial protection to cover public liability, as described in Paragraph D.2 below. DOE may, however, at any time require in writing that the Contractor provide and maintain financial protection of such a type and in such amount as DOE shall determine to be appropriate to cover such public liability, provided that the costs of such financial protection are reimbursed to the Contractor by DOE.
- D. Indemnification.
1. To the extent that the Contractor and other persons indemnified are not compensated by any financial protection permitted or required by DOE, DOE will indemnify the Contractor and other persons indemnified against (a) claims for public liability as described in Paragraph D.2 of this clause; and (b) such legal costs of the Contractor and other persons indemnified as are approved by DOE, provided that DOE's liability, including such legal costs, shall not exceed the amount set forth in section 170t of the Act in the aggregate for each nuclear incident or precautionary evaluation occurring within the United States or \$500 million in the aggregate for each nuclear incident occurring outside the United States, irrespective of the number of persons indemnified in connection with this contract.
 2. The public liability referred to in Paragraph D.1 of this Clause is public liability as defined in the Act which (a) arises out of or in connection with the activities under this Contract, including transportation; and (b) arises out of or results from a nuclear incident or precautionary evacuation, as those terms are defined in the Act.
- E. Waiver of Defenses.
1. In the event of a nuclear incident, as defined in the Act, arising out of nuclear waste activities, as defined in the Act, the Contractor, on behalf of itself and other persons indemnified, agrees to waive any issue or defense as to charitable or governmental immunity.
 2. In the event of an extraordinary nuclear occurrence which—
 - a. Arises out of, results from, or occurs in the course of the construction, possession, or operation of a production or utilization facility; or
 - b. Arises out of, results from, or occurs in the course of transportation of source material, by-product material, or special nuclear material to or from a production or utilization facility; or
 - c. Arises out of or results from the possession, operation, or use by the Contractor or a subcontractor of a device utilizing special nuclear material or by-product material, during the course of the contract activity; or
 - d. Arises out of, results from, or occurs in the course of nuclear waste activities, the Contractor, on behalf of itself and other persons indemnified, agrees to waive:
 - (i) Any issue or defense as to the conduct of the claimant (including the conduct of persons through whom the claimant derives its cause of action) or fault of persons indemnified, including, but not limited to—
 - (a) Negligence;
 - (b) Contributory negligence;
 - (c) Assumption of risk; or
 - (d) Unforeseeable intervening causes, whether involving the conduct of a third person or an act of God;
 - (ii) Any issue or defense as to charitable or governmental immunity; and
 - (iii) Any issue or defense based on any statute of limitations, if suit is instituted within 3 years from the date on which the claimant first knew, or reasonably could have known, of his injury or change and the cause thereof. The waiver of any such issue or defense shall be effective regardless of whether such issue or defense may otherwise be

deemed jurisdictional or relating to an element in the cause of action. The waiver shall be judicially enforceable in accordance with its terms by the claimant against the person indemnified.

- e. The term extraordinary nuclear occurrence means an event that DOE has determined to be an extraordinary nuclear occurrence as defined in the Act. A determination of whether or not there has been an extraordinary nuclear occurrence will be made in accordance with the procedures in 10 CFR Part 840.
 - f. For the purposes of that determination, "offsite" as that term is used in 10 CFR Part 840 means away from "the contract location" which phrase means any DOE facility, installation, or site at which contractual activity under this contract is being carried on, and any Contractor-owned or controlled facility, installation, or site at which the Contractor is engaged in the performance of contractual activity under this contract.
3. The waivers set forth above:
- a. Shall be effective regardless of whether such issue or defense may otherwise be deemed jurisdictional or relating to an element in the cause of action;
 - b. Shall be judicially enforceable in accordance with its terms by the claimant against the person indemnified;
 - c. Shall not preclude a defense based upon a failure to take reasonable steps to mitigate damages;
 - d. Shall not apply to injury or damage to a claimant or to a claimant's property which is intentionally sustained by the claimant or which results from a nuclear incident intentionally and wrongfully caused by the claimant;
 - e. Shall not apply to injury to a claimant who is employed at the site of and in connection with the activity where the extraordinary nuclear occurrence takes place, if benefits therefore are either payable or required to be provided under any workmen's compensation or occupational disease law;
 - f. Shall not apply to any claim resulting from a nuclear incident occurring outside the United States;
 - g. Shall be effective only with respect to those obligations set forth in this clause and in insurance policies, contracts or other proof of financial protection; and
 - h. Shall not apply to, or prejudice the prosecution or defense of, any claim or portion of claim which is not within the protection afforded under (i) the limit of liability provisions under subsection 170e of the Act, and (ii) the terms of this agreement and the terms of insurance policies, contracts, or other proof of financial protection.
- F. Notification and Litigation of Claims. The Contractor shall give immediate written notice to Battelle of any known action or claim filed or made against the Contractor or other person indemnified for public liability as defined in Paragraph D.2. Except as otherwise directed by the Battelle Contracts Representative, the Contractor shall furnish promptly to Battelle, copies of all pertinent papers received by the Contractor or filed with respect to such actions or claims. Battelle and DOE shall have the right to, and may collaborate with, the Contractor and any other person indemnified in the settlement or defense of any action or claim and shall have the right to—
1. require the prior approval of Battelle for the payment of any claim that DOE be required to indemnify hereunder; and
 2. appear through the Attorney General on behalf of the Contractor or other person indemnified in any action brought upon any claim that DOE may be required to indemnify hereunder; take charge of such action, and settle or defend any such action. If the settlement or defense of any such action or claim is undertaken by Battelle or DOE, the Contractor or other person indemnified shall furnish all reasonable assistance in effecting a settlement or asserting a defense.
- G. Continuity of DOE Obligations. The obligations of DOE under this Clause shall not be affected by any failure on the part of the Contractor to fulfill its obligation under this Contract and shall be unaffected by the death, disability, or termination of existence of the Contractor, or by the completion, termination or expiration of this Contract.
- H. Effect of Other Clauses. The provisions of this clause shall not be limited in any way by, and shall be interpreted without reference to any, other clause of this contract, including the clause entitled "Disputes" provided, however, that this clause shall be subject to the clauses entitled "Covenant Against Contingent Fees," "Officials Not to Benefit," and "Examination of Records by the Comptroller General," and any provisions that are later added to this Contract as required by applicable Federal law, including statutes, executive orders and regulations, to be included in Nuclear Hazards Indemnity Agreements.
- I. Civil Penalties. The Contractor and its subcontractors and supplier who are indemnified under the provisions of this clause are subject to civil penalties, pursuant to section 234A of the Act, for violations of applicable DOE nuclear-safety related rules, regulations, or orders. If the Contractor is a not-for-profit contractor, as defined by section 234Ad.(2), the total amount of civil penalties paid shall not exceed the total amount of fees paid within any 1-year period (as determined by the Secretary) under this contract.
- J. Criminal Penalties. Any individual director, officer, or employee of the Contractor or of its subcontractors and suppliers who are indemnified under the provisions of this Clause are subject to criminal penalties, pursuant to 223(c) of the Act, for knowing and willful violation of the Atomic Energy Act of 1954, as amended, and applicable DOE nuclear safety-related rules, regulations or orders which violation results in, or, if undetected, would have resulted in a nuclear incident.
- K. Inclusion in Subcontract. The Contractor shall insert this clause in any subcontract that may involve the risk of public liability, as that term is defined in the Act and further described in Paragraph D.2 above. However, this clause shall not be included in

subcontracts in which the subcontractor is subject to Nuclear Regulatory Commission (NRC) financial protection requirements under section 170b of the Act or NRC agreements of indemnification under section 170c or k of the Act for the activities under the subcontract.

Price-Anderson Amendments Act (cl. 3111 - Nov 2008)

This clause applies when the Contract may involve risk of public liability from a nuclear incident.

In addition to applicable Quality and ES&H contract clauses and requirements, the following shall apply:

A. Indemnification for Nuclear Safety Violations

1. **Applicability.** The provisions of this clause shall be applicable if the Contractor's products or services are subject to the Nuclear Hazards Indemnity provisions of section 170 of the Atomic Energy Act of 1954, as amended, and the U.S. Department of Energy's Procedural Rules for DOE Nuclear Activities as described in Title 10, Code of Federal Regulations, Part 820 (10 CFR Part 820), or could otherwise have any effect on nuclear or radiological safety.
2. The Contractor assumes full responsibility and shall indemnify, hold harmless, and defend Battelle, its directors, officers, and employees from any civil liability, if any, under §234A of the Atomic Energy Act of 1954, as amended, or the implementing regulations, arising out of the activities of the Contractor, its subcontractors, suppliers, agents, employees, and their officers, or directors. The Contractor's obligation to indemnify and hold harmless shall expressly include attorney fees and other reasonable costs of defending any action or proceeding instituted under §234A or DOE's implementing regulations.

B. Nuclear Safety Regulations

1. **Applicability.** The provisions of this clause apply to any activity carried out pursuant to this contract by the Contractor, its subcontractors, suppliers, and employees that has the potential to result in a risk of harm to an individual from radiation or radioactive material, or the potential to affect a DOE nuclear facility or radiological activity. The term "individual" as used in this clause includes, without limitation, general employees, radiological workers, embryo/fetus of a declared pregnant worker, minors, and members of the public. The requirements of this clause do not apply to activities that are regulated, and either indemnified or subject to financial assurance provisions, through a license by the Nuclear Regulatory Commission or a State under an Agreement with the Nuclear Regulatory Commission (an Agreement State), including activities certified by the Nuclear Regulatory Commission under §1701 (42 USC §2297(f)) of

the Atomic Energy Act of 1954, as amended. Other specific applicability exclusions are identified in 10 CFR §820 and related Department of Energy regulations.

2. The Contractor shall comply, as applicable, with the requirements of Title 10, Code of Federal Regulations, Part 835, "Occupational Radiation Protection" (10 CFR Part 835). The Contractor's programs and associated documents are subject to review at all times by Battelle.
3. The Contractor shall: (1) comply, as applicable with the requirements of Title 10, Code of Federal Regulations, Part 830 "Nuclear Safety Management," including Subpart A, Quality Assurance Requirements or a quality assurance program that meets the stated requirements of 10 CFR 830.120, and (2) implement, document, and maintain such programs (e.g., administrative controls, procedures, and technical work documents) as necessary to ensure compliance with the QA requirements section of this contract. The Contractor's programs and associated documents are subject to review at all times by Battelle.
4. The Contractor shall: (1) comply with all applicable requirements of Title 10, Code of Federal Regulations, Part 708, "Contractor Employee Protection" (10 CFR 708), and (2) implement, document, and maintain such programs as necessary to ensure compliance with this requirement. The Contractor's programs and associated documents are subject to review at all times by Battelle.
5. The Contractor shall (1) comply with all applicable requirements of newly promulgated Department of Energy nuclear safety requirements in Title 10, Code of Federal Regulations, and (2) implement, document, and maintain such programs as necessary to ensure compliance with these requirements. The Contractor's programs and associated documents are subject to review at all times by Battelle.
6. If any noncompliance or deficiency occurs in the programs or activities subject to this clause, or a lack of appropriate or timely corrective action by the Contractor, causes a potential violation of nuclear safety requirements, then the Contractor may be subject to enforcement actions under the Atomic Energy Act, 10 CFR 820 and/or other provisions of this contract.
7. Where reporting of a potential violation of a nuclear safety regulation to the DOE is necessary, the Contractor shall report through Battelle.

The Contractor shall include the provisions of this clause, including this paragraph, in all lower-tier Contracts for any activity subject to the applicability requirements in Paragraphs A.1 and B.1.

Environment, Safety, and Health Requirements – PNNL F&O Sponsored Work Sites (JPP/WEA/JSA) (cl. 3113b – Apr 2015)

- A. In performing any work under this contract on property or facilities owned or controlled by Battelle that are identified as PNNL Work Sites (hereinafter “onsite”), the Contractor shall comply with all applicable federal, state and local environment, safety, and health laws and regulations. The Contractor shall also comply with 10 CFR 851, DOE Worker Safety and Health Program, and DEAR 970.5223-1, Integration of Environment, Safety and Health (ES&H) into Work Planning and Execution (Dec. 2000). In order to comply with the requirements of 10 CFR 851 and DEAR 970.5223-1, the Contractor shall be guided by the principles set forth below.
- B. The Contractor shall perform work safely and in a manner that ensures adequate protection for employees, the public, and the environment, and shall be accountable for the safe performance of work. The Contractor shall exercise a degree of care commensurate with the work and the associated hazards. The Contractor shall ensure that management of ES&H functions and activities becomes an integral but visible part of the Contractor’s work planning and execution processes. The Contractor shall, in the performance of work, ensure that—
1. Line management is responsible for the protection of employees, public, and the environment. Line management includes those contractor and subcontractor employees managing and supervising employees performing work.
 2. Clear and unambiguous lines of authority and responsibility for ensuring (ES&H) are established and maintained at all organizational levels.
 3. Personnel possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities, and shall retain records respecting such competency and qualifications, making them available upon request.
 4. Resources are effectively allocated to address ES&H, programmatic, and operational considerations. Protecting employees, the public, and the environment is a priority whenever activities are planned and performed.
 5. Before work is performed, the associated hazards are evaluated and a set of ES&H standards and requirements are established which, if properly implemented, provide adequate assurance that employees, the public, and the environment are protected from adverse consequences.
 6. Administrative and engineering controls to prevent and mitigate hazards are tailored to the work being performed and associated hazards. Emphasis should be on designing the work and/or controls to reduce or eliminate the hazards and to prevent accidents and unplanned releases and exposures.
- C. The Contractor, relative to the Statement of Work and contract specifications, shall be able to demonstrate through documentation and work practices that its performance of work under this contract—
1. Fulfilled the scope of work as outlined in this contract
 2. Identified and analyzed specific, task-level hazards associated with the work
 3. Developed and implemented hazard controls related to the hazards
 4. Allowed the performance of work within the controls
 5. Provided feedback to Battelle and Contractor employees on adequacy of hazard controls
- D. The Contractor shall perform work in accordance with a DOE-approved Worker Safety and Health Program (also referred to in the DEAR as a Safety Management Plan) as described below:
1. The Contractor shall demonstrate well-established safety protocols applicable to the scope of work and consistent with the required elements stated in this clause. Prior to the initiation of any onsite work, the Contractor shall either—
 - a. Accept and incorporate Battelle’s PNNL Contractor Environment Safety and Health (CES&H) Manual as its own. The Battelle Contracts Representative can provide a hard copy of the manual upon request. In those cases where the Contractor’s onsite activities are limited to an office or meeting environment, with no additional or unusual hazards, the CES&H Manual requirements can be met through review of the Visitor Orientation Pamphlet. Both the CES&H Manual and the Visitor Orientation Pamphlet are available on-line at <http://www.pnnl.gov/contracts/Forms.aspx?area=Procurement>.
 - b. Submit its own 10 CFR 851 and DEAR 970.5223-1 compliant Worker Safety and Health Program (WSHP) document to the Battelle Contracts Representative. The Battelle Contracts Representative will coordinate the review and approval of the program document by DOE. The Contractor will be notified by the Battelle Contracts Representative of the program document’s approval by DOE. Acceptance of the Contractor’s program document will be at the sole discretion of DOE.
 2. The Contractor will be provided a completed Job Planning Package (JPP) and Workplace Exposure Assessment (WEA) in the Invitation for Bid (IFB) or Request for Proposal (RFP). The completed JPP and WEA, which are a part of this contract, incorporate elements of effective job planning and hazard identification. Elements include identifying: the scope of work to be performed; facility operating requirements; potential hazards to Battelle and Contractor staff, the public and environment created by the work performed; hazard control methods and mitigation; and mechanisms to evaluate the adequacy of those controls. The JPP and WEA are key control processes in the safe conduct of work at Battelle. The Contractor is expected to develop their work sequence and job safety analysis (JSA) including information provided within the JPP and WEA in order to access Battelle property or facilities and initiate work.
- E. The Contractor shall perform the following additional hazard identification tasks consistent with an approved WSHP:
1. The Contractor shall be responsible for identifying all potential occupational exposures that its employees and the employees of its lower-tier subcontractors will be exposed to while performing any work under this contract.

2. The Contractor shall assure that its employees and those of any lower-tiered subcontractor are medically qualified to perform work associated with any potential occupational exposures that have been identified. Medical qualification and medical surveillance programs are the sole responsibility of the Contractor. In addition, the Contractor is responsible for maintaining any records associated with the administration of these programs.
 3. For each of its employees and each of its lower-tier subcontract employees that the Contractor has identified as having potential occupational exposures that require enrollment in a medical surveillance or medical qualification program, the Contractor shall provide its Occupational Medical provider with the following information:
 - a. Current information about actual or potential work-related site hazards (chemical, radiological, physical, biological, or ergonomic);
 - b. Employee job-task and hazard analysis information, including essential job functions;
 - c. Actual or potential work-site exposures of each employee; and
 - d. Personnel actions resulting in a change of job functions such that a change of hazards, or exposures results.
 4. For each of its employees and each of its lower-tier subcontract employees, a copy of the exposure information provided to the Contractor's occupational medical provider shall be submitted to the Battelle Contracts Representative and approved by Battelle before any of these employees begin work under this contract.
- F. The Contractor shall notify the Battelle Contracts Representative immediately of any OSHA-recordable injuries/illnesses, any "off-normal occurrences," or Government property damaged, that the Contractor determines to have occurred in the course of operations onsite and shall furnish such further information as the Battelle Contracts Representative may require. An "off-normal occurrence" is any unplanned or unexpected event, including near misses, or the discovery of a deficiency in a procedure, plan, or system that has real or potentially undesirable consequences to personnel, equipment, facilities, the environment, and/or programs.
- G. The Contractor's onsite ES&H activities will be subject to review by the Technical Oversight Representative of this contract. Other representatives of Battelle may conduct periodic inspections of the Contractor's equipment, work and storage areas for compliance with the applicable ES&H requirements. The Battelle Contracts Representative will notify the Contractor by a written Notice of Non-compliance of any observed non-compliance with applicable ES&H requirements. The Contractor shall immediately take appropriate corrective action. The Contractor shall advise the Battelle Contracts Representative, in writing, within five (5) working days of the corrective action taken on any safety non-compliance noted on the written Notice of Non-compliance. If the Contractor fails or refuses to correct the safety non-compliance, Battelle may perform, or cause to be performed, the necessary corrective work and unilaterally charge the Contractor for the cost thereof. Such charges will be deducted from payments otherwise due the Contractor under this contract.
- H. The Contractor shall promptly evaluate and resolve any non-compliance with applicable ES&H requirements. If the Contractor fails to provide resolution or if, at any time, the Contractor's acts or failure to act causes substantial harm or an imminent danger to the environment, or health and safety of employees or the public, the Battelle Contracts Representative may issue an order stopping work in whole or in part and the Contractor shall be liable for the delay and any costs thereby incurred. Any stop-work order issued by Battelle under this clause (or issued by the Contractor to a subcontractor in accordance with this clause) shall be without prejudice to any other legal or contractual rights of Battelle. In the event that the Battelle Contracts Representative issues a stop-work order, an order authorizing the resumption of the work may be issued at the discretion of the Battelle Contracts Representative. The Contractor shall not be entitled to an extension of time, or additional cost or fee, or damages by reason of, or in connection with, any work stoppage ordered in accordance with this clause.
- I. Employee Concerns Program
1. The Contractor, its agents, employees or subcontractors, are entitled to use the Battelle Employee Concerns Program and Hotline (509) 375-3999. The Hotline operates 24 hours per day, 7 days a week. Messages may be left anonymously, and all concerns are handled with confidentiality to the maximum extent possible. Employee concerns may also be submitted in writing to the Battelle Employee Concerns Office, Battelle, Pacific Northwest National Laboratory, P.O. Box 999, K1-42, Richland, Washington, 99352, or in person at the Staff Concerns Office, Battelle's Research Operation Building during normal business hours, Monday through Friday 7:30 a.m. to 4:30 p.m.
 2. For the purpose of this document, allegations, concerns, and complaints are handled in a like manner and are referred to collectively as "employee concerns." A concern can consist of a declaration, statement, or assertion of impropriety or inadequacy on the part of one's employer or others at a DOE Site that has affected (or threatens to affect) aspects of operations, such as the environment, health, safety, quality, or security, and may include fraud, mismanagement, waste, or abuse of authority.
 3. No retaliation or retribution shall be taken toward any individual as a result of filing an employee concern consistent with 10 CFR 708.
- J. Civil Penalties and Indemnification
1. The 2002 Bob Stump National Defense Authorization Act amended the Atomic Energy Act by adding section 234C "Worker Health and Safety Rules for Department of Energy Nuclear Facilities." It required DOE to promulgate a worker safety and health rule, published in the Federal Register on February 9, 2006, as 10 CFR 851. It establishes worker safety and health requirements that govern the conduct of contractor activities at both nuclear and non-nuclear DOE Sites. Contractors that fail to comply with the Rule are subject to civil penalties or contract penalties.
 2. The Contractor assumes full responsibility and shall indemnify, hold harmless, and defend Battelle, its directors, officers, and employees from any civil or contractual liability under section 234C of the Atomic Energy Act of 1954, as amended, or

the implementing regulations, arising out of the activities of the Contractor, its subcontractors, suppliers, agents, employees, and their officers, or directors. The Contractor's obligation to indemnify and hold harmless shall expressly include attorney fees and other reasonable costs of defending any action or proceeding instituted under section 234C or DOE's implementing regulations.

- K. Contractor is responsible to ensure that its direct hired and Subcontractor employees who will work on the Site be free of physical or cognitive impairment resulting from the use of alcohol or drugs, including legal drugs, when working or involved in any activity on Battelle/PNNL premises. In order to achieve the federal Drug Free Workplace Act standards, Battelle/PNNL prohibits its non-staff and subcontractors from illegally manufacturing, distributing, selling, possessing, or using illegal drugs, including marijuana, or being under the influence of alcohol while on Battelle/PNNL premises or during PNNL activities. Individuals suspected of being under the influence of any substance, legal or illegal, that may impair their ability to perform their duties are subject to termination of their work agreements and/or having access to the Battelle/PNNL premises revoked. If Battelle, or the Contractor or Subcontractor believes that a Contractor or Subcontractor employee's job performance is being adversely affected by drug or substance (including alcohol) use, Battelle may direct the Contractor to remove the employee. Examples of behavior or circumstances indicating possible drug or substance abuse are observed use, possession, sale or delivery, or credible information that an individual is using suspected of being impaired by drugs or abusing alcohol, or an accident or injury.
- L. The Contractor is responsible for its subcontractors' compliance with the ES&H requirements of this contract. The Contractor shall include a clause substantially the same as this clause in lower-tier subcontracts involving work at on property or facilities owned or controlled by Battelle that are identified as PNNL Work Sites. Such subcontracts shall provide for the right to stop work under the conditions described herein.

Welding (cl. OA-171 –Mar 2011)

Welded items shall be fabricated by qualified/certified personnel utilizing qualified procedures based on contract-specified nationally recognized welding codes/standards in effect on the contract date.

The Contractor shall maintain records of welding qualifications and procedures including welder qualification/certification documentation. Welder qualification/certification shall include documented evidence of continued welding performance by welding process.

After contract award, but 15 working days prior to performing any welding, the Contractor shall deliver to Battelle for review and acceptance the following documentation:

- Procedure Qualification Record for each applicable welding process and/or reference to applicable pre-qualified procedures indicating applicable code/standard and section.
- Welding Procedure Specification for each applicable welding process.
- Welder Qualification/Certification Records for those individuals performing the welding as required by the contract.

Unless otherwise specified, the Contractor shall mail all documents required by this contract to be delivered to the Battelle Contracts Representative, Battelle, PO Box 999, Richland, WA 99352. Submission of a certification constitutes Contractor's express warranty that the identified supplies conform to all of the requirements of this contract. A document is not delivered until it is received by Battelle. Battelle shall have the right to reject, as not in conformity with the requirements of this contract, any supplies or services for which all required reports, procedures, or certifications are not delivered. The Contractor's failure to deliver such documents, or delivery of deficient documents, shall be deemed a failure to make delivery within the meaning of the default clause of this contract.

Pre-Work Evaluation Requirement: Prior to performing any welding, Battelle's Acquisition Quality Support Services must evaluate the supplier's documentation (as required above) for compliance with contractual requirements.

RED-LINED DRAWINGS *(cl QA-183 – April 2008)*

Prior to submission of its final payment invoice, the Contractor shall deliver to Battelle three revised copies of all Battelle furnished or Contractor-generated design drawings and specifications necessary to depict accurately all delivered supplies; provided, however, that if the supplies delivered conform exactly to all such design drawings and specifications, the Contractor shall instead so certify in writing. Such certification shall clearly specify all applicable design drawings and specifications (red-lined drawings are acceptable). Contractor's failure to deliver all required "As-Built" design drawings and specifications, or the delivery of "As-Built" design drawings and specifications that are deficient, shall be deemed a failure to make delivery within the meaning of the Default clause of this contract.

Unless otherwise specified, Contractor shall mail all documents required by this contract to be delivered to the Battelle Contracts Representative, Battelle, PO Box 999, Richland, Washington 99352. A document is not delivered until it is received by Battelle. Battelle shall have the right to reject, as not in conformity with the requirements of this contract, any supplies or services for which all required reports, procedures or certifications are not delivered. Contractor's failure to deliver such documents, or delivery of deficient documents, shall be deemed a failure to make delivery within the meaning of the Default clause of this contract.

HOISTING AND RIGGING EQUIPMENT (cl QA-199 – April 2008)

Contractor shall attest in writing (Certificate of Conformance) that the Hoisting and Rigging Equipment was manufactured in the United States in accordance with the appropriate process (e.g., The American National Standard Institute/American Society of Mechanical Engineers (ANSI/ASME B-30 Series)).

Obtaining Material from a Foreign Manufacture:

If the material is supplied by a foreign manufacturer, the Contractor shall submit documentation authenticating that the material used complies with United States standards.

Certificate of Conformance:

The Contractor shall submit a Certificate of Conformance containing the following:

1. nomenclature and part number
2. contract requirements met, including reference to codes, standards, specification (including revision status).

Each report shall be legible, reproducible, and contain, in addition to any other requirements as specified by this contract, the following:

1. The contract number
2. A clear identification of the supplies covered, including, but not limited to, the use of serial, lot, batch, heat, or mill number
3. The date and title of the person signing

Unless otherwise specified, Contractor shall mail all documents required by this contract to be delivered to the Battelle Contracts Representative, Battelle, PO Box 999, Richland, Washington 99352. Submission of a certification constitutes Contractor's express warranty that the identified supplies conform to all of the requirements of this contract. A document is not delivered until it is received by Battelle. Battelle shall have the right to reject, as not in conformity with the requirements of this contract, any suppliers or services for which all required reports, procedures or certification are not delivered. Contractor's failure to deliver such documents, or delivery of deficient document, shall be deemed a failure to make delivery within the meaning of the default clause of this contract.

Contractor Nonconformance Report *(cl. 360 – May 2009)*

Contractor is required to report to the Battelle Contracts Representative any nonconformance or deviation from Battelle's technical requirements. To comply with the reporting requirements the Contractor shall complete Battelle's Contractor Nonconformance Report (CNCR) which is available at www.pnl.gov/contracts/documents. The completed CNCR shall be submitted by the Contractor to the Battelle Contracts Representative to request Battelle to accept a deliverable not meeting all of Battelle's technical requirements. The decision whether to accept or reject such a request shall be within Battelle's sole discretion, and the Contractor shall not proceed in accordance with the requested deviation or present for inspection or acceptance any product produced in accordance with such deviation, unless and until Battelle's written approval on the CNCR is received by the Contractor.

Battelle's rights and remedies provided in this clause are in addition to any and all other rights and remedies that Battelle may have under Federal or State law.

Invitation For Bid
#337486
Part III – Schedule
Section J – Attached Documents
331 – 200 T Chiller Replacement

Documents Included in the Invitation For Bid Package:

1. Division 1/General Requirements
2. Project Drawings
3. JPP
4. WEA
5. D-B Wage Determination – Benton County/HSSA
6. Reference Documents

Sample Forms On-line:

<http://www.pnnl.gov/contracts/contractdocuments.aspx>

1. Acceptance of Completed Work
2. Bid Bond – SF 24
3. Certificate of Liability Insurance – ACORD 25
4. Certified Payroll - WH-347
5. Construction Badge Request
6. Contract Daily Report
7. Contract Release
8. Injury/Illness Report
9. Invoice Template
10. OSHA Record Keeping
11. Payment Bond – SF 25a
12. Performance Bond – SF 25
13. Recycling Submittal Form
14. Request for Information
15. Statement and Acknowledgement – SF 1413
16. Submittal Form

All attachments are provided in .pdf format. You must have a .pdf viewer. A free viewer is available from Adobe Acrobat at www.adobe.com.

Doc. #: S740784-SOW-PM-001, Rev. 0

Approved: _____

Dan Ryan, Project Manager

3/15/16

Date

Project Summary

Job Title & ESR: "331 – 200T Chiller Replacement" (S740784)

CWO Project Type: Fixed Price

Statement of Work: 331 facility (331 Cyprus St., 300 Area, Richland, WA); Contractor shall furnish all the labor, supervision, equipment, materials and sub-contractors necessary to replace the existing 200 ton Chiller with a new owner furnished 250 ton capacity unit – Includes; removal/demolition of select infrastructure, modifications to the existing piping, electrical, control wiring, etc.

Perform as per this Statement of Work, General Requirements, Drawing's listed on Project Title Sheet (S740784 / 331- G0-001, Sht. 1, Rev. 0), Job Planning Package (JPP), Work Exposure Assessment (WEA) and other attached Contract Documents.

P.M./T.O.R.: Dan Ryan (509.430.0212)

Construction Manager: Ivan Sampson (509.521.1371)

Completion Date: 4/28/16

Approved: _____

Dan Ryan, Project Manager

3/15/16

Date

General Project Requirements

"331 – 200T Chiller Replacement" – S740784

USE OF PREMISES & PERMITS

Work hours shall be 6:00 a.m. to 4:30 p.m., Monday through Thursday. Authorization to access the facility or perform work on site at times other than as specified shall require prior written authorization.

All personnel performing work shall complete required PNNL training and possess a picture badge issued by PNNL or a Hanford Contractor – US citizenship required. Doors shall not be left unlocked, unattended, or blocked open at any time. Doors that are alarmed or not customarily used require specific authorization for use and may require full time supervision by PNNL Security personnel while in use. Provide five (5) working days notice to arrange for Security personnel. Provide five (5) working days notice proximity badge access requests.

331 is a fully operational facility. The Contractor shall take all necessary measures to limit the impact of construction and demolition activities on the occupants. Noise, dust, fumes, and vapors shall be controlled to the greatest extent practicable. Housekeeping shall be performed on an ongoing basis. Do not obstruct doorways/entrances.

Request authorization to access work areas and facility services/utilities, use storage and lay down areas, perform isolations, conduct outages, and perform work from the Construction Manager (CM). Request authorization before the end of shift for the following day's access and work requirements. Approval is obtained the following morning through the Plan of the Day (POD) meeting. Request authorization a minimum of twenty four (24) hours in advance for use of storage and lay down areas. Request authorization to perform isolations and conduct outages in writing a minimum of five (5) working days in advance.

The project Job Planning Package (JPP) & WEA (Work Exposure Assessment) identifies specific work activity permits (e.g., Confined Space, Hot Work, Blind Penetration, etc.). Contact the project CM if further definition is required.

For all electrical work, including repairs and maintenance, radio and television transmitting devices, and temporary testing systems in this PNNL facility; inspection to be performed by PNNL's designated third party inspector. Request for inspection(s) to be coordinated with the project CM and require a minimum of five (5) days advanced notification.

Asbestos containing materials (ACM) may be encountered during the course of work. ACM may be identified, unidentified, concealed or contained within building materials. Should Contractor or sub-tier personnel encounter suspected ACM contact the PNNL Construction Manager immediately. Do not proceed with any work that may disturb ACM without direction.

WORK CONTROL

Job Planning Package: PNNL will provide the Contractor with a JPP/equivalent document as part of the solicitation documents. The JPP identifies the phases of work to be performed, permits, training/qualifications, special tools or materials, pre- and post-notification requirements, pre- and post-job meetings, system/equipment configuration and verification, outages, waste disposal path, critical (mandatory) work steps and environmental and/or worker safety hazards. The JPP will contain the following attachments; Work Place Exposure Assessment (WEA - Identifies non-radiological hazards).

Contractor to comply with all elements of the Contractor Environment Safety and Health (CESH) manual.

Contractor shall submit a Job Safety Analysis (JSA) to the project CM addressing work to be performed before commencing any work activities on Site.

QUALITY

Quality Assurance Program: Compliance with contract documents forms the Quality Assurance program for this project.

Contractor(s) must have demonstrated experience and ability to perform described work requirements. Supervision must be fully qualified to direct all project activities. Workers to be qualified and competent.

TRAINING

Include costs for course attendee's time in proposal. PNNL is responsible for initial and refresher training course fees. Contractor shall be required to pay course fees for no-shows and any retraining required as a result of failure. Classroom training will be conducted on PNNL premises unless otherwise noted.

The JPP identifies the required training. Some courses may require up to ten (10) working days of advance notice - Coordinate with the project CM for all training needs to include coursework details/requirements. Training format may be either classroom or "web based."

Project personnel to possess current State/Federal licensing/certifications for the work performed.

SCHEDULE - WORK

Referencing the Statement/Description of Work; Submit a simple Bar/Gantt Chart Schedule for approval by PNNL immediately after contract award. Schedule should depict major construction activities, submittals, key deliverables, permits and utility tie in dates to Battelle. Revise the schedule as needed to reflect actual construction dates.

TRANSMITTALS

Transmit each submittal using the Primavera Unifier electronic systems "Submittal" process, provided by Battelle.

SUBMITTALS

Submittal Schedule used for identifying required submittals. Provided as a convenience to the contractor – Omission of an item does not relieve the Contractor from requirements specified elsewhere.

RECORD DRAWINGS

Maintain one set of black-line white prints of the Contract Drawings. Mark-up drawings with an erasable red-colored pencil to show the actual installation when varied from original. Submit to the project CM upon completion of work.

DECLARATION OF KEY SUPERVISOR(S)

Key Supervisors include as a minimum the Contractors Jobsite Superintendent and the Site Safety Supervisor. Prior to on-Site work, Contractor shall declare its key supervisor(s) and submit documentation to demonstrate the individuals are adequately qualified to supervise the contract Work. The Site Safety Supervisor/Superintendent must meet the following minimum qualifications:

- (1) Safety training in construction through seminars, workshops, conferences, educational courses, etc.
- (2) 10-Hour OSHA Construction course
- (3) Knowledge of CFR, Title 29, Part 1910, Occupational Safety and Health Standards
- (4) Knowledge of CFR, Title 29, Part 1926, Safety and Health Regulations for Construction
- (5) Knowledge of CFR, Title 10, Part 851, Worker Safety and Health Program

KEY SUPERVISOR(S)

- (1) The Jobsite Superintendent shall be present on site during the performance of all fieldwork to oversee and coordinate the daily work activities. The Jobsite Superintendent shall be identified as the designated line management representative responsible for Contractor and sub-tier contractor's employees and empowered by Contractor to take immediate action to correct unsafe conditions/acts, and other deficiencies identified during inspections.
- (2) The Jobsite Superintendent shall have a thorough knowledge of construction industry safety standards established by Federal and State regulations and shall provide documentation that they have attended a 10 hour OSHA Construction Course. This individual shall have the authority and responsibility to identify and correct hazardous and unsafe conditions, acts and non-compliances.
- (3) The Jobsite Superintendent shall ensure that the Site Safety Supervisor is fully engaged and empowered to oversee and implement the CESH Program requirements.

- (4) **Copies of the following documents shall be maintained at the jobsite for Battelle review;** safety inspections, employee orientations, employee training records, weekly and monthly safety meeting records, equipment inspections, and competent person designations.

WORKER SAFETY – WEATHER CONDITIONS

To insure worker safety, work or portions of work may be temporarily and incrementally shut down due to high winds, lightning, or other inclement weather as determined by PNNL. Contractor will not be additionally compensated in terms of cost or schedule for weather related shutdowns. PNNL will issue weather warnings via radio, telephone, public announcement, or in person. The Contractor shall ensure that all contractor and subcontractor personnel are apprised of the warnings and take the required actions as stated below.

Contact 375-2124 and/or monitor local radio stations for PNNL inclement weather closure and delay information before reporting to site. During inclement weather delay or closure conditions the Contractor shall not proceed with the work without authorization by the Construction Manager.

Sustained winds greater than 15 mph – the necessity for crane operations will be closely scrutinized.

Sustained winds greater than 25 mph and/or gusts greater than 40 mph – all crane activities must cease and be secured. All loose outdoor material shall be secured. The Contractor's safety representative shall evaluate work on roofs or elevated work surfaces before continuing. All personnel working outdoors are required to wear safety goggles. Depending on dust hazards, work may be stopped. Personnel may be directed to shelter.

Sustained winds greater than 30 mph and/or gusts greater than 45 mph – all outdoor work activities may be stopped. Personnel may be directed to shelter.

Sustained winds greater than 50 mph – outdoor work activities will be curtailed and limited to those approved by PNNL and Contractor's Safety Representative. Personnel will be directed to shelter. Site closure may be implemented and all work activities ceased.

Thunderstorm/lightning advisory based on lightning activity within a 30 mile radius of the Site – Contractor personnel shall not work on roofs or elevated surfaces. Personnel shall stay away from equipment such as drilling rigs, cranes, boom trucks, or elevated work platforms. These protective measures shall remain in place until Battelle cancels the warning.

In response to seasonal storm conditions, Battelle may close the Site. If so, Battelle will make appropriate announcements and coordinate closures or early dismissals.

HOISTING & RIGGING

Hoisting and Rigging/Load Handling Activities: Contractor shall comply with requirements of the approved U.S. Department of Energy Standard DOE-STD-1090 Hoisting and Rigging & ASME P30 Planning for Load Handling Activities. The Contractor shall download and utilize the current, approved version of DOE-STD-1090 available at: <http://energy.gov/ehss/services/nuclear-safety/department-energy-technical-standards-program/doe-approved-technical>. Contractor shall maintain one (1) copy of the Hoisting and Rigging Standard at the Site for reference.

Submit qualifications/training records of individuals that will be engaged in hoisting and rigging activities before allowing individuals to perform hoisting and rigging activities on Site.

- Crane Operator Certification – NCCCO is valid for a five year period

Document No. S740784-PLAN-PM-001, Rev 0

- Training records of individuals who are engaged in rigging, signal-person, crane assembly, disassembly, or spotter for working around overhead electrical lines.
- Forklift Operator Qualification – submit training record for operator. Valid for three years.

Lift Plan Determination: PNNL will make the determinations as to when a lift requires a Lift Plan. Contractor will always submit an ordinary "Lift Plan" for PNNL approval prior to commencing work. Other lift plans include critical or multiple mobile cranes.

Assess the current condition of equipment. Contents designated to remain with the "lifting profile" shall be secured/placed in such a condition as to prevent shifting/movement during hoisting/transporting activities.

Validation of equipment weight required prior to hoisting and transporting activities.

CONCRETE SCANNING

SCAN: Utilize Electromagnetic Frequency (EMF) and Radio Frequency (RF) technologies to identify subsurface interferences/embedments. Scan the selected area incorporating 2 passes in a traditional checkerboard pattern. Provide interpretation of the results on a basic drawing to include the physical marking (as directed by the CM) of observed interferences

BIOLOGICAL RESOURCE PROTECTION

If nesting birds (e.g., bank swallows), a pair of birds of the same species or a single bird that will not leave the area when disturbed, defensive behaviors (e.g., flying at workers or strident vocalizations), animal dens, or other wildlife are encountered in the work area (e.g., equip., facilities, or soil with vertical banks) immediately stop work in the vicinity and notify the Battelle/PNNL CM for an biological assessment.

Before disturbing native vegetation, verify authorization to proceed with the Battelle/PNNL CM.

CONSTRUCTION & DEMOLITION WASTE RECYCLING

Complete and submit to the PNNL CM; the attached Construction & Demolition Waste Recycling Submittal Form.

SUBMITTAL SCHEDULE:

Bldg 331 -200T Chiller Replacement Submittal Schedule

Submittal	Division	Division Title	Section	Section Title	Parag.	Submittal Type	Short Description	Notes
H								
H	001 01	GENERAL REQUIREMENTS	1000	GENERAL REQUIREMENTS		Approval Required	TRAINING & ACCESS REQUIREMENTS FOR CONTRACTOR PERSONNEL	PRE-CONST. 5 DAYS FROM NOA & REQUIRES RESUBMITTAL EACH TIME A NEW INDIVIDUAL IS ADDED TO THE JOB
H	002 01	GENERAL REQUIREMENTS	6000	ENVIRONMENTAL, SAFETY AND HEALTH	1.4.C	Approval Required	CONTRACTORS JOB SAFETY ANALYSIS (JSA)	PRE-CONST. 5 DAYS FROM NOA. CHANGE OF MEANS OR METHOD REQUIRES RESUBMITTAL.
H	003 01	GENERAL REQUIREMENTS	1000	GENERAL REQUIREMENTS		Approval Required	CONSTRUCTION SCHEDULE	PRE-CONST. 5 DAYS FROM NOA
H	004 01	GENERAL REQUIREMENTS	6000	ENVIRONMENTAL, SAFETY AND HEALTH	1.4.A	Approval Required	LETTER OF CONFIRMATION - CESH COMPLIANCE	PRE-CONST. 5 DAYS FROM NOA
H	005 01	GENERAL REQUIREMENTS	6000	ENVIRONMENTAL SAFETY AND HEALTH	1.4.E	Approval Required	KEY SUPERVISORS	PRE-CONST. 5 DAYS FROM NOA
H	006 20	GENERAL MECHANICAL	0500	COMMON MECHANICAL WORK REQUIREMENTS	G.2	Information Only	WELDING PROCESSES AND WELDER QUALIFICATIONS	10 DAYS FROM NOA
H	007 01	GENERAL REQUIREMENTS		ENVIRONMENTAL SAFETY AND HEALTH		Approval Required	BASIC/ORDINARY LIFT PLAN	PRE CONST. 5 DAYS FROM NOA
H	008 01	GENERAL REQUIREMENTS		ENVIRONMENTAL SAFETY AND HEALTH		Information Only	HOISTING & RIGGING QUALIFICATIONS	PRE CONST. 5 DAYS FROM NOA
H	009 01	GENERAL REQUIREMENTS		ENVIRONMENTAL SAFETY AND HEALTH		Information Only	ELECTRICAL WORKER QUALIFICATION	PRE CONST. 5 DAYS FROM NOA
H	010 20	GENERAL MECHANICAL	0500	COMMON MECHANICAL WORK REQUIREMENTS	B	Approval Required	START-UP & DEMONSTRATION	3 DAYS AFTER START-UP COMPLETION
H	011 20	GENERAL MECHANICAL	0500	COMMON MECHANICAL WORK REQUIREMENTS	E.4	Information Only	GENERAL PIPING REQUIREMENTS: DISINFECT/FLUSH PLAN	10 DAYS FROM NOA
H	012 20	GENERAL MECHANICAL	0500	COMMON MECHANICAL WORK REQUIREMENTS	F.9	Information Only	LEAK & PRESSURE TEST REPORT	3 DAYS AFTER TEST COMPLETIONS
H	013 20	GENERAL MECHANICAL	0500	COMMON MECHANICAL WORK REQUIREMENTS	H.1	Information Only	PAINT COLOR/PRODUCT	10 DAYS FROM NOA
H	014 20	GENERAL MECHANICAL	0523	GENERAL DUTY MECHANICAL VALVES	A,B	Approval Required	PRODUCT DATA: VALVES	10 DAYS FROM NOA
H	015 20	GENERAL MECHANICAL	0700	MECHANICAL PIPING INSULATION	A,C	Approval Required	PRODUCT DATA: INSULATION	10 DAYS FROM NOA
H	016 23	HEATING VENTILATION, AND AIR CONDITIONING	0900	INSTRUMENTATION AND CONTROL FOR HVAC	B (1-3)	Approval Required	PRODUCT DATA: INSTRUMENTATION AND CONTROLS	10 DAYS FROM NOA
H	017 23	HEATING VENTILATION, AND AIR CONDITIONING	2113	HYDRONIC PIPING	B	Approval Required	PRODUCT DATA: PIPING	10 DAYS FROM NOA
H	018 23	HEATING VENTILATION, AND AIR CONDITIONING	2116	HYDRONIC PIPING SPECIALTIES	A-1	Approval Required	PRODUCT DATA: SPECIALTIES	10 DAYS FROM NOA
H	019 23	HEATING VENTILATION, AND AIR CONDITIONING	2116	HYDRONIC PIPING SPECIALTIES	H	Information Only	GLYCOL CHARGING: SAMPLE/TEST REPORT	3 DAYS AFTER PROJECT COMPLETION
H	020 23	HEATING VENTILATION, AND AIR CONDITIONING	6400	AIR-COOLED CHILLERS	E	Information Only	TRAINING OF PNNL CRAFT PERSONNEL	3 DAYS AFTER START-UP COMPLETION
H	021 26	ELECTRICAL	0500	BASIC ELECTRICAL MATERIALS AND METHODS	A-O	Approval Required	PRODUCT DATA: CONDUCTORS, FUSES	10 DAYS FROM NOA
H	022 26	ELECTRICAL	0500	BASIC ELECTRICAL MATERIALS AND METHODS	P	Information Only	FIELD CONTROL & TESTING	3 DAYS AFTER FIELD TESTING COMPLETION
H	023 26	ELECTRICAL	0523	CONTROL VOLTAGE POWER CABLES	A	Approval Required	PRODUCT DATA	10 DAYS FROM NOA
H	024 20	GENERAL MECHANICAL	0500	COMMON MECHANICAL WORK REQUIREMENTS		Approval Required	OPERATION & MAINTENANCE MANUAL	3 DAYS AFTER PROJECT COMPLETION
H	025 01	GENERAL REQUIREMENTS		RECORD DRAWINGS		Information Only	RECORD DRAWINGS	3 DAYS AFTER PROJECT COMPLETION
H	026 01	GENERAL REQUIREMENTS	1000	GENERAL REQUIREMENTS		Information Only	WASTE RECYCLING SUBMITTAL FORM	3 DAYS AFTER PROJECT COMPLETION
H	027 01	GENERAL REQUIREMENTS	1000	COMPLETION AND TURNOVER		Information Only	WARRANTIES	3 DAYS AFTER PROJECT COMPLETION

Pacific Northwest National Laboratory Pressure Test Certification	Report No.:	Page: 1 of
------------------------------------------------------------------------------	-------------	------------

Project / Job No.:	Project Title:	Test Procedure:
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Spec. Section:	Code or Standard & Year:	Drawing & Rev:	System:
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Contractor: _____

Description of System Tested:

Test Preparation

Notification Requirements:

QA/QC
 Third Party Inspection
 Customer
 NBBI Inspector
 Other

Valve Line-Up Requirements:

Required Test Medium:	Flushing Requirements:
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System Design Pressure:	Test Pressure:	Specified Hold Time:	Prepared by: Date:
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Test Checklist

Item or Requirement	QC Verification	
	Initial	Date
Flushing of System and/or Components Completed per Specification		
Valve Line-up Verified		
Test gauge(s) correct range and currently calibrated: Gauge No.: _____ Gauge No.: _____ Range: _____ Range: _____ Cal Due: _____ Cal Due: _____		
Pressure Relief Valve: Pressure Relief Valve ID: _____ Valve Set Point: _____ Date Checked: _____		

Authorization to Proceed: _____ Date: _____

Onsite QC

Test Data (Examination conducted While System/Component Pressurized)

Test Pressure of _____ Attained at (time) _____

Final Pressure of _____ Hold time comp. _____

Test Evaluation & Acceptance:

By: _____ Date: _____
(Contractor Representative)

By: _____ Date: _____
(PNNL Representative)



CONSTRUCTION & DEMOLITION WASTE RECYCLING SUBITTAL FORM

Instructions for Completing

CONSTRUCTION & DEMOLITION WASTE - RECYCLING SUBMITTAL FORM

- This C&D Waste-Recycling Submittal Form is used by contractors performing work on behalf of Battelle for required reporting of construction and demolition waste that is recycled or reused.
- Refer to Specification 017600 ENVIRONMENTAL PROTECTION AND WASTE MANAGEMENT (if applicable)
- Report all weights in pounds, kilograms or tons.

FORM COMPLETION INSTRUCTIONS

Section A, Total Waste Generated:

- Under "Material" describe the construction and demolition waste generated from the project (e.g. concrete rubble, general construction debris, etc).
- Under "Weight" enter the total weight of all waste generated from the project INCLUDING any materials sent for recycle or reuse (weights from estimates or scaled).

Section B, Recycled/Reused:

- Under "Material" describe each type of material recycled or reused (e.g. scrap metal, casework, etc).
- Under "Weight" enter the total weight of each type of material recycled.
- Enter the weight (estimated) of any items sent off-site for reuse separately.
- If available, attach truck tickets or receipts from recycling or disposal facilities.

Section C, Percent Recycled:

- Under Total Generated enter the weight of total waste generated from section A.
- Add together the weight of ALL materials sent for recycle or reuse in section B and enter under Total Recycled/Reused.
- Divide Total Recycled/Reused by Total generated and enter the quotient under % Recycled.

Signature Block:

- Identify the project by PNNL service request number or title, sign and date the form, and forward to the PNNL Construction or Project Manager.



CONSTRUCTION & DEMOLITION WASTE RECYCLING SUBITTAL FORM

Complete all sections below and provide to the PNNL Construction or Project Manager.

If there is no reportable activity in a section, enter N/A:

A. TOTAL WASTE GENERATED:

Material	Weight

B. RECYCLED/REUSED:

Material	Weight

C. PERCENT RECYCLED:

Total Generated	Total Recycled/Reused	% Recycled

Project: _____ Signature: _____ Date: _____
Project Title and Contract Number
Contractor Representative

PROJECT S740784

BUILDING 331 200-TON CHILLER REPLACEMENT



SHEET INDEX

GENERAL

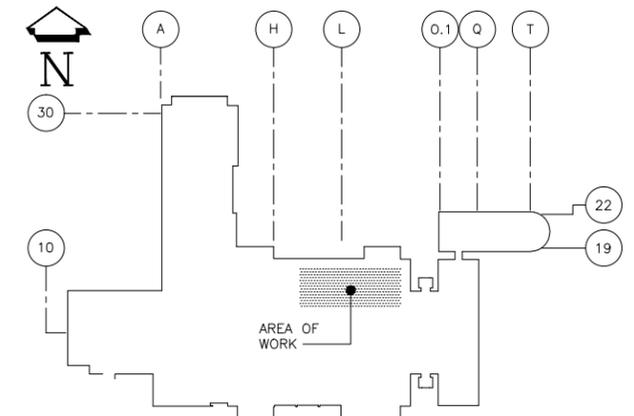
G0-001 TITLE SHEET, PROJECT INFORMATION
G0-002 SPECIFICATIONS
G0-003 SPECIFICATIONS

DEMOLITION

D1-101 CHILLER DEMOLITION PLAN

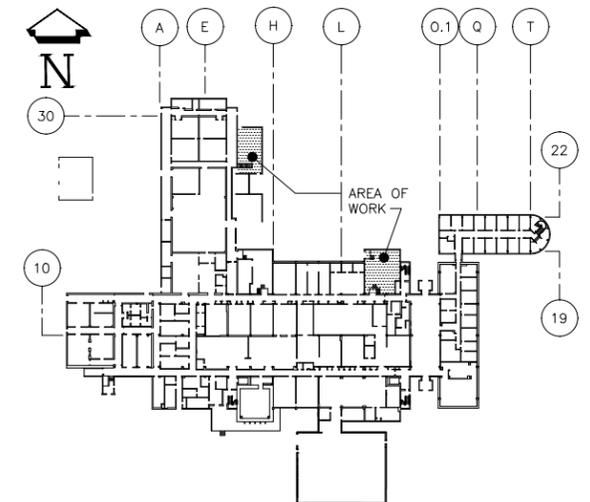
MECHANICAL

M1-101 MECHANICAL/ELECTRICAL CHILLER
INSTALLATION PLAN
M1-401 MECHANICAL CHILLED WATER PIPING ROOF
PLAN
M5-101 MECHANICAL DETAILS
M7-101 MECHANICAL CONTROLS



ROOF KEY PLAN

SCALE: NONE



FIRST FLOOR KEY PLAN

SCALE: NONE

ABBREVIATIONS

(NOT ALL LISTED APPLY TO PROJECT)

A	AMPERE	OC	ON CENTER
AC	ALTERNATING CURRENT	OCC	OCCUPANCY
AFCV	AUTOMATIC FLOW CONTROL VALVE	OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
AFF	ABOVE FINISHED FLOOR	OFOI	OWNER FURNISHED, OWNER INSTALLED
AUX	AUXILIARY	OH	OVERHEAD
BLDG	BUILDING	OPP	OPPOSITE
CB	CIRCUIT BREAKER	OS	OCCUPANCY SENSOR
CFM	CUBIC FEET PER MINUTE	ΔP	PRESSURE CHANGE
CKT	CIRCUIT	P/PWR	POWER
CFCI	CONTRACTOR FURNISHED, CONTRACTOR INSTALLED	PH	PHASE
CHWR	CHILLED WATER RETURN	PL	PLACES
CHWS	CHILLED WATER SUPPLY	PNL	PANEL/PANELBOARD
CM	CONSTRUCTION MANAGER	PNNL	PACIFIC NORTHWEST NATIONAL LABORATORY
COMM	COMMUNICATIONS	PR	PROPANE
CONC	CONCRETE	PROVIDE	FURNISH & INSTALL
CU	COPPER	PSF	PER SQUARE FOOT
DEMO	DEMOLISH	PSI	POUNDS PER SQUARE INCH
DIA	DIAMETER	PSIG	POUNDS PER SQUARE INCH GAUGE
DIAG	DIAGRAM(S)	PTW	POTABLE WATER
DISC	DISCONNECT	PVC	POLYVINYL CHLORIDE
(E)/EXST	EXISTING	REC	RECEPTACLE
EA	EACH	RFGT	REFRIGERANT
EER	ENERGY EFFICIENCY RATING	RFI	REQUEST FOR INFORMATION
ELEC	ELECTRICAL	RGS	RIGID GALVANIZED STEEL
EMT	ELECTRICAL METALLIC TUBING	RM	ROOM
EWT	ENTERING WATER TEMPERATURE	SAN	SANITARY SEWER
FACP	FIRE ALARM CONTROL PANEL	SATC	SUSPENDED ACOUSTIC TILE CEILING
FCO	FLOOR CLEANOUT	SCHED	SCHEDULE(S)
FLR	FLOOR	SIM	SIMILAR
FMCS	FACILITY MANAGEMENT CONTROL SYSTEM	SST	STAINLESS STEEL (OR SS)
FPM	FEET PER MINUTE	SV	SANITARY VENT
FT	FEET	SVC	SERVICE
GA	GAUGE	TYP	TYPICAL
GFCI	GROUND FAULT CIRCUIT INTERRUPT	UC	UNDER COUNTER
GPM	GALLONS PER MINUTE	UNO	UNLESS NOTED OTHERWISE
GND	GROUND	UPS	UNINTERRUPTIBLE POWER SUPPLY
GWB	GYPSUM WALL BOARD	V	VOLT/VOLTMETER
HE	HELIUM	VA	VOLT AMPERE
HHWR	HEATING HOT WATER RETURN	VAC	VOLTS ALTERNATING CURRENT
HHWS	HEATING HOT WATER SUPPLY	VAV	VARIABLE AIR VOLUME
HP	HORSE POWER	VP	VACUUM POT
HRW	HEAT RECOVERY WATER	W	WATT/WATTMETER
HVAC	HEATING, VENTILATION & AIR CONDITIONING	WCO	WALL CLEAN OUT
HVE	HEATING VENTILATION EXHAUST	WG	WATER GAUGE
HVR	HEATING VENTILATION RETURN	WP	WEATHERPROOF
HVS	HEATING VENTILATION SUPPLY		
HZ	HERTZ		
IN	INCHES		
LAN	LOCAL AREA NETWORK		
LCP	LOCAL CONTROL PANEL		
LFTM	LINEAR FEET PER MINUTE		
LTG	LIGHTING		
LWT	LEAVING WATER TEMPERATURE		
MAX	MAXIMUM		
MBH	MILLION BTU PER HOUR		
MCA	MAXIMUM CIRCUIT AMPACITY		
MCCP	MAXIMUM OVERCURRENT PROTECTION DEVICE		
MECH	MECHANICAL		
MIN	MINIMUM		
MTG	MOUNTING		
NEC	NATIONAL ELECTRICAL CODE		

GENERAL SYMBOLS LEGEND

	EXISTING BUILDING OR STRUCTURE
	EXISTING EQUIPMENT
	DEMOLITION
	PROJECT WORK
	DETAIL TAG
	EQUIPMENT TAG
	SHEET NOTE
	SECTION TAG
	ELEVATION TAG
	GRID LINE
	PRESSURE GAGE WITH VALVE
	STRAINER WITH BLOWDOWN VALVE HOSE CONNECTION AND CAP
	PUMP
	BUTTERFLY VALVE
	MANUAL BALANCING VALVE
	THERMOMETER
	SAFETY RELIEF VALVE
	PIPE FLOW DIRECTION

PROJECT INFORMATION

PROJECT DESCRIPTION:
200-TON CHILLER REPLACEMENT

PROJECT ADDRESS:
325 CYPRUS STREET, RICHLAND, WA 99352

OWNER INFORMATION:
OWNER: DEPARTMENT OF ENERGY/BATTELLE
CONTACT: DAN RYAN
FACILITIES AND OPERATIONS
902 BATTELLE BOULEVARD
P.O. BOX 999
PHONE: 509-371-7995

LIFE SAFETY AND CODE SUMMARY

APPLICABLE CODES:

- 2015 NFPA 101, LIFE SAFETY CODE (LIFE SAFETY CODE OF RECORD)
- 2012 INTERNATIONAL BUILDING CODE (IBC) (CONSTRUCTION CODE OF RECORD)
- 2012 INTERNATIONAL MECHANICAL CODE (CONSTRUCTION CODE OF RECORD)
- 2012 INTERNATIONAL PLUMBING CODE (CONSTRUCTION CODE OF RECORD)
- 2014 NFPA 70, NATIONAL ELECTRICAL CODE

DOCUMENT NO S740784-G0-001		SERVICE REQUEST NO S740784	
CURRENT REVISION		ORIGINAL	
DRAWN	JM SCOTT	DRAWN	JM SCOTT
CHECKED	SE GOURLEY	CHECKED	SE GOURLEY
DRAFTING CHECKER	SD BURNETT	DRAFTING CHECKER	SD BURNETT
ENGINEER	JM SCOTT	ENGINEER	JM SCOTT
APVD	DJ DE SMET	APVD	DJ DE SMET
OTHER		OTHER	
U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST SITE OFFICE		Pacific Northwest Division Battelle Richland, Washington 99352	
GENERAL TITLE SHEET PROJECT INFORMATION			
PROJ TITLE	BLDG 331 200-TON CHILLER REPLACEMENT	REV NO	0
SIZE/BLDG	331	DWG NO	G0-001
SCALE	NONE	SHEET	1 OF 1

REVISIONS DESCRIPTION

GENERAL NOTES

(UNLESS OTHERWISE SPECIFIED)

- A. SCOPE OF WORK: PROVIDE SYSTEMS SHOWN AND SPECIFIED COMPLETE IN EVERY RESPECT AND FULLY FUNCTIONAL. ITEMS NOT SPECIFICALLY IDENTIFIED ON THE DRAWINGS OR SPECIFICATIONS THAT ARE REQUIRED TO MAKE FULLY FUNCTIONAL ASSEMBLIES SHALL BE PROVIDED.
- B. DEMOLITION:
 - 1. DEMOLISH PIPING AND EQUIPMENT AS INDICATED.
 - 2. PROVIDE TEMPORARY SUPPORT FOR PIPING AS REQUIRED.
 - 3. COORDINATE WITH BATTELLE CONSTRUCTION MANAGER FOR DEMOLITION OF EXISTING CHILLER. REFRIGERANT AND OIL IN CHILLER SHALL BE RECOVERED AND DISPOSED OF BY BATTELLE.
- C. MATERIALS SHALL BE AS SPECIFIED OR BATTELLE ENGINEER APPROVED.
- D. CONSTRUCTION CHANGES SHALL BE PER BATTELLE ENGINEERING CHANGE NOTICE (ECN) OR RED-LINE CHANGE PROCESS IF DIFFERENT THAN SHOWN.
- E. MANUFACTURER'S DATA AND INSTRUCTIONS: WORK SHALL BE INSTALLED IN STRICT COMPLIANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS INCLUDING PRESSURE AND TEMPERATURE LIMITATIONS, ACCESS AND SERVICE CLEARANCES, AND START-UP INSTRUCTIONS.
- F. INSPECTION: VERIFY INSTALLATION CONDITIONS AS SATISFACTORY TO RECEIVE WORK. DO NOT START WORK UNTIL UNSATISFACTORY CONDITIONS ARE CORRECTED. BEGINNING WORK CONSTITUTES ACCEPTANCE OF CONDITIONS AS SATISFACTORY.
- G. SERVICE INTERRUPTIONS: OBTAIN BATTELLE'S WRITTEN APPROVAL PRIOR TO INTERRUPTING ANY SERVICE INCLUDING WATER, ELECTRICAL, SPECIALTY COMPRESSED GASES, EXHAUST, SEWER, ETC.
- H. PRODUCT AND MATERIAL SUBMITTALS:
 - 1. SUBMIT TO THE ENGINEER FOR REVIEW COMPLETE INFORMATION FOR PRODUCTS THAT ARE TO BE USED ON THE PROJECT AS DEFINED IN THE DRAWINGS AND SPECIFICATIONS. INCLUDE CATALOG CUTS, DIAGRAMS, COMPLETE DIMENSIONAL DRAWINGS, INSTALLATION INSTRUCTIONS, WARRANTY DATA, AND OTHER INFORMATION AS REQUESTED BY THE ENGINEER.
 - 2. CLEARLY IDENTIFY PRODUCTS THAT ARE TO BE USED. THE PACKAGE WILL BE REVIEWED AND APPROVED PRIOR TO BEGINNING CONSTRUCTION. THE CONTRACTOR SHALL RE-SUBMIT AS REQUESTED UNTIL THE ENTIRE SUBMITTAL IS ACCEPTED.
 - 3. SUBMITTALS SHALL BE IN ELECTRONIC PDF FORMAT USING PRIMAVERA UNIFIER SYSTEM.
 - 4. APPROVAL OF SUBMITTALS DOES NOT RELIEVE THE CONTRACTOR FROM COMPLIANCE WITH THE REQUIREMENTS OF THE DRAWINGS AND SPECIFICATIONS. SUBMITTAL REVIEWS ARE FOR VERIFICATION OF GENERAL CONFORMANCE WITH THE CONTRACT DOCUMENTS. THE CONTRACTOR IS RESPONSIBLE FOR CONFIRMING AND CORRELATING QUANTITIES AND DIMENSIONS, SELECTING FABRICATION PROCESSES AND TECHNIQUES OF CONSTRUCTION AND PERFORMING WORK IN A SAFE, SATISFACTORY, AND PROFESSIONAL MANNER.
 - 5. THE PRE-CONSTRUCTION SUBMITTAL PACKAGE WILL BE REVIEWED BY BATTELLE. WITHIN 7 CALENDAR DAYS OF RECEIPT OF BATTELLE'S REVIEW COMMENTS, RE-SUBMIT AS REQUIRED TO ADDRESS THE COMMENTS PROVIDED.
- I. PRODUCT SUBSTITUTIONS: PROVIDE EQUIPMENT SPECIFIED OR CLEARLY NOTE ON EQUIPMENT SUBMITTAL SUBSTITUTE EQUIPMENT. THE ENGINEER RESERVES THE RIGHT TO REJECT SUBSTITUTE EQUIPMENT. SUBSTITUTIONS ARE ALLOWED ONLY FOR PRODUCTS SPECIFICATIONS WHICH LIST THREE OR MORE ACCEPTABLE MANUFACTURERS OR STATE "OR APPROVED EQUAL".
- J. INTENT AND INTERPRETATION:
 - 1. THE DRAWINGS AND SPECIFICATIONS SUPPLEMENT EACH OTHER AND DETAILS CONTAINED IN ONE SHALL BE INCLUDED AS IF CONTAINED IN BOTH. ITEMS OR COMPONENTS NOT SPECIFICALLY DESCRIBED IN THE SPECIFICATIONS OR NOTED ON THE DRAWINGS, BUT WHICH ARE NECESSARY TO MAKE A COMPLETE WORKING INSTALLATION SHALL BE INCLUDED AT NO ADDITIONAL COST. IN CASE OF CONFLICT BETWEEN DRAWINGS AND/OR SPECIFICATIONS, THE MOST STRINGENT REQUIREMENT SHALL APPLY.
 - 2. THE DRAWINGS ARE PARTLY DIAGRAMMATIC AND DO NOT SHOW THE EXACT LOCATION OF PROJECT WORK. THESE DRAWINGS ARE NOT INTENDED TO GIVE COMPLETE AND EXACT DETAILS IN REGARD TO LOCATION. EXACT LOCATIONS ARE TO BE DETERMINED BY ACTUAL MEASUREMENTS AT THE BUILDING, PRIOR TO COMMENCING WORK, AND WILL BE SUBJECT TO ENGINEERING APPROVAL. MAKE OFFSETS IN PIPING, DUCTWORK, CONDUIT, ETC. WITH FITTINGS AND AS REQUIRED.
- K. COORDINATION AND COOPERATION: THE CONTRACTOR SHALL COORDINATE WITH THE WORK OF THE TRADES INVOLVED ON THE PROJECT. PROTECT SURROUNDING AREAS, SURFACES, AND EQUIPMENT TO PRECLUDE DAMAGE FROM WORK OF ALL DIVISIONS AND SECTIONS.
- L. PROJECT COMPLETION REQUIREMENTS:
 - 1. OPERATION & MAINTENANCE MANUAL: PROVIDE IN ELECTRONIC PDF FORMAT. INCLUDE PRODUCT VENDOR INFORMATION, SUBMITTAL DATA, TEST REPORTS, INSPECTION DOCUMENTATION, AND START-UP DEMONSTRATION DOCUMENTATION. INCLUDE WARRANTY CERTIFICATES FOR PROJECT WORK AND EQUIPMENT.
 - 2. DRAWINGS: SUBMIT "AS-BUILT" DRAWINGS INDICATING WORK AS REVISED, DETAILED AND ACTUALLY INSTALLED.
 - 3. WARRANTIES AND CERTIFICATES: PROVIDE MINIMUM ONE YEAR WRITTEN WARRANTY CERTIFICATES COVERING MATERIALS AND LABOR FOR PROJECT WORK FROM APPLICABLE CONTRACTORS AND VENDORS.
- M. CODES AND STANDARDS: WORK SHALL BE IN STRICT ACCORDANCE WITH THE THE BUILDING CODE, MECHANICAL CODE, PLUMBING CODE, FIRE CODE, NATIONAL ELECTRICAL CODE AS NOTED ON GO-001 AND PER APPLICABLE STATE AND LOCAL CODES, LAWS, AND ORDINANCES. IN CASE OF CONFLICT WITH DRAWINGS OR SPECIFICATIONS, THE CODES AND ORDINANCES GOVERN.
- N. DIMENSIONS ARE IN FEET AND INCHES UNLESS OTHERWISE SPECIFIED.
- O. FIELD VERIFY DIMENSIONS PRIOR TO ORDERING MATERIALS OR BEGINNING WORK.
- P. EXISTING SURFACES DAMAGED DURING CONSTRUCTION SHALL BE REPAIRED TO MATCH EXISTING.

SPECIFICATIONS

(UNLESS OTHERWISE NOTED)

DIVISION 20 – GENERAL MECHANICAL

200500 COMMON MECHANICAL WORK REQUIREMENTS

- A. GENERAL: THE LOCATION OF MECHANICAL WORK SHALL BE FIELD VERIFIED TO ENSURE THAT IT CLEARS ALL OPENINGS AND STRUCTURAL MEMBERS; THAT IT MAY BE PROPERLY CONCEALED; AND THAT IT CLEARS CABINETS, LIGHTS AND EQUIPMENT HAVING FIXED LOCATIONS. PROVIDE OFFSETS, TRANSITIONS, AND FITTINGS AS REQUIRED TO REROUTE MECHANICAL WORK AROUND OBSTRUCTIONS AT NO ADDITIONAL COST TO BATTELLE.
- B. START-UP & DEMONSTRATION: PREPARE, START, AND DEMONSTRATE THAT MECHANICAL SYSTEMS OPERATE AND FUNCTION AS DESIGNED AND IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS. PERFORM DEMONSTRATIONS AS REQUESTED AND IN THE PRESENCE OF THE BATTELLE CONSTRUCTION MANAGER, GIVEN ONE WEEK'S PRIOR NOTICE. PROVIDE INSTRUMENTS AND PERSONNEL REQUIRED TO CONDUCT DEMONSTRATION AND START-UP TO BATTELLE'S SATISFACTION. SUBMIT STARTUP REPORTS FOR MECHANICAL EQUIPMENT AND SYSTEMS CERTIFYING PROPER OPERATION AT TIME OF STARTUP AND INCLUDE IN O&M MANUAL.
- C. SERVICEABILITY AND ACCESSIBILITY OF PRODUCTS:
 - 1. PROVIDE WORK AND EQUIPMENT WITH THE PROPER ORIENTATION OF SERVICEABLE COMPONENTS TO ACCESS SPACE PROVIDED.
 - 2. COORDINATE INSTALLATION OF EQUIPMENT, SYSTEMS COMPONENTS, AND OTHER PRODUCTS TO ALLOW PROPER SERVICE OF ITEMS REQUIRING MAINTENANCE OR REPLACEMENT.
- D. PIPE ROUTING: ROUTE PIPING PARALLEL WITH BUILDING LINES AND AS HIGH AS POSSIBLE EXCEPT WHERE UNDERGROUND OR SHOWN OTHERWISE ON THE BUILDING PLANS. ROUTE PIPING TO AVOID OTHER PIPES AND SIMILAR ITEMS.
- E. GENERAL PIPING REQUIREMENTS:
 - 1. FABRICATE, WELD, AND INSPECT PER THE SPECIFIED CODE(S) IN THE APPLICABLE SECTION(S) OF DIVISION 20 AND 23.
 - 2. PIPE JOINT CONSTRUCTION: JOIN PIPE AND FITTINGS PER THE FOLLOWING REQUIREMENTS AND APPLICABLE CODES.
 - 3. REAM ENDS OF PIPE AND TUBES AND REMOVE BURRS. BEVEL PLAIN ENDS OF STEEL PIPE.
 - 4. DISINFECT/FLUSH: REMOVE SCALE, SLAG, DIRT AND DEBRIS FROM INSIDE AND OUTSIDE OF PIPE AND FITTINGS PRIOR TO ASSEMBLY.
 - a. WATER SYSTEMS: UTILIZE A NON-FOAMING LIQUID DETERGENT DISPERSANT CLEANER TO REMOVE OIL AND FOREIGN MATERIAL FROM THE PIPING AND EQUIPMENT PRIOR TO THE FINAL FILLING OF THE SYSTEMS. THIS CHEMICAL SHALL NOT BE INJURIOUS TO PERSONS, PIPING, PIPE JOINT COMPOUNDS, PACKING, COILS, VALVES, PUMPS AND THEIR MECHANICAL SEALS, TUBES, GASKETS, OR OTHER PARTS OF THE SYSTEM. FOR EXAMPLE, 50 PPM NALCO 7465 ANTIFOAM AND 25 PPM NALCO 7308 CLEANING AGENT.
 - 5. WELDED JOINTS: CONSTRUCT JOINTS IN ACCORDANCE WITH ASME B31.9. WELDING FILLER METALS PER REFERENCED STANDARDS.
 - 6. FLANGED JOINTS: SELECT APPROPRIATE NON-ASBESTOS GASKET MATERIAL BASED ON FLUID, PRESSURE AND TEMPERATURE REQUIREMENTS.
 - 7. SOLDERED JOINTS: USE LEAD FREE SOLDER, FREE FLOWING WITHIN DESIRED TEMPERATURE RANGE, AND IN CONJUNCTION WITH FLUX SHALL ADHERE TO THE SURFACES BEING JOINED. THE FLUX SHALL BE CHEMICALLY ACTIVE AT DESIRED TEMPERATURE AND USED TO ELIMINATE OXIDATION OF THE FILLER METAL AND THE SURFACE BEING JOINED. PER COPPER TUBE HANDBOOK OF THE COPPER DEVELOPMENT ASSOCIATION.
- F. LEAK AND PRESSURE TESTING:
 - 1. FLUSH SYSTEM PRIOR TO TEST: HYDRONIC PIPING SHALL BE FLUSHED WITH WATER. FLUSH PIPING SYSTEMS UNTIL CLEAN AND FREE OF PARTICULATE MATTER. EXERCISE PROPER CARE TO PREVENT DAMAGE. SUBMIT WRITTEN DOCUMENTATION OF FLUSHING AND PRESSURE TESTS. SEE ADDITIONAL AND SUPPLEMENTAL REQUIREMENTS SPECIFIED IN THE FOLLOWING DIVISIONS AND SECTIONS.
 - 2. TESTING SHALL BE DONE BEFORE INSULATION IS INSTALLED ON PIPE AND EQUIPMENT OR THE PIPING OR EQUIPMENT IS OTHERWISE OBSTRUCTED TO DETERMINE IF THE TEST IS SUCCESSFUL.
 - 3. EACH JOINT SHALL BE VISUALLY INSPECTED TO HAVE NO LEAKS DURING TESTING UNLESS SPECIFICALLY EXEMPTED BY THE PROJECT DRAWINGS OR APPLICABLE CODE.
 - 4. LEAKS SHALL BE REPAIRED AND RETESTED UNTIL PIPE SYSTEM CAN PASS THE HYDROSTATIC TEST. SYSTEMS THAT FAIL MORE THAN ONE TEST SHALL BE REPORTED TO THE BATTELLE CONSTRUCTION MANAGER.
 - 5. CONTRACTORS MAY SUBMIT ALTERNATIVE TEST AND FLUSH PROCEDURES THAN THOSE NOTED ON THE DRAWINGS. ALTERNATE PROCEDURES SHALL BE APPROVED BY PNNL ENGINEERING PRIOR TO USE.
 - 6. DO NOT TEST OR FLUSH WITH WATER OR OTHER LIQUID WHEN FREEZING CONDITIONS ARE PRESENT.
 - 7. ISOLATE OR REMOVE COMPONENTS THAT CANNOT WITHSTAND THE TEST PRESSURE. IN-SERVICE LEAK TESTING OF ISOLATED AND OTHER CONNECTION POINTS, THAT CAN NOT BE TESTED DURING THE SYSTEM TEST, IS REQUIRED.
 - 8. AT NO TIME SHALL THE TEST PRESSURE EXCEED THE MANUFACTURER'S MAXIMUM ALLOWED TEST PRESSURE OF PIPE, TUBE, AND/OR OTHER FITTINGS AND ACCESSORIES.
 - 9. DOCUMENTATION: SUBMIT COMPLETED TEST REPORT DOCUMENTATION FOR TESTING SPECIFIED IN DIVISION 20 AND 23 TO THE BATTELLE CONSTRUCTION MANAGER. TEST REPORTS TO INCLUDE TEST PERFORMER, TEST PRESSURE, DURATION, MEDIA USED, WITNESS, AND DATE AS A MINIMUM. ITEMS THAT REQUIRE A TEST, BUT DO NOT HAVE DOCUMENTATION WILL NOT BE ACCEPTED AS COMPLETE. INCLUDE TEST REPORT DOCUMENTATION IN O&M MANUAL.
- G. WELDING:
 - 1. CARBON STEEL SHAPES AND PLATES: PROCESSES AND WELDERS SHALL BE QUALIFIED IN ACCORDANCE WITH AWS D1.1. FABRICATE PER AWS D1.1, STATICALLY LOADED. NO WELD INSPECTION REQUIRED.
 - 2. CARBON STEEL PIPE AND FITTINGS: PROCESSES AND WELDERS SHALL BE QUALIFIED IN ACCORDANCE WITH ASME SECTION IX. FABRICATE PER ASME B31.9. NO WELD INSPECTION REQUIRED.

H. PAINTING:

- 1. FINISH EXTERIOR MECHANICAL PIPING SUPPORTS, MATERIALS, DEVICES, APPURTENANCES AND CONSTRUCTION WITH THREE COATS OF GRAY ENAMEL.
- 2. CLEAN SCRATCHED OR MARRED FACTORY FINISHED AND PAINTED SURFACES OF RUST OR OTHER FOREIGN MATTER AND PAINT WITH MATCHING COLOR.
- I. CLEANING AND ADJUSTING: THOROUGHLY CLEAN MECHANICAL EQUIPMENT AND PIPING OF STAMPINGS, MARKINGS, IRON CUTTINGS, AND OTHER REFUSE. CAREFULLY CAP PIPING DURING CONSTRUCTION WHEN CONSTRUCTION ACTIVITIES ARE NOT UNDERWAY.
- 200523 GENERAL DUTY MECHANICAL VALVES
 - A. VALVES (2" AND UNDER): BRASS OR BRONZE, THREADED CONNECTIONS, FULL PORT, LOCKABLE HANDLE; 125 SWP OR AS REQUIRED FOR SPECIFIC SECTION OF DIVISION 23.
 - B. VALVES (2 1/2" AND OVER): BUTTERFLY TYPE, MSS SP-67, 200 PSI CWP, CAST IRON BODY, STAINLESS STEEL STEM AND DISC, EPDM COATED DISC AND SEAT, FULL LUG STYLE, LOCKABLE GEAR TYPE ACTUATOR, RATED FOR BI-DIRECTIONAL DEAD-END SERVICE AT FULL PRESSURE.
 - C. APPROVED MANUFACTURERS: MILWAUKEE VALVE CO, HAMMOND VALVE CO, NIBCO, OR APPROVED EQUAL.
- 200529 HANGARS AND SUPPORTS FOR MECHANICAL PIPING AND EQUIPMENT
 - A. FABRICATE AND INSTALL PIPING IN ACCORDANCE WITH ASME B31.9. PROVIDE PIPE SUPPORTS AND HANGERS AS REQUIRED AND AS INDICATED; MAXIMUM SPACING FOR HVAC STEEL PIPING PER ASME B31.9.
 - B. INSTALL AND APPLY HANGERS PER LATEST EDITION OF MANUFACTURER'S STANDARDIZATION SOCIETY (MSS) STANDARD SP-58.
- 200553 IDENTIFICATION FOR MECHANICAL PIPING AND EQUIPMENT
 - A. VALVE LABELS FOR OUTDOOR LOCATIONS: SELF ADHESIVE VINYL TYPE WITH METAL BACKING, ATTACH DIRECTLY TO VALVE.
 - 1. METAL BACKING MATERIAL: 0.032-INCH THICK ALUMINUM
 - 2. DATA (PER DRAWINGS OR BATTELLE REP): ALPHANUMERIC IDENTIFIER
 - 3. LETTERING: 1/2-INCH HELVETICA
 - 4. SIZE: 1-INCH X 2-1/2-INCH
 - 5. COLOR TO MATCH APPLICABLE CONNECTING PIPING COLOR SCHEME.
 - 6. INSTALLATION: INSTALL TAGS ON VALVES AS INDICATED ON THE DRAWINGS OR PER CONSTRUCTION MANAGER.
 - B. EQUIPMENT LABELS FOR OUTDOOR LOCATIONS: SELF ADHESIVE VINYL TAPE, FOR PERMANENT ATTACHMENT ON EQUIPMENT AT ACCESSIBLE AND VISIBLE LOCATION. IF THERE IS NOT ADEQUATE FLAT SPACE ON EQUIPMENT FOR ATTACHMENT OF LABEL, PROVIDE A METAL BACKING PLATE FOR LABEL.
 - 1. METAL BACKING MATERIAL: 0.032-INCH THICK ALUMINUM
 - 2. DATA (PER EQUIPMENT SCHEDULE OR BATTELLE REP): ALPHANUMERIC IDENTIFIER WITH NOUN DESCRIPTION.
 - 3. LETTERING: 1/2-INCH HELVETICA
 - 4. SIZE: 4-INCH X 4-1/2-INCH
 - 5. COLORS: GREEN BACKGROUND WITH WHITE LETTERS.
 - 6. INSTALLATION: INSTALL INDOOR AND/OR OUTDOOR EQUIPMENT LABELS ON OR NEAR EACH PIECE OF MAJOR MECHANICAL EQUIPMENT.

200700 MECHANICAL PIPING INSULATION

- A. INSULATION: 1-INCH THICK 500°F SNAP-ON FIBERGLASS, WITH A FACTORY APPLIED VAPOR RETARDER ALL SERVICE JACKET (ASJ); AND SELF-SEALING LAP (SSL). APPLY INSULATION CONTINUOUSLY THROUGH HANGERS. INSTALL SADDLES, SHIELDS AND INSERTS ON CHILLED WATER PIPING. COVER HANGER INSERTS AND SHIELDS WITH JACKET MATERIAL MATCHING ADJACENT PIPE INSULATION. INSULATION SHALL BE UL-LISTED WITH MAXIMUM FLAME SPREAD AND SMOKE DEVELOPED INDEXES OF 25 AND 50, RESPECTIVELY. CERTAINTEED, KNAUF OR JOHNS-MANVILLE.
- B. VAPOR BARRIER COMPOUND: WATER BASED. FIRE RESISTANT AS RECOMMENDED BY INSULATION MANUFACTURER. CONTINUOUS VAPOR BARRIER SHALL BE MAINTAINED OVER ENTIRE LENGTH OF CHILLED WATER PIPES.
- C. ALUMINUM JACKET (FOR OUTDOOR USE): ASTM B209, 3003 ALLOY, H-14 ROLL STOCK READY FOR SHOP OR FIELD CUTTING. EMBOSSED FINISH, 0.010" THICK. FACTORY APPLIED MOISTURE BARRIER 1-MIL THICK, HEAT BONDED POLYETHYLENE AND KRAFT PAPER. PREFORMED ELBOWS OF SAME MATERIAL, THICKNESS AND FINISH.

DOCUMENT NO S740784-GO-002		SERVICE REQUEST NO S740784	
CURRENT REVISION		ORIGINAL	
DRAWN JM SCOTT	DRAWN JM SCOTT	U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST SITE OFFICE Pacific Northwest Division Battelle Richland, Washington 99352	
CHECKED SE GOURLEY	CHECKED SE GOURLEY		
DRAFTING CHECKER SD BURNETT	DRAFTING CHECKER SD BURNETT	GENERAL SPECIFICATIONS	
ENGINEER JM SCOTT	ENGINEER JM SCOTT		
APVD DJ DE SMET	APVD DJ DE SMET	PROJ TITLE BLDG 331 200-TON CHILLER REPLACEMENT	REV NO 0
OTHER	OTHER	SIZE/BLDG 331	DWG NO GO-002
OTHER	OTHER	SCALE SHOWN	SHEET 1 OF 1

REVISIONS DESCRIPTION

SPECIFICATIONS
(UNLESS OTHERWISE NOTED)

DIVISION 23 – HEATING VENTILATION, AND AIR CONDITIONING

230500 COMMON WORK RESULTS FOR HVAC

- A. SEE 200500
- B. LEAK TESTING: SEE 200500 FOR GENERAL LEAK TESTING REQUIREMENTS.
- C. HANGERS: CONFORM TO 200529.
- D. CONNECTIONS: DRAWINGS INDICATE GENERAL ARRANGEMENT OF PIPING, FITTINGS, AND SPECIALTIES. INSTALL PIPING ADJACENT TO SPECIALTIES AND EQUIPMENT TO ALLOW SERVICE AND MAINTENANCE.
- E. FIELD INSPECTIONS: VERIFY CORRECT LABELING FOR EACH FLUID TRANSFER LINE.
- F. TEST CERTIFICATION: CERTIFY THAT SPECIFIED TESTS, INSPECTIONS, AND PROCEDURES HAVE BEEN PERFORMED AND CERTIFY REPORT RESULTS. INCLUDE 1) THE INSPECTION PERFORMED. 2) PROCEDURES, MATERIALS, AND GASES USED. 3) TEST METHOD USED. 4) RESULT OF TEST.

230800 TESTING AND BALANCING

- A. AFTER HYDRONIC INSTALLATION AND CONSTRUCTION IS COMPLETE, VERIFY FLOW RATE AT CHILLED WATER AUTOMATIC FLOW CONTROL VALVE.
- B. PERFORM FUNCTIONAL TESTING OF INSTALLED EQUIPMENT AND CONTROL SYSTEMS. DOCUMENT TESTING ON FORMS PROVIDED BY BATTELLE.

230900 INSTRUMENTATION AND CONTROL FOR HVAC

- A. WORK INCLUDED: THE DIVISION 230900 CONTRACTOR SHALL PROVIDE MATERIALS, PRODUCTS AND INSTALLATION REQUIRED TO MEET THE SEQUENCE OF OPERATIONS DESCRIBED ON M7-101 AND INTEGRATE WITH THE EXISTING FACILITIES MONITORING AND CONTROL SYSTEM (FMCS). EXISTING FMCS IS JOHNSON CONTROLS, INC. METASYS USING NETWORK AUTOMATION ENGINES (NAE) AND FIELD EQUIPMENT CONTROLLERS (FEC). THE EXISTING NAE AND FEC SHALL BE RETAINED AS INDICATED. PROGRAMMING OF THE FMCS/FEC SHALL BE BY BATTELLE. COORDINATE WITH BATTELLE'S FMCS SPECIALIST AND ENGINEER.
- B. SUBMITTALS

- 1. PRODUCT DATA: INCLUDE MANUFACTURER'S TECHNICAL LITERATURE FOR EACH CONTROL DEVICE. INDICATE DIMENSIONS, CAPACITIES, PERFORMANCE CHARACTERISTICS, ELECTRICAL CHARACTERISTICS, FINISHES FOR MATERIALS, AND INSTALLATION AND STARTUP INSTRUCTIONS FOR EACH TYPE OF PRODUCT INDICATED.
- 2. SHOP DRAWINGS: DETAIL EQUIPMENT ASSEMBLIES AND INDICATE DIMENSIONS, WEIGHTS, LOADS, REQUIRED CLEARANCES, METHOD OF FIELD ASSEMBLY, COMPONENTS, AND LOCATION AND SIZE OF EACH FIELD CONNECTION. BILL OF MATERIALS, SCHEMATIC FLOW DIAGRAMS, SEQUENCE OF CONTROL, WIRING DIAGRAMS, DETAILS OF CONTROL, AND SYSTEM ARCHITECTURE DESIGN DIAGRAM.
- 3. STARTUP TESTING PLAN: SUBMIT A STARTUP TESTING AND VALIDATION PLAN FOR THE CHILLER, AS WELL AS EQUIPMENT INSTALLED UNDER THIS PROJECT. ACCEPTANCE TESTING PROCEDURES WILL BE PROVIDED BY BATTELLE WHICH THE CONTRACTOR SHALL INCORPORATE INTO THE STARTUP AND TESTING PLAN.

C. TEMPERATURE SENSORS:

- 1. SINGLE-POINT IMMERSION TEMPERATURE SENSORS (LIQUIDS).
- 2. TEMPERATURE RANGE: -50 TO 250 DEG F
- 3. RESISTANCE RATING: 1,000 OHM, NICKEL.
- 4. ACCURACY: ± 0.5 DEG F
- 5. PROBE: SINGLE-POINT SENSOR WITH A STAINLESS-STEEL SHEATH.
- 6. LENGTH: AS REQUIRED BY APPLICATION TO ACHIEVE TIP AT MIDPOINT.
- 7. ENCLOSURE: JUNCTION BOX WITH REMOVABLE COVER; NEMA 250, TYPE 4 FOR OUTDOOR APPLICATIONS.
- 8. GASKET FOR ATTACHMENT TO EQUIPMENT TO SEAL CONNECTION AIRTIGHT.
- 9. CONDUIT CONNECTION: 1/2-INCH TRADE SIZE.
- 10. MANUFACTURERS: JOHNSON CONTROLS TE-6300 SERIES OR APPROVED EQUAL.

D. THERMOWELLS: STAINLESS STEEL, THREADED, INSIDE DIAMETER AND INSERTION LENGTH AS REQUIRED FOR THE APPLICATION.

E. CONTROL VALVES: 2-WAY, ASTM A126 CAST IRON OR ASTM A536 DUCTILE IRON BODY, BUTTERFLY TYPE WITH ELASTOMER-COATED DUCTILE IRON DISC, STAINLESS STEEL STEM WITH EXTENDED NECK, GROOVED PIPE CONNECTIONS, FIELD-REPLACEABLE EPDM OR BUNA-N SLEEVE AND STEM SEALS, 200 PSIG, 150 PSIG MAXIMUM PRESSURE DIFFERENTIAL. MANUFACTURERS: BELIMO, SIEMENS, JOHNSON CONTROLS, OR APPROVED EQUAL.

F. PNEUMATIC VALVE OPERATORS: ROLLING DIAPHRAGM, SPRING-LOADED, PISTON TYPE WITH SPRING RANGE AS REQUIRED AND START-POINT ADJUSTMENT AND POSITIONING RELAY. OPERATOR SHALL MAINTAIN FULL SHUTOFF AT MAXIMUM PUMP DIFFERENTIAL PRESSURE OF 60 PSIG. MANUFACTURERS: BELIMO, SIEMENS, JOHNSON CONTROLS, OR APPROVED EQUAL.

G. WIRING AND CONDUIT: SEE DIVISION 26.

230993 SEQUENCE OF OPERATION – SEE DRAWING M7-101

232113 HYDRONIC PIPING

A. INSTALLATION SHALL CONFORM TO ASME B31.9 FOR A SYSTEM MAXIMUM ALLOWABLE WORKING PRESSURE OF 100 PSIG.

B. PIPING

- 1. PIPE (2" AND UNDER): TYPE "L" HARD DRAWN COPPER TUBING PER ASTM B88.
- 2. FITTINGS (2" AND UNDER): WROUGHT COPPER SOLDER JOINT TYPE PER ASME B16.22, OR COPPER PRESS-FIT WITH EPDM RUBBER O-RING SEALS.
- 3. PIPE (2-1/2" AND OVER): BLACK STEEL, SCHEDULE 40 WELDED OR SEAMLESS, PER ASTM A53.

- 4. FITTINGS (2-1/2" AND OVER) SHALL BE ONE OF THE FOLLOWING:
 - a. BUTTWELDED PER ASTM A234, GRADE WPB AND ASME B16.9, WALL THICKNESS TO MATCH PIPE.
 - b. GROOVED MECHANICAL JOINT FITTINGS PER ASTM A536. VICTAULIC OR ANVIL INTERNATIONAL.

C. PIPE INSULATION: SEE 200700

D. VALVES: SEE 200523.

E. PIPE HANGERS: SEE 200529.

F. TESTING: PERFORM HYDROSTATIC TESTING PER ASME B31.9 ON PIPING INSTALLED UNDER THIS PROJECT. TEST PRESSURE SHALL BE 150 PSIG, 4-HOUR TEST DURATION.

232116 HYDRONIC PIPING SPECIALTIES

A. DRAIN VALVE: BRONZE BALL VALVE, FULL PORT, STAINLESS TRIM, 3/4" HOSE CONNECTION WITH CAP AND CHAIN, LOCKABLE HANDLE (VALVE CLOSED POSITION) NIBCO MODEL T-585 OR APPROVED EQUAL.

B. MANUAL AIR VENT: 150 PSIG WORKING PRESSURE, 1/2" INLET CONNECTION, 1/8" DISCHARGE CONNECTION. BELL & GOSSETT, TACO, OR APPROVED EQUAL.

C. TEMPERATURE GAUGE: 1/2" OR 1/4" NPT STEM CONNECTION WITH LENGTH AS REQUIRED, 30/130°F RANGE, 2" DIAL SIZE, STAINLESS STEEL. ASHCROFT SERIES EI OR APPROVED EQUAL. PROVIDE THERMOWELL.

D. THERMOWELL: PRESSURE-TIGHT, SOCKET-TYPE METAL FITTING FOR INSERTION INTO PIPING. TYPE, DIAMETER AND LENGTH REQUIRED TO HOLD TEMPERATURE GAUGE. MANUFACTURER: SAME AS MANUFACTURER OF TEMPERATURE GAUGE USED.

E. PRESSURE GAUGE: 0-200 PSI, 2-1/2" DIAL, LIQUID FILLED 1/4" NPT BOTTOM CONNECTION, WEKSLER #BY42Y OR APPROVED EQUAL. PROVIDE COMPLETE WITH 1/4" BRASS OR STAINLESS STEEL BALL VALVE.

F. RELIEF VALVE: STAINLESS STEEL BODY, VITON SEAT, STAINLESS STEEL STEM AND SPRINGS, AUTOMATIC, DIRECT-PRESSURE ACTUATED, THREADED CONNECTIONS, ASME CERTIFIED CAPACITY AND LABELED FOR 125 PSIG MAXIMUM OPERATING PRESSURE, RELIEF PRESSURE FACTORY SET AND FIELD ADJUSTABLE. FARRIS, KUNKLE, BELL & GOSSETT, OR APPROVED EQUAL.

G. EXPANSION JOINTS: ASSEMBLY OF COMBINATION OF GROOVED COUPLINGS AND PIPE NIPPLES JOINED IN TANDEM, EPDM GASKETS, SELECTED FOR 1/2" MAXIMUM AXIAL MOVEMENT. VICTAULIC STYLE 155 OR APPROVED EQUAL.

H. AUTOMATIC FLOW CONTROL VALVE: STEEL BODY, FLANGED OR GROOVED CONNECTIONS, CONTROL RANGE OF 2-32 PSI DIFFERENTIAL PRESSURE, PROVIDE WITH EXTENDED PRESSURE/TEMPERATURE PORTS AND TAGGING KIT. FLOW RATE = 525 GPM. FLOW DESIGN INC MODEL WG, OR APPROVED EQUAL BY HAYES FLUID CONTROL OR NEXUS.

I. GLYCOL SOLUTION:

- 1. MANUFACTURERS: DOW CHEMICAL COMPANY, DOWFROST HD.
- 2. FLUID PROPERTIES:
 - a. FORMULATION OF 94% PROPYLENE GLYCOL AND 6% INDUSTRIAL GRADE CORROSION INHIBITORS, DYED BRIGHT YELLOW OR GREEN, PER MANUFACTURER.
 - b. RECOMMENDED USE TEMPERATURE RANGE: -50° F TO 325° F.
 - c. OPERATING SOLUTION: PRE-MIXED WITH DE-IONIZED WATER TO A CONCENTRATION OF 70% WATER, 30% PROPYLENE GLYCOL FOR FREEZE PROTECTION TO 9° F, BURST PROTECTION TO -20° F.

L. GLYCOL CHARGING: PRIOR TO DRAINING CHILLED WATER SYSTEM, WATER TREATMENT SPECIALIST SHALL SAMPLE AND TEST THE EXISTING WORKING FLUID TO VERIFY THE CONCENTRATION OF GLYCOL. AFTER HYDRONIC PIPING INSTALLATION IS COMPLETE, RE-FILL SYSTEM WITH GLYCOL SOLUTION. SUBMIT WRITTEN REPORT INDICATING VOLUME ADDED AND CERTIFYING THE GLYCOL CONCENTRATION PRESENT IN THE SYSTEM.

236400 AIR-COOLED CHILLERS

A. THE CHILLER IS OWNER FURNISHED, TO BE INSTALLED BY THE CONTRACTOR.

B. INSTALLATION:

- 1. INSPECT CHILLER FOR DAMAGE PRIOR TO RELOCATION. NOTIFY BATTELLE CONSTRUCTION MANAGER IF ANY DAMAGE IS FOUND.
- 2. CHECK PRESSURE IN REFRIGERANT CIRCUITS TO VERIFY THAT REFRIGERANT CHARGE IS INTACT.
- 3. RELOCATE CHILLER FROM STORAGE LOCATION AT THE LSW WAREHOUSE TO THE PROJECT SITE.
- 4. INSTALL PER MANUFACTURER'S REQUIREMENTS AND CONTRACT DOCUMENTS.
- 5. INSTALL CHILLER ON EXISTING CONCRETE FOUNDATION WITH ELASTOMERIC VIBRATION ISOLATION PADS AS INDICATED ON DRAWINGS.
- 6. MAINTAIN MANUFACTURER'S RECOMMENDED CLEARANCES FOR SERVICE AND MAINTENANCE.
- 7. COORDINATE ELECTRICAL INSTALLATION WITH ELECTRICAL CONTRACTOR.
- 8. COORDINATE CONTROLS WITH BATTELLE FMCS SPECIALIST.
- 9. PROVIDE MATERIAL REQUIRED FOR A FULLY OPERATIONAL AND FUNCTIONAL CHILLER.
- 10. INSTALL DEVICES FURNISHED BY THE MANUFACTURER FOR FIELD INSTALLATION.
- 11. SET FACTORY-INSTALLED FLOW SWITCH FOR USE WITH PROPYLENE GLYCOL WORKING FLUID.

C. THE CONTRACTOR SHALL COORDINATE WITH THE CHILLER FACTORY REPRESENTATIVE FOR START-UP SERVICES BY A FACTORY-AUTHORIZED SERVICE REPRESENTATIVE.

D. COMPLETE INSTALLATION AND STARTUP CHECKS ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS AND PERFORM THE FOLLOWING:

- 1. REMOVE COMPRESSOR RACK HOLDDOWN BOLTS AND SHIPPING BRACES.
- 2. CHECK PRESSURE IN REFRIGERANT CIRCUITS TO VERIFY THAT REFRIGERANT CHARGE IS INTACT.
- 3. VERIFY THAT THERMOMETERS AND GAGES ARE INSTALLED.
- 4. OPERATE WATER CHILLER FOR RUN-IN PERIOD.
- 5. CHECK BEARING LUBRICATION AND OIL LEVELS.
- 6. VERIFY PROPER MOTOR ROTATION.
- 7. VERIFY AND RECORD PERFORMANCE OF WATER CHILLER PROTECTION DEVICES.
- 8. TEST AND ADJUST CONTROLS AND SAFETIES. REPLACE DAMAGED OR MALFUNCTIONING CONTROLS AND EQUIPMENT.

E. TRAINING: THE START-UP TECHNICIAN SHALL INSTRUCT THE OWNER'S REPRESENTATIVE IN PROPER CARE AND OPERATION OF THE UNIT.

DIVISION 26 – ELECTRICAL

260500 BASIC ELECTRICAL MATERIALS AND METHODS

A. ELECTRICAL – INSTALLATION SHALL BE IN ACCORDANCE WITH NATIONAL ELECTRICAL CODE (NEC) VERSION 2014. INSTALLATION WILL BE CHECKED FOR CODE COMPLIANCE BY A DESIGNATED BATTELLE INSPECTOR. REWORK MAY BE REQUIRED TO MEET CODE AS NEEDED.

B. ANY CONFLICTS BETWEEN THE ENGINEERING DRAWINGS AND ELECTRICAL CODE MUST BE RESOLVED WITH THE BATTELLE CONSTRUCTION MANAGER BEFORE PROCEEDING WITH INSTALLATION.

C. ELECTRICAL COMPONENT IDENTIFICATION SHALL CONFORM WITH BATTELLE ADMINISTRATIVE PROCEDURE ADM-CM-064. USE BLACK LETTERS ON WHITE BACKGROUND FOR NORMAL POWER, RED LETTERS ON WHITE BACKGROUND FOR STANDBY/EMERGENCY POWER AND WHITE LETTERS ON BLUE BACKGROUND FOR UPS POWER. LETTERS SHALL BE 3/8" MINIMUM HEIGHT.

D. ELECTRICAL OUTAGES OF EXISTING CIRCUITS SHALL BE SCHEDULED TO ALLOW FOR PLANNED SHUTDOWN OF EXISTING EQUIPMENT.

E. PULL, JUNCTION AND SPLICE BOXES SHALL BE FURNISHED AND INSTALLED, EVEN IF NOT SHOWN ON DRAWINGS.

F. OUTDOOR RATED COMPRESSION TYPE FITTINGS SHALL BE USED WITH EMT WHERE EXPOSED TO WEATHER.

G. UNDERGROUND RACEWAYS SHALL BE RIGID METAL CONDUIT FOR VERTICAL AND 90 DEGREES, AND RMC OR PVC FOR HORIZONTAL RACEWAYS.

H. ALL INSTALLED ELECTRICAL EQUIPMENT SHALL BE LISTED, LABELED OR OTHERWISE INDICATED AS ACCEPTABLE BY A NATIONALLY ACCREDITED TESTING LABORATORY (UL LISTED AND LABELED EQUIPMENT). EXCEPTIONS TO THE UL LISTING OF ONE OF A KIND EQUIPMENT WILL BE INSPECTED FOR CONFORMANCE WITH THE NATIONAL ELECTRICAL CODE.

I. EXTERIOR ABOVE GRADE RACEWAYS SHALL BE RIGID METAL CONDUIT WHERE EXPOSED TO MECHANICAL DAMAGE.

J. INTERIOR RACEWAYS SHALL BE EMT OR FLEXIBLE METAL CONDUIT AS ALLOWED BY NEC.

K. SURFACE MOUNTED EMT SHALL RUN PARALLEL TO CEILING AND VERTICAL RUNS SHALL BE PERPENDICULAR TO FLOOR. SUPPORT AS REQUIRED BY NEC.

L. IN WET LOCATIONS, INSULATED CONDUCTORS SHALL BE COPPER WITH FLAME RETARDANT MOISTURE AND HEAT RESISTANT, THERMOPLASTIC, 600 VOLT (THHN) INSULATION.

M. WIRE SHALL BE COPPER, #12 AWG MINIMUM SIZE, FOR POWER WIRING, WITH 90° C TEMPERATURE RATED, FLAME RETARDANT, HEAT RESISTANT, THERMOPLASTIC 600 VOLT (THHN) INSULATION.

N. PROVIDE A GREEN EQUIPMENT GROUND WIRE, #12 AWG COPPER MINIMUM, FOR ALL NEW CIRCUITS. SIZE IN ACCORDANCE WITH NEC 250.122.

O. SPLICES IN SOLID WIRE SHALL BE MADE WITH SOLDERLESS CONNECTORS. SPLICES AND TERMINATIONS IN STRANDED WIRE SHALL BE MADE WITH PRESSURE-CONNECTED TUBULAR AND SPADE LUGS.

P. FIELD CONTROL AND TESTING

- 1. FOR FEEDER AND BRANCH CIRCUITS OF 100 AMPS AND LARGER, 600V MAXIMUM. PERFORM INSULATION RESISTANCE TEST ON EACH CONDUCTOR USING A MEGOHMMETER WITH RESPECT TO GROUND AND ADJACENT CONDUCTORS APPLIED POTENTIAL SHALL BE 1000 VOLTS DC FOR 600V RATED CABLE. TEST DURATION SHALL BE ONE MINUTE.
- 2. TEST FOR CORRECT VOLTAGE AT THE CHILLER TERMINALS.
- 3. VERIFY CORRECT PHASE ROTATION.
- 4. SUBMIT TESTING DOCUMENTATION FOR CONDUCTOR INSULATION RESISTANCE TEST AND CORRECT VOLTAGE TEST.
- 5. TORQUE CONDUCTOR LUGS AT CHILLER AND DISCONNECT SWITCH PER MANUFACTURER'S RECOMMENDATIONS WITH A CALIBRATED TORQUE WRENCH. PROCESS TO BE WITNESSED BY BATTELLE.

Q. ELECTRICAL CONDUCTORS SHALL BE COLOR CODED TO MEET IDENTIFICATION REQUIREMENTS IN NEC 210.5(C) AS FOLLOWS:

- 1. 480V, 3 PHASE, A, B, C COLORS RED, YELLOW AND BLUE, RESPECTIVELY. NEUTRAL WHITE OR GRAY EXCEPT WHEN INSTALLED IN CONDUIT SHARED WITH 120V TO GROUND. IN THOSE CASES THE 277V TO GROUND SHOULD HAVE A WHITE WITH RED STRIPE NEUTRAL.

260523 CONTROL VOLTAGE ELECTRICAL POWER CABLES

A. SUBMITTALS: PRODUCT DATA FOR EACH TYPE OF PRODUCT.

B. MANUFACTURERS: SUBJECT TO COMPLIANCE WITH REQUIREMENTS, OR COMPARABLE PRODUCT BY ONE OF THE FOLLOWING:

- 1. ENCORE WIRE CORPORATION
- 2. GENERAL CABLE TECHNOLOGIES CORPORATION
- 3. SOUTHWIRE COMPANY

C. CONTROL AND SIGNAL CIRCUIT CONDUCTORS AS FOLLOWS:

- 1. CLASS 1 CONTROL CIRCUITS: STRANDED COPPER, TYPE THHN-THWN.
- 2. CLASS 2 AND 3 CONTROL CIRCUITS: STRANDED COPPER; CABLE TYPES CL2, CL3, CM, CMG, CMP OR OTHERS AS ALLOWED BY NEC ARTICLE 725.

D. COMPLY WITH REQUIREMENTS IN SECTION 260500 FOR PATHWAYS.

E. INSTALLATION OF CONDUCTORS AND CABLES AS FOLLOWS:

- 1. INSTALL CABLES AND CONDUCTORS IN EMT, CONCEALED IN BUILDING FINISHES TO EXTENT FEASIBLE. JUNCTION BOX COVERS FOR RACEWAYS 50V OR LESS SHALL BE PAINTED GREEN.
- 2. CABLE/CONDUCTOR JACKET COLOR AS FOLLOWS:
 - a. SENSOR CABLE: WHITE
 - b. MSTP/FC/N2 CABLE: BLUE
 - c. SA BUS/CONTROLLER EXPANSIONS/THERMOSTAT CABLE: BROWN
 - d. MODBUS CABLE: GREEN
- 3. CONDUCTOR SIZE: IF MANUFACTURER RECOMMENDED SIZES VARY FROM SPECIFICATION SUBMIT FOR APPROVAL BEFORE INSTALLING.
 - a. SENSOR CONDUCTORS: #18 AWG SHIELDED ANIXTER #CBL-18/*-PLN.
 - b. MSTP/FC/N2 CONDUCTORS: #22 AWG SHIELDED, ANIXTER #CBL-22/3-FC-PLN.
 - c. SA BUS/CONTROLLER EXPANSIONS/THERMOSTAT CONDUCTORS: #22 AWG, ANIXTER #CBL-22/2P-SA-PLN.
 - d. MODBUS CONDUCTORS: #22 AWG SHIELDED, ANIXTER #CBL-22/*-PLN.
- 4. SPLICED CABLES NOT ALLOWED.
- 5. DO NOT INSTALL CABLES IN SAME CONDUIT AS HIGH VOLTAGE (50 VOLTS AND HIGHER) CONDUCTORS.
- 6. BUNDLE, LACE, AND TRAIN CONDUCTORS TO TERMINAL POINTS WITHOUT EXCEEDING MANUFACTURER'S LIMITATIONS ON BENDING RADI.
- 7. DO NOT INSTALL BRUISED, KINKED, SCORED, DEFORMED, OR ABRADED CABLE. DO NOT SPLICE CABLE BETWEEN TERMINATION, TAP, OR JUNCTION POINTS. REMOVE AND DISCARD CABLE IF DAMAGED DURING INSTALLATION AND REPLACE IT WITH NEW CABLE.
- 8. LABEL EACH END OF CABLING FOR FC BUS AND INPUT/OUTPUT CABLING.

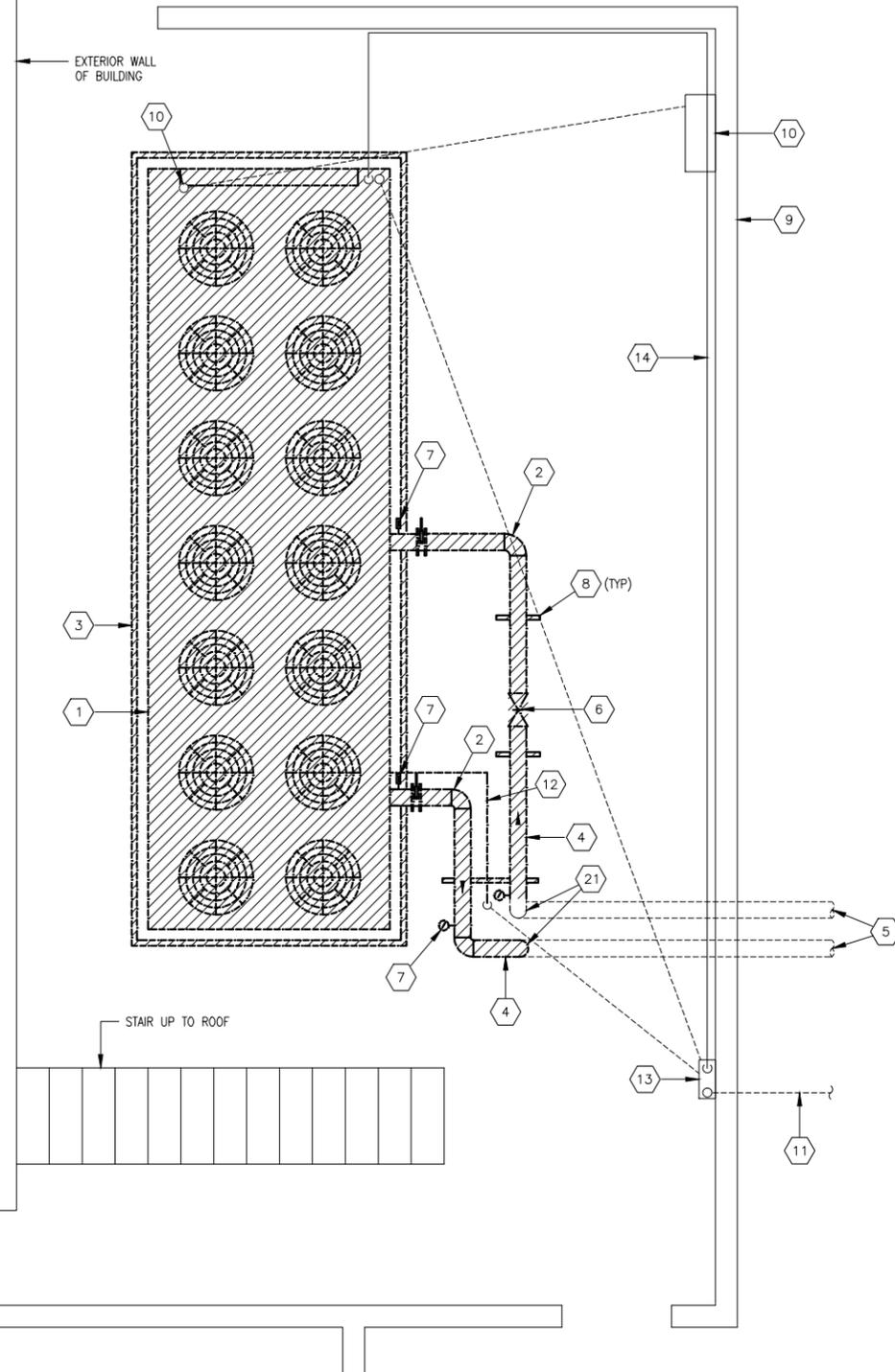
F. MINIMUM CONTROL CIRCUIT CONDUCTOR SIZES:

- 1. CLASS 1 REMOTE-CONTROL AND SIGNAL CIRCUITS #14 AWG.
- 2. CLASS 2 LOW-ENERGY, REMOTE-CONTROL, AND SIGNAL CIRCUITS, #18 AWG.
- 3. CLASS 3 LOW-ENERGY, REMOTE-CONTROL, ALARM, AND SIGNAL CIRCUITS, #18 AWG.
- 4. UNLESS OTHERWISE NOTED IN INSTALLATION OF CONDUCTORS AND CABLES SECTION.

G. FIELD QUALITY CONTROL: VISUALLY INSPECT CABLE PLACEMENT, CABLE TERMINATION, GROUNDING AND BONDING, EQUIPMENT AND PATCH CORDS, AND LABELING OF ALL COMPONENTS.

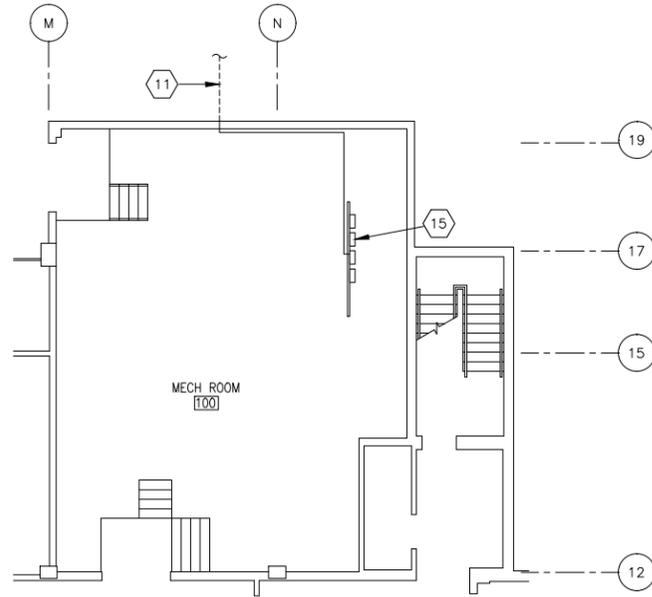
DOCUMENT NO S740784-G0-003		SERVICE REQUEST NO S740784	
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DRAFTING CHECKER SD BURNETT	ENGINEER JM SCOTT	APVD DJ DE SMET	OTHER
OTHER	OTHER	OTHER	OTHER
U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST SITE OFFICE		Pacific Northwest Division Richland, Washington 99352	
Battelle			
GENERAL SPECIFICATIONS			
PROJ TITLE BLDG 331 200-TON CHILLER REPLACEMENT	DWG NO G0-003	REV NO 0	
SCALE D 331 SHOWN		SHEET 1 OF 1	

REVISIONS DESCRIPTION



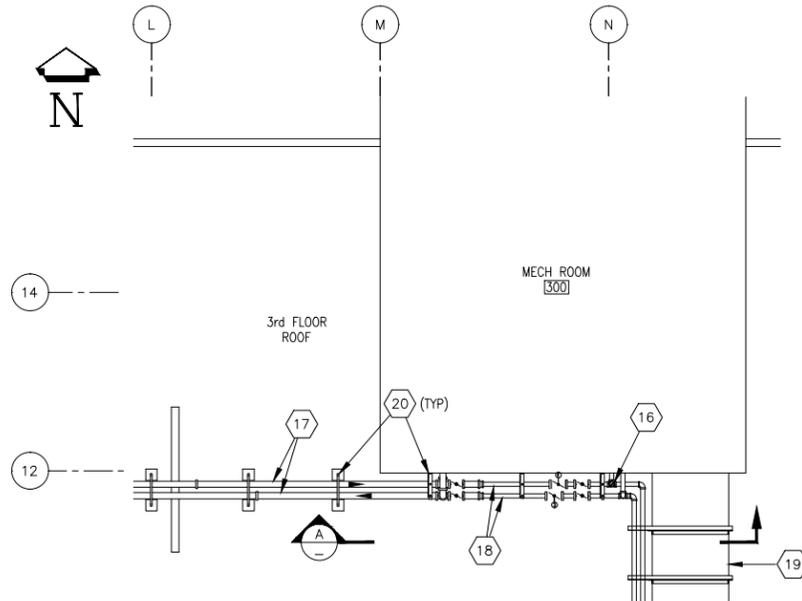
CHILLER DEMOLITION PLAN

3/8" = 1'-0"
SCALE
0' 2' 4' 8'
FEET



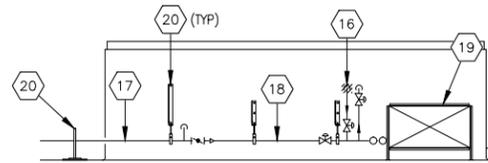
MECH ROOM DEMOLITION PLAN

SCALE: 1/8" = 1'-0"



PIPING DEMOLITION PLAN - ROOF

SCALE: 1/8" = 1'-0"



A ELEVATION
SCALE: 1/8" = 1'-0"

GENERAL NOTES

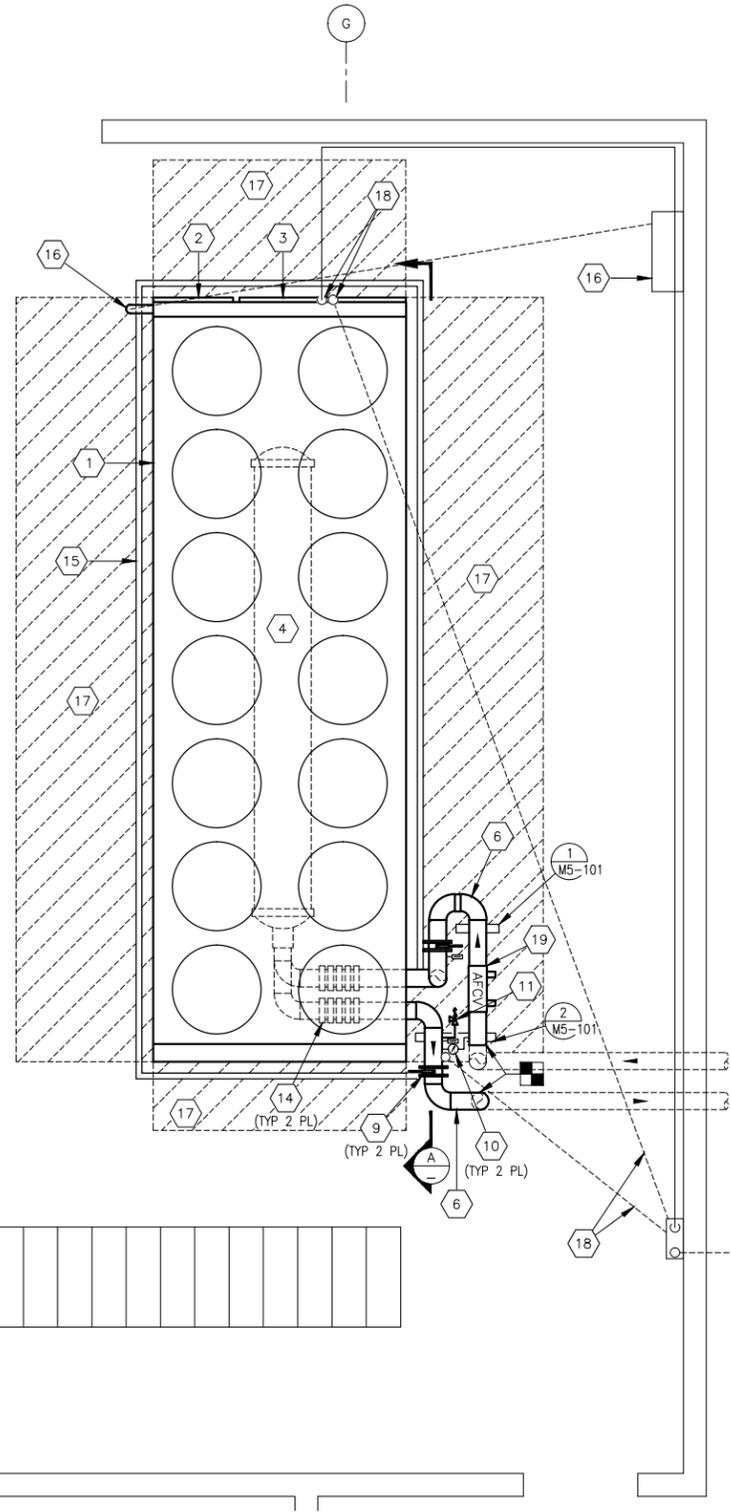
(UNLESS OTHERWISE SPECIFIED)

1. FOR SPECIFICATIONS, LEGEND AND KEY PLAN SEE G0-001 THROUGH G0-003.
2. DRAWING NUMBERS BEGIN WITH 'S740784-' UNLESS OTHERWISE SPECIFIED.

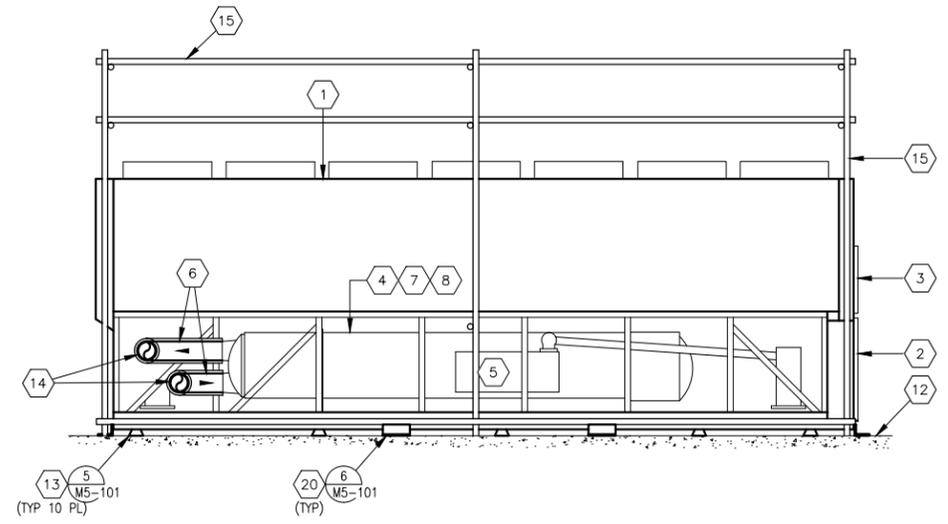
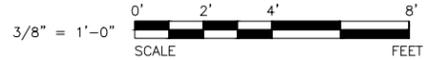
SHEET NOTES

- 1 DEMOLISH CHILLER CH-005. GROUT ANCHOR BOLT HOLES IN CONCRETE PAD.
- 2 DEMOLISH 6" CHWS/R PIPING TO EXTENT INDICATED TO ACCOMMODATE INSTALLATION OF REPLACEMENT CHILLER.
- 3 DISASSEMBLE CHILLER GUARD RAIL/SCAFFOLDING AND RETAIN FOR RE-USE.
- 4 6" CHWS/R PIPING (ABOVE GROUND).
- 5 6" CHWS/R PIPING (BELOW GROUND).
- 6 DEMOLISH AUTOMATIC FLOW CONTROL VALVE.
- 7 DEMOLISH FLOW SWITCH, TEMPERATURE GAUGES AND TEMPERATURE SENSORS.
- 8 DEMOLISH PIPE SUPPORT.
- 9 CONCRETE ENCLOSURE TO REMAIN.
- 10 DISCONNECT POWER CONDUCTORS FROM CHILLER LUGS BACK TO DISCONNECT SWITCH. RETAIN BURIED CONDUIT FOR USE WITH REPLACEMENT CHILLER. DISCONNECT SWITCH IS FED FROM 331-#SWBD-1, SECTION 4 SPACE 10.
- 11 DEMOLISH CONTROL WIRING IN BURIED CONDUIT ROUTED INTO 331 BUILDING MECHANICAL ROOM 100. CONDUIT TO REMAIN FOR RE-USE.
- 12 DEMOLISH CONTROL WIRING IN CONDUIT CONNECTED TO EXISTING SENSORS. DEMOLISH ABOVEGROUND CONDUIT, PREPARE FOR RECONNECTION.
- 13 CONTROL WIRING JUNCTION BOX, MOUNTED ON WALL.
- 14 DEMOLISH CONTROL WIRING IN CONDUIT ROUTED OVERHEAD, CONDUIT TO REMAIN.
- 15 DISCONNECT CHILLER CONTROL WIRING TERMINATIONS IN CHILLER CONTROL PANEL. DEMOLISH CONTROL WIRING BACK TO CHILLER.
- 16 DEMOLISH 90-ELBOW IN 4" CHWS PIPE AND REPLACE WITH 4x4x4 TEE. VERTICAL PIPE AND CONTROL VALVE TO REMAIN.
- 17 6" CHWS/R
- 18 4" CHWS/R
- 19 EXISTING HVAC DUCT
- 20 EXISTING PIPE SUPPORT/HANGER.
- 21 EXISTING BUTTERFLY ISOLATION VALVE ON VERTICAL RISER TO REMAIN.

DOCUMENT NO S740784-D1-101		SERVICE REQUEST NO S740784	
CURRENT REVISION		ORIGINAL	
DRAWN JM SCOTT	CHECKED SE GOURLEY	DRAFTING CHECKER SD BURNETT	ENGINEER JM SCOTT
APVD DJ DE SMET	OTHER BJ GRAF	OTHER	OTHER
U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST SITE OFFICE		Pacific Northwest Division Battelle Richland, Washington 99352	
DEMOLITION CHILLER DEMOLITION PLAN			
PROJ TITLE BLDG 331	DWG NO D1-101	REV NO 0	SCALE SHOWN
REVISIONS DESCRIPTION		SHEET 1 OF 1	



CHILLER INSTALLATION PLAN



A CHILLER - ELEVATION
SCALE: 3/8" = 1'-0"

GENERAL NOTES
(UNLESS OTHERWISE SPECIFIED)

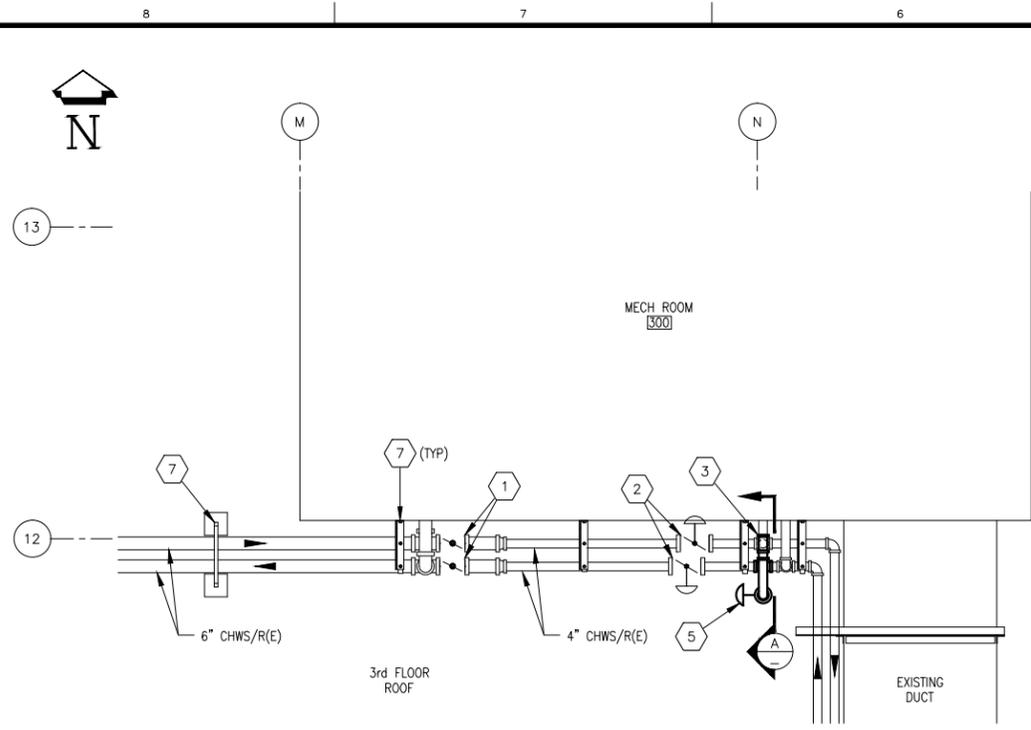
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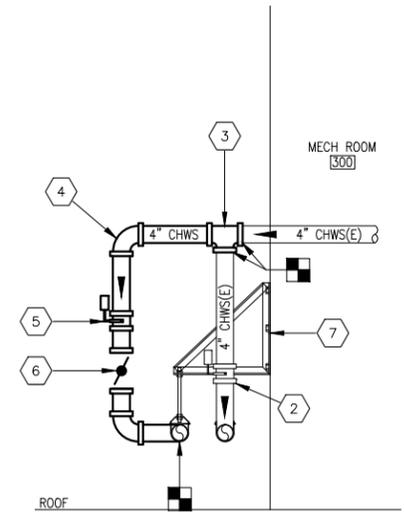
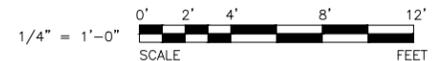
- 1 CHILLER CH-005, OFCI.
- 2 CHILLER ELECTRICAL POWER PANEL.
- 3 CHILLER CONTROL PANEL.
- 4 CHILLER EVAPORATOR
- 5 CHILLER COMPRESSOR
- 6 6" CHWS/R PIPING, CONNECT TO EXISTING AND TO PIPE CONNECTIONS AT CHILLER EVAPORATOR. OFFSET PIPING VERTICALLY TO MATCH THE ELEVATION OF THE EXISTING PIPING.
- 7 PROVIDE DRAIN VALVE AT EVAPORATOR PER MANUFACTURER'S INSTRUCTIONS.
- 8 PROVIDE AIR VENT AT EVAPORATOR PER MANUFACTURER'S INSTRUCTIONS.
- 9 PROVIDE BUTTERFLY VALVE.
- 10 PROVIDE TEMPERATURE GAUGE AND PRESSURE GAUGE WITH BALL ISOLATION VALVE ON TOP OF PIPE.
- 11 PROVIDE PRESSURE RELIEF VALVE
- 12 EXISTING CONCRETE PAD
- 13 CHILLER VIBRATION ISOLATOR. REFER TO MANUFACTURER'S INSTALLATION INSTRUCTIONS. INSTALL CHILLER LEVEL WITHIN 1/4" OVER ENTIRE LENGTH AND WIDTH, PROVIDE SHIMS AS REQUIRED.
- 14 PROVIDE EXPANSION JOINT AS SPECIFIED. SUPPORT JOINT PER MANUFACTURER'S INSTRUCTIONS.
- 15 RE-CONSTRUCT GUARD RAIL/SCAFFOLDING AROUND CHILLER.
- 16 REPLACE EXISTING 450A FUSES IN 600A DISCONNECT SWITCH WITH 600A FUSES. FUSES ARE TO BE CLASS J. EXTEND EXISTING 3" CONDUIT INTO SIDE OF CHILLER. INSTALL TWO SETS OF 250 KCMIL, #1G COPPER CONDUCTORS FROM LOAD SIDE LUGS OF DISCONNECT SWITCH TO CHILLER INCOMING LUGS. RE-INSTALL EXISTING VERIS METERING ON INCOMING CONDUCTORS.
- 17 MAINTAIN MANUFACTURER'S REQUIRED CLEARANCES ALL SIDES OF CHILLER.
- 18 EXTEND EXISTING CONTROL WIRING CONDUIT TO CHILLER CONTROL PANEL. ROUTE CONTROL WIRING IN EXISTING CONDUITS FROM CHILLER CONTROL PANEL TO EXISTING WIRING JUNCTION BOX AND FIELD EQUIPMENT CONTROLLER AS SHOWN ON M7-101. COORDINATE WITH BATTELLE FMCS SPECIALIST.
- 19 PROVIDE AUTOMATIC FLOW CONTROL VALVE WITH FLOW RATE AS SPECIFIED.
- 20 SEISMIC SNUBBER, SEE DETAIL 7/M5-101.

DOCUMENT NO S740784-M1-101		SERVICE REQUEST NO S740784																													
<table border="1"> <thead> <tr> <th>CURRENT REVISION</th> <th>ORIGINAL</th> </tr> </thead> <tbody> <tr><td>DRAWN</td><td>DRAWN</td></tr> <tr><td>JM SCOTT</td><td>JM SCOTT</td></tr> <tr><td>CHECKED</td><td>CHECKED</td></tr> <tr><td>SE GOURLEY</td><td>SE GOURLEY</td></tr> <tr><td>DRAFTING CHECKER</td><td>DRAFTING CHECKER</td></tr> <tr><td>SD BURNETT</td><td>SD BURNETT</td></tr> <tr><td>ENGINEER</td><td>ENGINEER</td></tr> <tr><td>JM SCOTT</td><td>JM SCOTT</td></tr> <tr><td>APVD</td><td>APVD</td></tr> <tr><td>DJ DE SMET</td><td>DJ DE SMET</td></tr> <tr><td>OTHER</td><td>OTHER</td></tr> <tr><td>BJ GRAF</td><td>BJ GRAF</td></tr> <tr><td>OTHER</td><td>OTHER</td></tr> </tbody> </table>		CURRENT REVISION	ORIGINAL	DRAWN	DRAWN	JM SCOTT	JM SCOTT	CHECKED	CHECKED	SE GOURLEY	SE GOURLEY	DRAFTING CHECKER	DRAFTING CHECKER	SD BURNETT	SD BURNETT	ENGINEER	ENGINEER	JM SCOTT	JM SCOTT	APVD	APVD	DJ DE SMET	DJ DE SMET	OTHER	OTHER	BJ GRAF	BJ GRAF	OTHER	OTHER	<p align="center">U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST SITE OFFICE</p> <p align="center">Pacific Northwest Division Battelle Richland, Washington 99352</p> <p align="center">MECHANICAL/ELECTRICAL CHILLER INSTALLATION PLAN</p>	
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REVISIONS DESCRIPTION



CHILLED WATER PIPING PLAN – ROOF



SECTION A
SCALE: 1/2" = 1'-0"

GENERAL NOTES
(UNLESS OTHERWISE SPECIFIED)

1. FOR SPECIFICATIONS, LEGEND AND KEY PLAN SEE G0-001 THROUGH G0-003.
2. DRAWING NUMBERS BEGIN WITH 'S740784-' UNLESS OTHERWISE SPECIFIED.

SHEET NOTES

- 1 EXISTING BUTTERFLY ISOLATION VALVE.
- 2 EXISTING CONTROL VALVE WITH PNEUMATIC ACTUATOR.
- 3 4x4x4 TEE, CONNECT TO EXISTING PIPES.
- 4 4" CHWS, CONNECT TO EXISTING 4" CHWS PIPE FROM MECHANICAL ROOM 300. PROVIDE 4x4x4 TEE TO CONNECT INTO EXISTING 4" CHWS ON ROOF. INSULATE PER SPECIFICATIONS.
- 5 PROVIDE CONTROL VALVE WITH PNEUMATIC ACTUATOR. CONNECT TO EXISTING INSTRUMENT AIR TUBING.
- 6 PROVIDE BUTTERFLY ISOLATION VALVE.
- 7 EXISTING PIPE SUPPORT/HANGER.

AIR-COOLED CHILLER SCHEDULE

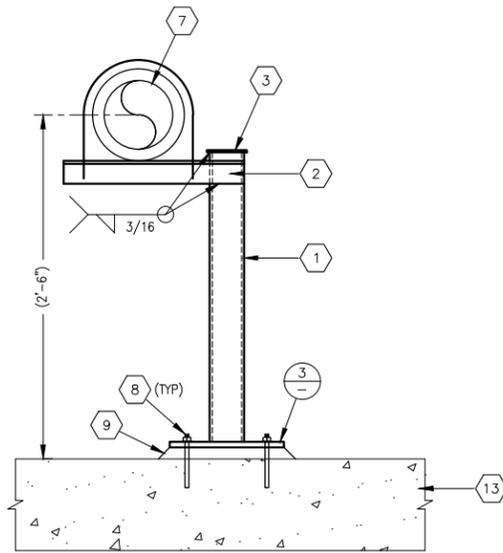
EQUIPMENT ID USED ON DRAWINGS	BATTELLE COMPONENT NUMBER	MANUFACTURER & MODEL NO	NOMINAL CAPACITY (TONS)	RFGT	MIN EER	EVAPORATOR				ELECTRICAL DATA					COMPRESSORS			AMBIENT AIR TEMP (°F)	OPER WT (LB)	NOTES	
						FLOW (GPM)	EWT (°F)	LWT (°F)	ΔP (FT WC)	MEDIUM	MCA	MOCF	VOLTS	PH	HZ	TYPE	QUANTITY				MINIMUM OPERATING CAPACITY
CH-005	331-CHW-CH-005	TRANE RTAC-250	250	R-134A	9.8	525	55	44	13	30% PG	495	600	460	3	60	SCREW	2	15%	101° F	15,190	OWNER FURNISHED, CONTRACTOR INSTALLED

CONTROL VALVE SCHEDULE

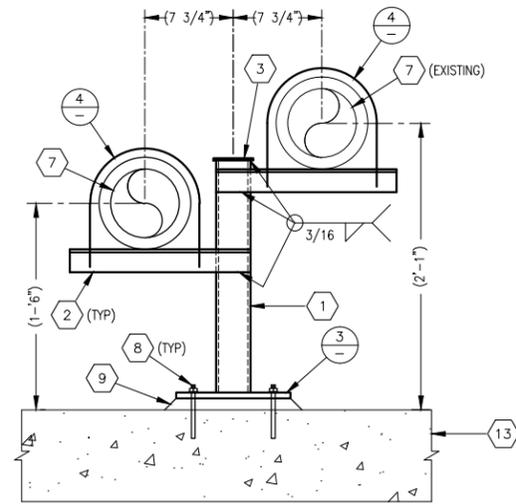
EQUIPMENT ID USED ON DRAWINGS	EQUIPMENT IDENTIFICATION NUMBER	MANUFACTURER & MODEL NO	SYSTEM SERVED	MEDIUM	FLOW (GPM)	Cv	SIZE (IN)	NORMAL POSITION	FAIL POSITION	ACTUATOR TYPE	VALVE TYPE	NOTES
CTV-01	331-CHW-CTV-0100	BELIMO (MODEL # SELECTED BY CONTRACTOR)	CHWS	30% PG	300	175	4"	CLOSED	CLOSED	PNEUMATIC	BUTTERFLY	

DOCUMENT NO S740784-M1-401		SERVICE REQUEST NO S740784																	
<table border="1"> <tr><th>CURRENT REVISION</th><th>ORIGINAL</th></tr> <tr><td>DRAWN JM SCOTT</td><td>DRAWN JM SCOTT</td></tr> <tr><td>CHECKED SE GOURLEY</td><td>CHECKED SE GOURLEY</td></tr> <tr><td>DRAFTING CHECKER SD BURNETT</td><td>DRAFTING CHECKER SD BURNETT</td></tr> <tr><td>ENGINEER JM SCOTT</td><td>ENGINEER JM SCOTT</td></tr> <tr><td>APVD DJ DE SMET</td><td>APVD DJ DE SMET</td></tr> <tr><td>OTHER</td><td>OTHER</td></tr> <tr><td>OTHER</td><td>OTHER</td></tr> </table>		CURRENT REVISION	ORIGINAL	DRAWN JM SCOTT	DRAWN JM SCOTT	CHECKED SE GOURLEY	CHECKED SE GOURLEY	DRAFTING CHECKER SD BURNETT	DRAFTING CHECKER SD BURNETT	ENGINEER JM SCOTT	ENGINEER JM SCOTT	APVD DJ DE SMET	APVD DJ DE SMET	OTHER	OTHER	OTHER	OTHER	<p>U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST SITE OFFICE</p> <p>Pacific Northwest Division Battelle Richland, Washington 99352</p> <p>MECHANICAL CHILLED WATER PIPING ROOF PLAN</p>	
CURRENT REVISION	ORIGINAL																		
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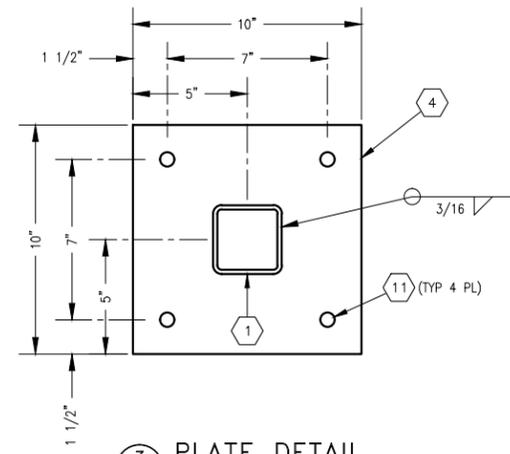
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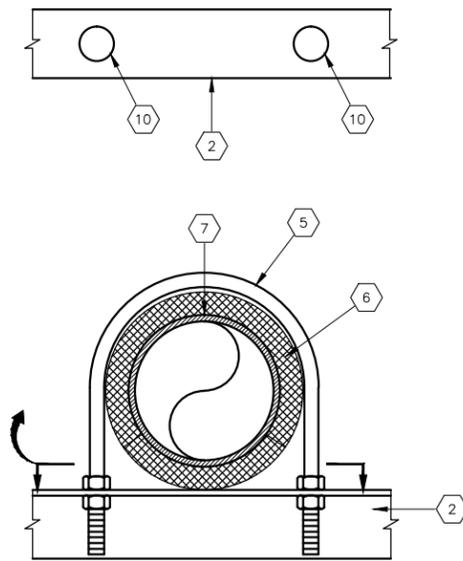
1 PIPE SUPPORT DETAIL
M1-101 SCALE: 3" = 1'-0"



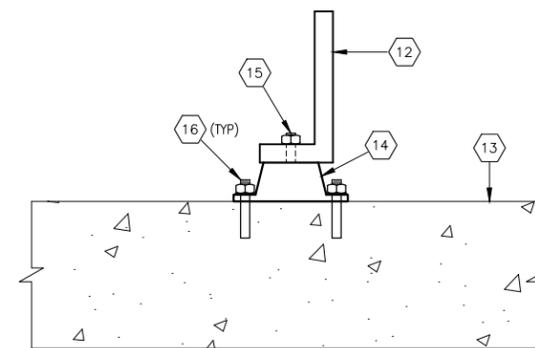
2 PIPE SUPPORT DETAIL
M1-101 SCALE: 3" = 1'-0"



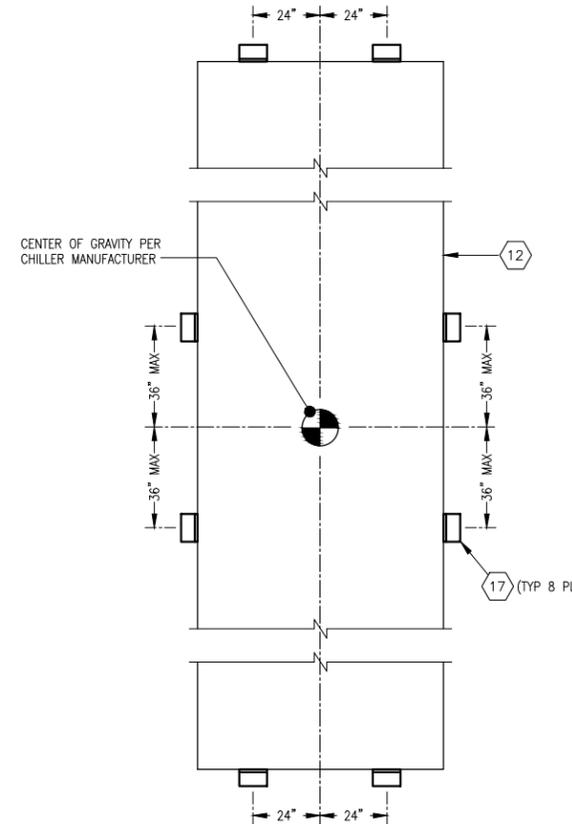
3 PLATE DETAIL
SCALE: 3" = 1'-0"



4 PIPE CLAMP DETAIL
SCALE: NONE



5 CHILLER ISOLATOR DETAIL
M1-101 SCALE: NONE



6 SEISMIC SNUBBER DETAIL
M1-101 SCALE: NONE

GENERAL NOTES
(UNLESS OTHERWISE SPECIFIED)

- FOR SPECIFICATIONS, LEGEND AND KEY PLAN SEE G0-001 THROUGH G0-003.
- DRAWING NUMBERS BEGIN WITH 'S740784-' UNLESS OTHERWISE SPECIFIED.
- PAINT SUPPORTS WITH (3) COATS OF MACHINERY ENAMEL, COLOR TO MATCH EXISTING PIPING SUPPORTS. REPAIR SCRATCHES OR OTHER FINISH DAMAGE AFTER INSTALLATION.

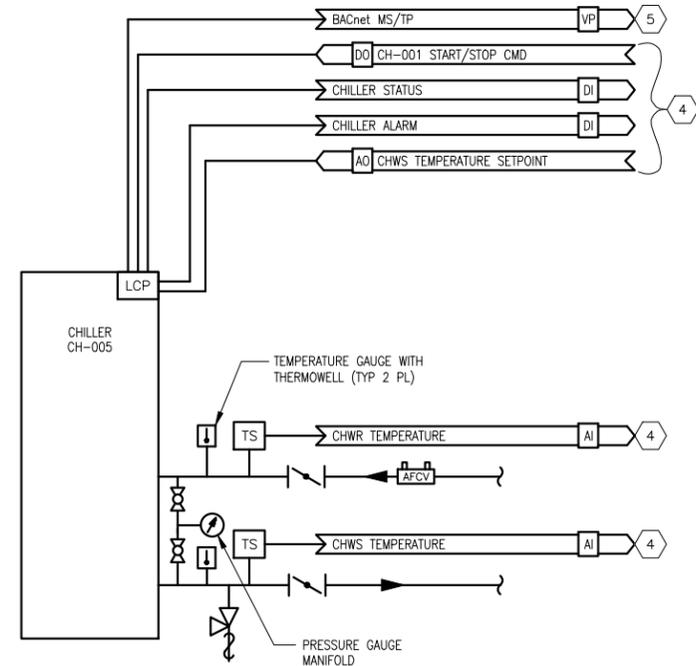
SHEET NOTES

- HSS, 3 x 3 x 1/4" ASTM A500 GRADE B.
- L 3 x 3 x 3/8" ASTM A36.
- PLATE, 3/16" x 3-1/2" SQUARE, ASTM A36.
- PLATE, 1/2" x 10" SQUARE, ASTM A36.
- 5/8" U-BOLT, COOPER B-LINE FIG. B3188 OR EQUAL.
- INSULATION PER SPECIFICATIONS, CONTINUOUS THROUGH PIPE CLAMP. PROVIDE CALCIUM SILICATE INSERT AND INSULATION SHIELD AT CLAMP.
- 6" CHWS/R PIPE.
- Ø1/2" x 2-3/8" EMBEDMENT HILTI KWIK BOLT TZ, TYPE 316 SST (TYP 4 PLACES).
- 1" MINIMUM THICKNESS DAYTON SUPERIOR 1107 ADVANTAGE GROUT. INSTALL IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS.
- Ø3/4" THROUGH ANGLE BRACKET.
- Ø5/8" THROUGH PLATE.
- CHILLER BASE RAIL
- EXISTING CONCRETE PAD
- INSTALL ELASTOMERIC ISOLATOR, FURNISHED BY CHILLER MANUFACTURER.
- ALIGN POSITIONING PIN ON TOP OF ISOLATOR WITH MOUNTING HOLE IN BASE RAIL, SECURE ISOLATOR TO BASE RAIL WITH A NUT.
- SECURE ISOLATOR TO CONCRETE PAD WITH Ø1/2" x 2-3/8" EMBEDMENT HILTI KWIK BOLT TZ, TYPE 316 SST.
- SEISMIC SNUBBER, KINETICS NOISE CONTROL #HS-1-4000 OR APPROVED EQUAL. INSTALL PER MANUFACTURER'S INSTRUCTIONS. SECURE TO CONCRETE WITH (2) Ø5/8" x 3-1/8" EMBEDMENT HILTI KWIK BOLT TZ, TYPE 316 SST.

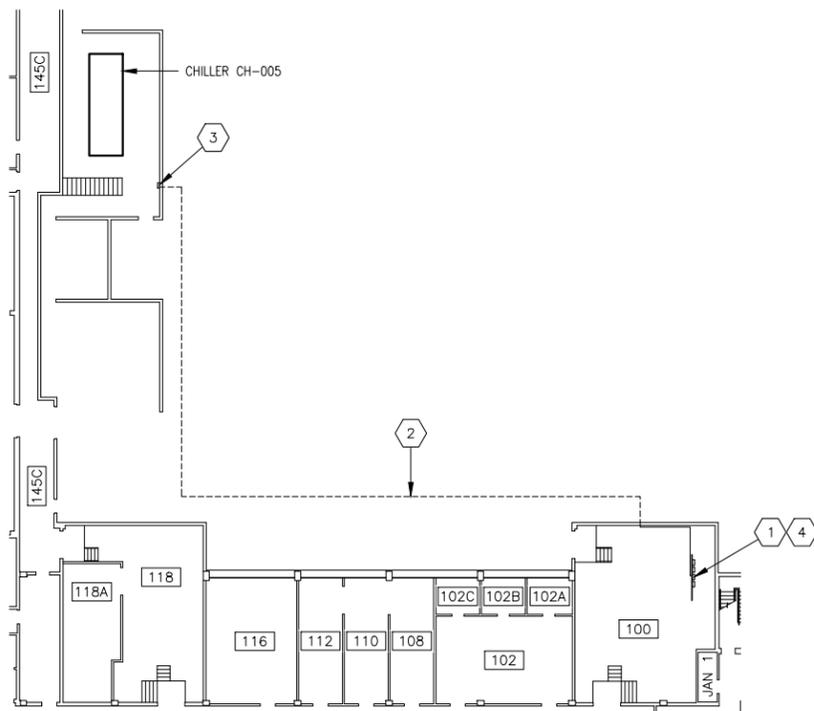
REVISIONS DESCRIPTION

DOCUMENT NO S740784-M5-101		SERVICE REQUEST NO S740784	
CURRENT REVISION		ORIGINAL	
DRAWN JM SCOTT	CHECKED SE GOURLEY	DRAFTING CHECKER SD BURNETT	ENGINEER JM SCOTT
APVD DJ DE SMET	OTHER	OTHER	OTHER
U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST SITE OFFICE		Pacific Northwest Division	
Richland, Washington 99352		Battelle	
MECHANICAL DETAILS			
BLDG 331 200-TON CHILLER REPLACEMENT		REV NO 0	
SIZE BLDG 331	DWG NO M5-101	SHEET 1 OF 1	
SCALE SHOWN			

DATE: 2/23/2016 8:17 AM
 FILE: S740784-M5-101.dwg



CHILLER PIPING/INSTRUMENTATION DIAGRAM
SCALE: NONE



CONTROLS INSTALLATION PLAN
SCALE: 1" = 20'

230993 SEQUENCE OF OPERATION

GENERAL:

ALL SETPOINTS DESCRIBED IN THE SEQUENCE OF OPERATIONS SHALL BE ADJUSTABLE FROM THE GRAPHICAL USER INTERFACE.

CHILLED WATER SYSTEM SEQUENCE OF OPERATION

- A. CHILLER CH-005 SHALL BE MANUALLY ENABLED BY THE OPERATOR FROM THE GRAPHICAL USER INTERFACE.
- B. WHEN CHILLER IS ENABLED, START LEAD CHILLED WATER PUMP AND VERIFY FLOW. ONCE FLOW IS VERIFIED, START THE CHILLER. WHEN ENABLED, THE CHILLER SHALL RUN FOR A MINIMUM OF 30 MINUTES.
- C. THE CHILLER'S ON-BOARD INTEGRAL CONTROLS SHALL OPERATE CHILLER TO MAINTAIN THE CHILLED WATER SUPPLY TEMPERATURE SETPOINT.
- D. CHILLED WATER CROSS-CONNECTION WITH 600-TON PIPING SYSTEM USING (5) PNEUMATIC CONTROL VALVES SHALL BE MANUALLY CONTROLLED BY THE OPERATOR TO ALLOW CH-005 TO OPERATE IN PARALLEL OR IN SERIES WITH THE 600-TON CHILLERS, OR AS A STAND-ALONE CHILLER.
- E. ALARMS: IF LEAD PUMP COMMAND AND STATUS DO NOT MATCH FOR MORE THAN 60 SECONDS, DISABLE LEAD PUMP AND START THE LAG PUMP.
- F. EXISTING SEQUENCE OF OPERATION SHALL REMAIN EXCEPT AS NOTED ABOVE.
- G. CALCULATE AND DISPLAY ENERGY USAGE IN KW/TON.
- H. MAP THE FOLLOWING CHILLER CH-005 CONTROL POINTS TO FMCS VIA BACNET:

- 1. CHILLED WATER SETPOINT.
- 2. ACTUAL RUNNING CAPACITY, PERCENT.
- 3. EVAPORATOR REFRIGERANT PRESSURE AND TEMPERATURE, CIRCUIT 1.
- 4. EVAPORATOR REFRIGERANT PRESSURE AND TEMPERATURE, CIRCUIT 2.
- 5. CONDENSER REFRIGERANT PRESSURE AND TEMPERATURE, CIRCUIT 1.
- 6. CONDENSER REFRIGERANT PRESSURE AND TEMPERATURE, CIRCUIT 2.
- 7. NUMBER OF STARTS, EACH COMPRESSOR.
- 8. TOTAL RUN TIME, EACH COMPRESSOR.
- 9. OIL PRESSURE AND TEMPERATURE, EACH COMPRESSOR.
- 10. AIRFLOW PERCENTAGE, EACH CIRCUIT.
- 11. EVAPORATOR ENTERING WATER TEMPERATURE.
- 12. EVAPORATOR LEAVING WATER TEMPERATURE.
- 13. CHILLER RUN ENABLE INDICATION.
- 14. CHILLER CAPACITY LIMITED STATUS.
- 15. CHILLER RUNNING STATUS.
- 16. RUN STATUS, EACH COMPRESSOR.
- 17. EVAPORATOR WATER FLOW STATUS.
- 18. ALARM STATUS.
- 19. SHUTDOWN ALARM STATUS.
- 20. LAST DIAGNOSTIC INDICATION.

GENERAL NOTES
(UNLESS OTHERWISE SPECIFIED)

- 1. FOR SPECIFICATIONS, LEGEND AND KEY PLAN SEE G0-001 THROUGH G0-003.
- 2. DRAWING NUMBERS BEGIN WITH 'S740784-' UNLESS OTHERWISE SPECIFIED.
- 3. FMCS PROGRAMMING BY BATTELLE FMCS SPECIALIST. CONTRACTOR SHALL PROVIDE CONDUIT, CONDUCTORS AND DEVICES TO PERFORM SEQUENCE OF OPERATIONS. COORDINATE WITH FMCS CONTROL SPECIALIST.

SHEET NOTES

- 1. CONNECT EXISTING CONTROL PANEL, WITH JCI FIELD EQUIPMENT CONTROLLER (FEC).
- 2. EXISTING 1" BURIED CONDUIT.
- 3. EXISTING CONTROL WIRING JUNCTION BOX.
- 4. TERMINATE CONTROL WIRING IN EXISTING FEC IN CONTROL PANEL LOCATED IN MECHANICAL ROOM 100 AS INDICATED. LABEL EACH CONNECTION IN PANEL. CONNECT POINTS AS FOLLOWS:
 - CHWS TEMPERATURE: UI INPUT #1
 - CHWR TEMPERATURE: UI INPUT #2
 - CHILLER ALARM: BI INPUT #7
 - CHILLER STATUS: BI INPUT #8
 - CHILLER START/STOP COMMAND: BO OUTPUT #1
 - CHILLER CHWS SETPOINT: AO OUTPUT #8
- 5. ROUTE MS/TP TRUNK WIRING (22 GA SHIELDED #3 CONDUCTOR) TO THE CHILLER AND BACK TO PANEL SUCH THAT EXISTING FEC REMAINS THE END OF LINE. PROVIDE TERMINAL STRIP IF SPLICE IS NEEDED (NO WIRE NUTS PERMITTED).

CONTROLS SYSTEM LEGEND

SYMBOL	DESCRIPTION
LCP	LOCAL CONTROL PANEL
TS	TEMPERATURE SENSOR
BI	BINARY INPUT
BO	BINARY OUTPUT
UI	UNIVERSAL INPUT

POINT-NAME	AO	- ANALOG OUTPUT
POINT-NAME	DO	- DIGITAL OUTPUT
POINT-NAME	AI	- ANALOG INPUT
POINT-NAME	DI	- DIGITAL INPUT
POINT-NAME	VP	- VIRTUAL POINT

DOCUMENT NO	S740784-M7-101	SERVICE REQUEST NO	S740784
CURRENT REVISION		ORIGINAL	
DRAWN	JM SCOTT	DRAWN	JM SCOTT
CHECKED	SE GOURLEY	CHECKED	SE GOURLEY
DRAFTING CHECKER	SD BURNETT	DRAFTING CHECKER	SD BURNETT
ENGINEER	JM SCOTT	ENGINEER	JM SCOTT
APVD	DJ DE SMET	APVD	DJ DE SMET
OTHER		OTHER	
U. S. DEPARTMENT OF ENERGY PACIFIC NORTHWEST SITE OFFICE		Richland, Washington 99352	
Pacific Northwest Division		Battelle	
MECHANICAL CONTROLS			
PROJ TITLE	BLDG 331 200-TON CHILLER REPLACEMENT		
SIZE BLDG	331	DWG NO	M7-101
SCALE	SHOWN	REV NO	0
SHEET 1			OF 1

REVISIONS DESCRIPTION

Job Planning Package Click the  for online help

Service Request # S740784B	Facility: 331	Location: 6666	Funding WP: N54599
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Request Subject:	CM Support (Sampson) - "331 - 250T Chiller Installation"
Description:	Replace the 200 ton chiller at 331 with new 250 ton chiller.
Justification:	200 ton chiller is failing and cannot provide cooling
Equipment Category:	3
Systems Affected:	Mechanical-Misc. Facility Equipment

JPP Type, Hold Points and Comments

Contingency Emergency Plan Hold Point:	<p>(A) The PNNL single-point-contact for emergencies is 375-2400. All injuries and accidents (e.g., personal, property, or equipment) shall immediately be reported to your supervisor, and PNNL Construction Manager (CM)(PIC) Ivan Sampson Cell 521-1371, Office 371-6617 or designee. If unavailable contact PM Dan Ryan 371-7995 / Cell 430-0212.</p> <p>Safety Brad Atencio 371-7786 / Cell 539-2671 Safety Mark Deichman 371-7962 / Cell 531-9441</p> <p>BM Sanjay Sanan 371-6997 / Cell 430-4483 BE Bill DeRousie 375-3620 / Cell 572-5667 BE Joe Bewick 375-3811 / Cell 713-5984</p> <p>(B) Review applicable Emergency Information Posting (EIP) for emergency actions, signals, equipment locations, evacuation routes and staging area.</p> <p>(C) Employees have the right and/or responsibility to STOP WORK without fear of reprisal, when convinced a situation exists that places themselves, coworkers, or the environment in danger. If this happens "stop", put work in safe-condition, notify your supervisor and CM immediately.</p> <p>(D) Hazards and/or controls contained in this JPP are not all inclusive. There is also potential for known hazards to change or unexpected hazards (changed conditions) may be encountered as work activities proceed. If work conditions change or are different than described,</p>
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	<p>STOP WORK, put in safe-condition; notify your supervisor and CM immediately. Should this occur, amend the Job Safety Analysis (JSA) to incorporate the new conditions and controls prior to continuing work.</p>
<p>Additional Comments:</p>	<p>(A) All work requires prior approval and must be released through the Core Team Plan of-the-Day (POD).</p> <p>(B) A security badge is required when visiting or working at the PNNL Campus.</p> <p>(C) The contractor retains responsibility for identifying work related hazards and preparing and maintaining an approved Job Safety Analyses (JSA).</p> <p>(D) Prior to entering posted Construction Areas, employees shall be given an orientation, read, understand and comply with the Job Planning Package (JPP), Workplace Exposure Assessment (WEA) provided by PNNL, and the contractor's JSA. Once the review has been completed sign the Pre-Job Meeting Attendance Roster.</p> <p>(E) All temporary power cords shall be protected to prevent damage and tripping hazards. Extension cords and power tools shall be GFCI protected.</p> <p>(F) Prior to any field work the contractor shall have an approved JSA.</p> <p>(G) Housekeeping is required periodically throughout the day, and at the end of each shift.</p> <p>(H) Cut resistant gloves shall be used any time when handling sharp objects and materials that could cause lacerations.</p> <p>(I) Keep interior/exterior building exits and paths to exits clear and unobstructed. If existing exit must be blocked for construction purposes and personnel safety, alternative exits must be established and approved by the CM. Roadway access for emergency vehicles, fire hydrants, and all deliveries shall be maintained at all times unless specifically approved by the CM.</p> <p>(J) The contractor's Key Supervisor and Construction Safety SHALL be on the PNNL site / property at all times while performing work, including subcontractors. If and when the Key Supervisors responsibilities are changed to a different individual the contractor SHALL notify the CM in advance and assure communication is in place.</p> <p>(K) Building and or room specific IOPS training shall be completed prior to entering the work areas. Completion of training must be documented.</p>

(L) All penetrations (e.g., architectural, electrical, or mechanical) in walls, ceilings and floors shall be performed in accordance with PNNL Blind Penetration requirements. When penetrating solid materials beyond 2" in depth or hollow structures where the absence of utilities or other hazards cannot be determined the contractor must submit a Blind Penetration Permit to the CM five working days in advance. Wear applicable PPE as noted in CESH 20.0.15

(M) Energized electrical work is not allowed. All electrical safe-to-work checks must be performed under the provisions of an Energized Electrical Work Permit (EEWP). Do not reach into areas that contain energized parts or perform functions that require being exposed to energized parts. If any open junction boxes, LB's, LL's, LR's or exposed electrical wires are encountered during this contract, stay back at least 4', danger tape off the area, and immediately contact the CM.

(N) A Fall Protection Plan(s) must be in place when performing work where fall hazard of 6ft or more exist, for man lifts, roof accesses, scaffold erection etc. Further fall plans may be required based on work methods.

(O) Existing surfaces (i.e., grounds, ceilings, floors, walls, etc.) damaged during construction shall be repaired to match the existing surface.

(P) Contractor shall submit Safety Data Sheets (SDS) to the CM five working days prior to bringing materials/chemicals onto the jobsite and/or into a PNNL facility. Copies of the SDS will be provided to Construction Safety for approval.

(Q) A Hot Work Permit is required when open flame or spark producing activities are utilized (e.g., welding, cutting, grinding, open flame). Standard practices and special requirements identified on Hot Work Permits shall be followed; coordinate permit through the PNNL Construction Manager

(R) Noise, dust, fumes, and vapors shall be controlled to the greatest extent practicable. Use of engineering controls (i.e., containments, HEPA vacuums, fume extractors, etc.) shall be used to the maximum practical extent. If a condition exists that a work activity has the potential to put unwanted odors into PNNL work spaces then, after hours or weekend work is required and shall be scheduled by the contractor as part of the work scope / plan. Coordinated activities through CM five working days in advance.

Work

Letter of Instruction:	No		
Task Order:	No		

Operating Requirements to communicate to Contractor	Yes	Specify Requirements	(A) 331 is an operational facility. The contractor's work needs to be planned in such a way to protect the safety of PNNL employees and vendors requiring access to the facilities and ongoing operations within the facilities
Project Plan:	Yes		
Statement of Work:	Yes		
Other Design Basis Documents:	Yes		
Specific Design Information:	The Contract Documents and contract drawings G0-001, 002, 003, D1-101, M1-101, 401, M5-101, and M7-101 outline all work to be performed.		
Work to be Performed By:	Off-site Contractor		

Lock and Tag Requirements

Personal, Controlling Organization, Written Instructions	<p>Instructions: (A) Employees that participate in or enter into a boundary that is controlled by Lockout/Tagout (LOTO) shall be trained as Authorized Workers. Approved equivalency will require contractors to attend the PNNL LOTO training.</p> <p>(B) NOTE: Written instructions must be formalized by using the PNNL F&O Lockout Tagout Written Instructions Form.</p> <p>(C) A lockbox may be used in situations where other methods are cumbersome, unsafe or infeasible. In this situation, key(s) for the Controlling Organization (CO) locking device(s) are secured in the lockbox by the authorized worker using his/her "GREEN" Authorized Worker lock and Do Not Operate tag. Items placed in a lockbox are not limited to keys; other items may be used (e.g., valve handles, fuses, etc.) to control isolating devices.</p> <p>(D) PNNL and Authorized Worker protocol: PNNL Controlling Organization (CO) applies their DANGER - Do Not Operate LOTO(s) being first-on. The CO allows the Contractors Authorized Workers to "watch the meter fall or light go out or equipment turn off" in preparation to over-lock. The Authorized Worker then over-locks the Controlling Organization using his/her (Green) lock with a PNNL approved tag (LOTO). The Authorized Worker then follows the Energized Electrical Work Permit instructions followed by the safe-to-work check. Upon</p>
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completion of the work activities the worker(s) shall remove their LOTO and notify their supervisor and CM. When notified that the LOTO evolution and/or work activities are complete and the Authorized Workers (AW) locks and tags are removed the CM will notify the CO to remove their locks and tags being last-off.

(E) Configuration of building equipment and systems will be performed by the Controlling Organization (CO)/PNNL operations personnel. The CO shall be notified prior to, and after completion of LOTO, through the CM.

(F) Energized electrical safe-to-work checks, diagnostic and testing (greater than 50 volts) work shall be performed under an Energized Electrical Work Permit (EEWP) and must be coordinated, through the Construction Manager (CM) five days in advance.

Permits and Plans

Blind Penetration Permit - Class II ([link](#)), Contractors Lift Plan, Electrical Code Compliance Review, Electrical Worker Qualification Form, Energized Electrical Work Permit ([link](#)), Fall Protection Work Plan ([link](#)), Hot Work Permit, Job Safety Analysis, Lockout Tagout Written Instruction Form, Work Place Exposure Assessment

Other permits:	3rd Party Electrical Inspection
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Job Site Prep

Documented Pre-job Meeting	Yes	
Barriers	Yes	Barriers will be placed around construction areas. Install barriers to keep non-construction personnel from accidentally entering the construction area. Use caution tape, barriers, cones, rope, etc., to prevent unauthorized access to the work area. Danger tape shall be used when work activities, may pose, an imminent danger to life or health.
Communication Eqpt	Yes	Contractor supervisor required to have cell phone.
Postings	Yes	On barriers and as needed to control work zone.
Procedures	Yes	JPP, CESH, WEA, and U.S. Department of Energy Standard DOE-STD-1090 Hoisting and Rigging.
Other	No	

Personnel Requirements

Special Training Requirements	Yes	Asbestos Awareness Training, Electrical Worker Safety Training, Fall Protection (Course 701), GERT (Course 817), Hands On Fire Extinguisher Training (off-site), Hot Work and Fire Watch Training (Course 2504), Lock & Tag - Authorized Worker (Course 692), Non
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		Staff Orientation (Course 2400) Other: Hoisting and Rigging/Load Handling Activities: Training shall comply with requirements of the approved U.S. Department of Energy Standard DOE-STD-1090
Special Medical Exams	Yes	Respiratory User (RESP USER) Other: Mask fit, Mask Fit Training, Medical on Mask Fit.
Security Clearance Requirements	Yes	1 (no clearance)

Work Activity

Step #	Potential Hazards/Control Methods
	Define Work Activity
	None Specified
1	<p>EQUIPMENT:</p> <p>(A) All equipment operators shall be trained as outlined in the CESH. Provide documentation as required.</p> <p>(B) For each piece of equipment, document the daily inspection and maintain at the work site.</p> <p>(C) Each piece of equipment that is to be used on this project must be addressed in the contractor's JSA. List all hazards associated with the operation of the equipment and personnel proximity to each piece of equipment, (i.e. backup alarms operational, pinch points, communications with ground crew etc).</p> <p>(D) Do not allow any fluids to be spilled on the ground. Caution is to be exercised when fueling or lubricating equipment.</p> <p>(E) If a spill occurs immediately notify the CM.</p> <p>(F) All equipment must be inspected prior to delivery to verify that all factory back up alarms, safety guards, signals, and interlocks are functioning and there are no visible leaks of any type must be accompanied with a pre-delivery inspection/checklist.</p> <p>(G) Spotter shall be utilized when moving machinery to work location.</p> <p>(H) Utilize protective measures (plywood or equal) to protect the landscape/grass.</p> <p>(I) Area of operation must be barricaded from pedestrian traffic and pedestrians detoured from the working area.</p> <p>(J) Use care and caution, along with calculated manipulation of the equipment when near personnel, building, and facility systems.</p>

None Specified

HOISTING AND RIGGING:

(A) **Note** Before each and every Hosting & Rigging activity takes place PNNL Safety shall conduct a review of the activity as outlined in Standing Order 2015-009 (attached).

(B) Hosting and rigging (e.g., cranes, hoists, fork-trucks, slings, or rigging) activities shall comply with requirements of the approved U.S. Department of Energy Standard DOE-STD-1090 Hoisting and Rigging, Freight Container Lifting Standard (RPP-40736 - Rev. 0), & ASME P30 Planning for Load Handling Activities. The Contractor shall download and utilize the current, approved version of DOE-STD-1090 available at:

<http://energy.gov/ehss/services/nuclear-safety/departement-energy-technical-standards-program/doe-approved-technical>. **Contractor shall maintain one (1) copy of the Hoisting and Rigging Standard at the Site for reference.**

2

Submit qualifications/training records of individuals that will be engaged in hoisting and rigging activities before allowing individuals to perform hoisting and rigging activities on Site.

- Crane Operator Certification – NCCCO is valid for a five year period
- Training records of individuals who are engaged in rigging, signal-person, crane assembly, disassembly, or spotter for working around overhead electrical lines.
- Forklift Operator Qualification – submit training record for operator. Valid for three years.

Lift Plan Determination: PNNL will make the determinations as to when a lift requires a Lift Plan. Contractor will always submit an ordinary "Lift Plan" for PNNL approval prior to commencing work. Other lift plans include critical or multiple mobile cranes.

(C) Contractors shall inspect all lifting equipment prior to use. Inspection shall include lifting capacities that meet the contract or project requirements and be in strict accordance with the PNNL CESH and PNNL Hoisting and Rigging Manual.

3

Blind Penetration-Class 2 / Blind Penetration Permit - Class 2

Scanning for Concrete Penetrations

(A) GPR Scan Contractor Submittal Requirements; A licensed company with at least five years of documented site experience to be submitted on and approved.

(B) The contractor provided GPR; Electromagnetic Frequency (EMF) and Radio Frequency (RF) technologies will be performed in two (2) steps: the first step will be in a traditional 90 degree grid over the area proposed for excavation. The second step will involve rotating the grid 45 degrees to aid in locating utilities or objects that lie diagonally to the first grid. After completion of the scan, a scan report will be presented to the CM.

(C) Mark utilities and or embedment's. All markings must be conspicuous and maintained.

(D) The contractor must have a qualified person scan the floor area where the embedment's are to be placed. The interferences are to be marked and the drill locations laid out. The contractor is to provide a sketch to the CM to be used to obtain a Class II Penetration Permit. Allow five working days for approval.

	(E) All drilling shall be done following the approved Class II Permit.
	Exposed electrical energy >50v / Lock and tag Falls from elevations > 6 ft. / Per Fall Protection Plan
	INSTALLATION:
	(A) Work steps can be performed in any order unless otherwise noted.
	(B) Note: PNNL craft will remove all refrigerant before the contractor starts removing the existing unit.
	(C) Once the welding submittals are approved, fabricate carbon steel shapes and plates.
	(D) Request system outages for each affected stream five working days in advance. Once the outage has been approved and scheduled follow the facility LOTO written instruction, and verification with the safe to work check.
	(E) Remove and retain Guardrail / scaffolding system around existing chiller.
	(F) Demolish existing chiller, piping, electrical, and control systems.
	(G) Once the Class II penetration permit has been approved, follow the requirements of the permit(s) and install anchors.
4	(H) Pick up owner furnished chiller located within the PNNL campus and move to 331 mechanical pad for final placement. Note: Before any Hosting & Rigging activity takes place PNNL Safety shall conduct a review of the activity.
	(I) Set new chiller in place, make piping modifications.
	(J) Paint piping, supports and Miss equipment as outlined on drawings.
	(K) Install all wiring, controls, and electrical components.
	(L) Insulate piping per drawings once leak testing has been approved.
	(M) Reinstall Guardrail / scaffolding system allowing for larger footprint around new chiller.
	(N) Perform Electrical Testing per Spec 260500.P.1-5.
	(O) Label all equipment, piping, J boxes, and electrical components.
	(P) Startup and Test all systems and equipment. Coordinate with Chiller Factory Rep.
	(Q) The contractor will provide startup, training, and proper care of unit for PNNL craft by a factory authorized representative. This activity SHALL be completed before work is accepted. Give the CM ten working days' notice to schedule craft for training.
5	None Specified

ACCEPTANCE OF WORK:

(A) Acceptance of work is contingent upon Contractor completing uncompleted or discrepant work identified on the Exceptions List during the final walk-down.

(B) Perform final housekeeping. Complete Acceptance of Completed Work form.

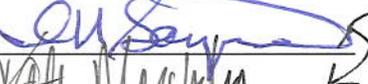
Approvals

Building Engineer



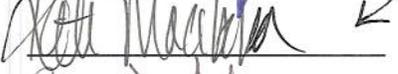
Date: 3/14/2016

Building Manager



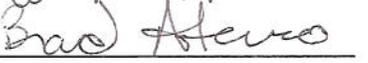
Date: 03/14/2016

Construction Manager



Date: 3/14/16

Safety: Occupational



Date: 3/14/2016

 Pacific Northwest <small>NATIONAL LABORATORY</small>	<h2 style="margin: 0;">Workplace Exposure Assessment</h2>		Industrial Hygiene Case #: 10878-IH	
			Date: 03/09/2016 Rev. 0	Page 1 of 3
			<input checked="" type="checkbox"/> Initial Survey	<input type="checkbox"/> Re-Survey <input type="checkbox"/> Other
Area: 300	Project Title: 331 – 200 Ton Chiller Replacement	Organization: Ivan Sampson Construction Manager	IH: Brad Atencio	
Bldg.: 331	Project #: N/A	SR #: S740784	Phone: (509) 539-2671	
Floor: Outdoors	Room: Northeast side of building	Work Package/Charge Code#: N54599	Email: Brad.Atencio@pnnl.gov	
Facility/Project and Operation: Describe the facility, work area, and process/operation being evaluated.				
<p>[SR # S740784] Replace the 200 ton chiller at 331 with new 250 ton chiller.</p> <p>Work activities include demolition of the existing 331 Chiller (# CH-005), associated piping, materials and equipment as noted on the design documentation for SR #S740784 included in job planning package. Install 200-Ton replacement chiller including build back of project specified piping, ducting, and electrical components necessary for operation. Disassemble chiller guard rail/scaffolding and retain for re-use. Existing chiller refrigerant and oil in chiller shall be recovered and disposed by Battelle.</p>				
Preliminary Hazard Assessment: Inventory chemical, physical, biological, and ergonomic stressors or attach PHA form.				
<p>Work activities associated with this Service Request include the following hazards: Hoisting/rigging, eye/hand injury, material handling, pinch points, noise, falls, silica, strains/sprains, awkward positions (kneeling, bending, and reaching), and power tools.</p> <p>Refer to the PNNL Contractor Environment, Safety and Health Manual (CESH) for requirements associated with the identified hazards, work situations, and implementation details. Contractor shall be cognizant and mindful of changing conditions; and as necessary, revise their JSA, hold pre-jobs, institute controls, and provide worker training/awareness. If conditions change from those that are described in their JSA, stop work and call the designated PNNL Construction Manager (CM) for guidance.</p>				
Potentially Exposed Work Force: Define the potentially exposed workforce				
<p>Contracted workers are the primary potential exposed workgroup.</p>				
Risk Assessment: Perform risk assessment. Attach sampling plan if quantitative monitoring is required.				
<p>Building Material Legacy Hazards: It is not anticipated that hazardous material will be encounter during this task, specifically asbestos, lead, radiological, beryllium, nanomaterials, or residual chemistries. If questionable or suspect material are encountered, stop work, secure area and contact the CM and supervision. Existing chiller refrigerant and oil in chiller shall be recovered and disposed by Battelle.</p> <p>Concrete Drilling/Cutting (Silica): Silica is a mineral that is found in stone, soil, and sand. It is also found in concrete brick, mortar, and other construction materials. Breathing is silica dust can cause silicosis, a serious lung disease. Using rotary hammers or similar tools to drill small holes in concrete, masonry blocks, or tiles creates dust that can expose workers to hazardous levels of airborne silica.</p> <p>Demolition: Construction activities, especially demolition has the ability to create significant challenges from shifting loads, pinch points, changing conditions, unforeseen utilities, etc. Disassembly will be done in a controlled and coordinated manner to safety reduce these potential hazards.</p> <p>Noise: Several noisy tasks will be associated with this task and the contractor shall endorse and provide the use of hearing protection. Contractors to post when noise producing activities are planned or ongoing.</p> <p>Welding fume/UV shields: Onsite welding will be controlled to the maximum extent possible, particularly associated with welding fume and UV emissions.</p>				
Hazard Controls: List and describe required engineering controls, administrative controls, and personal protective equipment				
<p>Access Control: Work activities may create a potential for non-project related personnel to enter the work environment without a clear understanding of the hazards associated with the task. Methods to control access (i.e. barricade tape, signs, cones, or other similar control) shall be used to control work area access. Many activities may affect research within the building and appropriate outage request and POD exchanges are required to inform staff of upcoming activities and reduced services.</p> <p>Blind Penetrations: Potential for unknown utilities within hidden cavities, or other solid surfaces. Follow PNNL's Blind Penetration guidance for the determination of Class 1 or 2 penetrations found in the Electrical Safety section of the CESH. Ensure that CM is aware of penetration activities. Inspect areas prior to construction activities to ensure no live feeds or charged lines are hidden.</p>				

Chemical products (i.e. solvents, epoxies, cement, caulking, etc): In order to ensure chemical safety in the workplace, information must be available about the identities and hazards of the chemicals. All products must have labels and MSDS to convey the hazard information. The Contractors' JSA shall identify the safe method and PPE required when handle these products. Contractor shall notify the CM prior to chemicals brought onsite or used within PNNL facilities.

Concrete Drilling/Cutting (Silica): Drilling/saw cutting will be performed utilizing wet methods and the slurry shall be HEPA vacuumed. If the contractor is expected to use a buster/jack hammer to remove concrete, this activity shall be well planned and performed using wet methods and personnel shall don respirators, Tyvek, face shield, etc. Contractor shall support PNNL staff exposure monitoring. Personnel respirator qualifications submittals and contractor respirator program plan will be required.

Electrical/Stored Energy/LOTO: Follow PNNL's lockout and tagout program. Ensure that electrical circuits are controlled by the controlling organization. Electrical Safe-to-Work checks shall be performed under an EEWP released by CM. Employees shall be required to wear PPE as identified within the EEWP. Circuits will be de-energized before work and workers within the LOTO boundary will need to have PNNLs Authorized Worker Training.

Eye/Hand Hazards: Planned work activities may pose a potential for eye / hand injury, especially during demolition activities. Safety glasses with side shields and cut resistant gloves shall be worn while using/handling sharp tools/objects. Activities shall be done in a controlled and coordinated manner to safely reduce these potential hazards. Arrange workspace to allow for adequate material handling.

Fall Protection: Contractor shall submit a Fall Protection Work Plan or a detailed JSA with required elements to PNNL for review prior to commencing elevated work (exposed to fall hazard > 6-ft). Designate competent person for this activity.

Hand, Power Tools, and Cords: Verify that tools are in a safe operating condition and are equipped with guards and only use the tool according to the manufacture's recommendations. All damaged or defective tools, cords, equipment shall be tagged and removed from the job site. Arrange workspace to allow for adequate material handling to protect against potential injury such as, pinch point or kickbacks. All electrical tools and cords shall be GFCI protected.

Hoisting and Rigging: For removal/installation of the chiller, a Lift Plan must be submitted for approval that identifies lift method to be used, worker qualifications, load weights, equipment to be used, equipment capacities, and rigging configuration. Load paths shall be clear and controlled to prevent non construction personnel from entering during movement. Only qualified workers shall perform hosting and rigging in accordance the DOE-STD-1090-2011 Hoisting and Rigging Standard. Contractor shall inspect all lifting equipment prior to use. Personnel shall stay out from underneath loads. Hard hats required when overhead hazard exists. Prior to performing hoisting and rigging work, PNNL WS&H must complete a review of the hoisting and rigging activity per Standing Order 2015-009. Provide the CM (5) working days' notice to schedule and perform the review.

Housekeeping: General housekeeping should be performed throughout the task to prevent additional workplace hazards. Equipment and supplies shall be staged in a manner to prevent hazard to workers.

IOPS Hazards: The contractor shall review applicable building work area IOPS hazard assessment prior to performing work in an IOPS posted area. Contact the CM or PNNL Project Safety with any posting questions and report all unusual or off-normal observations.

Ladder Use: Ladders shall be maintained in good condition at all times and inspected prior to use. Evaluate the hazards associated with use of the ladder and adjacent activities. Select the appropriate ladder for the task and ensure proper footing prior to use. Complete and document training by a designated competent person.

Material Handling, Repetitive Lifting, Body Positioning, and Awkward Movements: Contractor staff shall be mindful of awkward loads, lifting limits, and ergonomic stressors. Remember to size-up each load, stretch prior to lifting, ask for assistance, and be vigilant to personal limits. Ensure good posture, hand hold, and foot positioning prior to lifting. Pre-job briefing to include proper lifting techniques.

Noise: Contractor shall ensure that during high noise producing activities (i.e., heavy equipment use, roto-hammering, chipping, compressors, etc.) that hearing protection be provided and worn by workers within the construction area. High noise producing activities are continuous or intermittent noise >85 dBA on the A-weighted scale or impact noise in excess of a peak C-weighted level of 140dB.

Personal Protective Equipment (PPE): At a minimum, gloves (leather/cut resistant based on task hazards), safety glasses with side shields, substantial work boots, long pants and work shirt, shall be worn in posted construction areas. Additional, task specific PPE will be noted in the JSA and Lift Plan.

Permits: Contractor must be mindful and observant to special permitting required while at PNNL managed facilities. Work dealing with electrical, spark producing activities, blind penetration all require prior approval. Competent or qualified persons are needed for many of the noted permits. Your CM/WSH can assist in determining if/when permits are required.

Training: The contractor shall be fully responsible for orienting employees to potential workplace hazards and providing each employee with the necessary training to safely complete their work assignment. All training shall be documented. Competent person shall be qualified to act in this capacity prior to work activity.

Reevaluation Frequency: Mark the appropriate reevaluation frequency

<input type="checkbox"/> Reevaluate annually (High Hazard)	<input type="checkbox"/> Reevaluate every two years (Moderate Hazard)	<input type="checkbox"/> Reevaluate every four years (Low Hazard)	<input checked="" type="checkbox"/> One-time event
---------------------------------------------------------------	--------------------------------------------------------------------------	----------------------------------------------------------------------	----------------------------------------------------

Survey Performed by (Last Name, First Name, MI) Atencio, Brad P	Signature <i>Brad Atencio</i>	Date March 9, 2016
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Case Number 10878-IH Case Status OPENED Status Change Date 2/18/2016
Case Title (S740784) 331 - Replace 200 Ton Chiller w/ 250 Ton

Date 2/18/2016 Type QUAL
Description Replace the 200 ton chillers at 331 with new 250 ton chiller. Also perform piping mods per S737616B.

Case Location
PNNL PNNL Location RICHLAND Dept. PS243
Building RICH-331 Room 331-1-6666

Location Description On pad located on the Northeast side of building. On Premises

Primary Hazards
Primary Hazard WEA 1/1

Case Owner
Employee ID 3J277 Last Name Atencio First Name Brad

WEA Reevaluation Frequency Reevaluation not required

Use Only for Ergonomic and Caution Zone Evaluations
Employee ID Last Name First Name
Notes 0/0

Images & Attachments
Attachment Number Attachment
Data empty
Description 0/0

General Decision Number: WA150030 12/25/2015 WA30

Superseded General Decision Number: WA20140030

State: Washington

Construction Type: Building

County: Benton County in Washington.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Executive Order (EO) 13658 establishes an hourly minimum wage of \$10.10 for 2015 that applies to all contracts subject to the Davis-Bacon Act for which the solicitation is issued on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.10 (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract. The EO minimum wage rate will be adjusted annually. Additional information on contractor requirements and worker protections under the EO is available at www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/02/2015
1	02/27/2015
2	03/27/2015
3	06/12/2015
4	07/03/2015
5	07/10/2015
6	07/24/2015
7	07/31/2015
8	08/21/2015
9	12/25/2015

ASBE0082-001 08/01/2014

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR.....	\$ 33.42	17.85

BRWA0001-002 06/01/2015

	Rates	Fringes
BRICKLAYER.....	\$ 28.82	14.60

CARP9003-003 06/01/2014

	Rates	Fringes
CARPENTER (Including Cabinet Installation, Drywall Hanging and Form Work).....	\$ 27.06	13.39

ZONE PAY:

ZONE 1	0-45 MILES	FREE
ZONE 2	46-65 MILES	\$2.00/PER HOUR
ZONE 3	66-100 MILES	\$3.00/PER HOUR
ZONE 4	OVER 100 MILES	\$4.50/PER HOUR

DISPATCH POINTS:

PASCO (515 N. Neel Street) or Main Post Office of established residence of employee (Whichever is closest to the worksite).

SPOKANE (127 E. AUGUSTA AVE.) or Main Post Office of established residence of employee (Whichever is closest to the worksite).

WENATCHEE (27 N. CHELAN) or Main Post Office of established residence of employee (Whichever is closest to the worksite).

COEUR D' ALENE (1839 N. GOVERNMENT WAY) or Main Post Office of established residence of employee (Whichever is closest to the worksite).

MOSCOW (302 N. JACKSON) or Main Post Office of established residence of employee (Whichever is closest to the worksite).

ELEC0112-014 06/01/2015

	Rates	Fringes
ELECTRICIAN.....	\$ 38.80	18.59

ELEC0112-015 06/01/2015

	Rates	Fringes
ELECTRICIAN (Low Voltage Wiring Only).....	\$ 26.75	11.46

ENGI0370-017 06/01/2015

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1.....	\$ 26.16	13.55
GROUP 2.....	\$ 26.48	13.55
GROUP 3.....	\$ 27.09	13.55
GROUP 4.....	\$ 27.25	13.55
GROUP 5.....	\$ 27.41	13.55
GROUP 6.....	\$ 27.69	13.55
GROUP 7.....	\$ 27.96	13.55
GROUP 8.....	\$ 29.06	13.55

ZONE DIFFERENTIAL (Add to Zone 1 rate): Zone 2 - \$2.00

Zone 1: Within 45 mile radius of Spokane, Pasco, Washington; Lewiston, Idaho

Zone 2: Outside 45 mile radius of Spokane, Pasco, Washington; Lewiston, Idaho

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Compactor; Drill Oiler; Rollers, all types on subgrade, including seal and chip coatings

GROUP 2: Fork Lift

GROUP 3: Bulldozer (up to D-6 or equivalent)

GROUP 4: Drills (churn, core, calyx or diamond); Oiler; Loaders (overhead & front-end, under 4 yds. R/T); Vacuum Drill (reverse circulation drill under 8 inch bit)

GROUP 5: Backhoe (Under 45,000 gw); Trackhoe/Excavator (hoe Ram) (under 3/4 yd.); Cranes (25 tons & under), Drilling Equipment(8 inch bit & over) (Robbins, reverse circulation & similar)

GROUP 6: Asphalt Roller; Backhoe (45,000 gw and over to 110,000 gw); Trackhoe/Excavator (Hoe Ram) (3/4 yd. to 3 yd.); Compactor (self-propelled with blade); Cranes (over 25 tons, to and including 45 tons), Bulldozer, 834 R/T & similar; Loader Operator (front-end & overhead, 4 yds. incl. 8 yds.); Scrapers, all, rubber-tired; Screed Operator

GROUP 7: Backhoe (Over 110,000); Trackhoe/Excavator (Hoe Ram) (3 yds & over); Cranes (over 45 tons to but not including 85 tons); Loaders (overhead & front-end, over 8 yds. to 10 yds.); Rubber-tired Scrapers (multiple engine with three or more scrapers); Blade

GROUP 8: Cranes (85 tons and over, and all climbing, overhead, rail and tower); Loaders (overhead and front-end, 10 yards and over)

BOOM PAY: (All Cranes, Including Tower)
 180 ft to 250 ft \$.50 over scale
 Over 250 ft \$.80 over scale

NOTE:
 In computing the length of the boom on Tower Cranes, they shall be measured from the base of the Tower to the point of the boom.

HAZMAT:
 Anyone working on HAZMAT jobs, working with supplied air shall receive \$1.00 an hour above classification.

 IRON0014-012 07/01/2015

	Rates	Fringes
IRONWORKER (Ornamental, Reinforcing and Structural).....	\$ 32.76	23.19

 LABO0238-014 06/01/2013

	Rates	Fringes
LABORER: Mason Tender - Brick...	\$ 24.10	10.65

 LABO0238-021 06/01/2014

	Rates	Fringes
LABORER		
GROUP 1.....	\$ 22.95	10.95
GROUP 2.....	\$ 24.05	10.95
GROUP 3.....	\$ 24.32	10.95
GROUP 4.....	\$ 24.59	10.95

Zone Differential (Add to Zone 1 rates): Zone 2 - \$2.00

BASE POINTS: Pasco

Zone 1: 0-45 radius miles from the main post office.
 Zone 2: 45 radius miles and over from the main post office

LABORERS CLASSIFICATIONS

- GROUP 1: Flagman
- GROUP 2: Common or General Laborer; Form-Stripping
- GROUP 3: Chipping Guns; Concrete Saw; Pipelayer
- GROUP 4: Grade Checker; Gunite; Vibrating Plate

 PAIN0054-001 06/01/2008

	Rates	Fringes
DRYWALL FINISHER/TAPER.....	\$ 22.78	8.88

 PLAS0072-008 06/01/2015

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER...	\$ 27.01	12.59

Zone Differential (Add to Zone 1 rates): Zone 2 - \$2.00

BASE POINTS: Spokane, Pasco, Lewiston, Wenatchee

Zone 1: 0 - 45 radius miles from the main post office

Zone 2: 45 radius miles from the main post office

 * PLUM0598-013 06/01/2015

	Rates	Fringes
PLUMBER.....	\$ 49.24	28.79

 PLUM0598-015 06/01/2014

	Rates	Fringes
PIPEFITTER.....	\$ 48.72	27.19

 ROOF0189-011 07/01/2012

	Rates	Fringes
ROOFER (Includes Roof Tear Off, Waterproofing, and Installation of Metal Roofs).....	\$ 24.16	10.27

 SFWA0699-005 04/01/2015

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers).....	\$ 30.70	20.25

 SHEE0066-018 08/01/2013

	Rates	Fringes
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Sheet Metal Worker (Including
 HVAC Duct).....\$ 32.83 17.16

 TEAM0690-008 01/01/2014

	Rates	Fringes
Truck drivers: (ANYONE WORKING ON HAZMAT JOBS SEE FOOTNOTE A BELOW)		
ZONE 1: LEWISTON ZONE CENTER		
GROUP 3.....	\$ 22.94	15.19
GROUP 4.....	\$ 23.27	15.19
GROUP 5.....	\$ 23.38	15.19
GROUP 6.....	\$ 23.55	15.19
GROUP 7.....	\$ 24.08	15.19
GROUP 8.....	\$ 24.44	15.19
ZONE 1: PASCO ZONE CENTER		
GROUP 3.....	\$ 24.42	15.19
GROUP 4.....	\$ 24.75	15.19
GROUP 5.....	\$ 24.86	15.19
GROUP 6.....	\$ 25.02	15.19
GROUP 7.....	\$ 25.56	15.19
GROUP 8.....	\$ 25.88	15.19
ZONE 1: SPOKANE ZONE CENTER		
GROUP 3.....	\$ 22.94	15.19
GROUP 4.....	\$ 23.27	15.19
GROUP 5.....	\$ 23.38	15.19
GROUP 6.....	\$ 23.55	15.19
GROUP 7.....	\$ 24.08	15.19
GROUP 8.....	\$ 24.44	15.19

Zone Differential For ZONE 2: (Zone 1 +\$2.00)

BASE POINTS: Spokane, Moses Lake, Pasco, Lewiston

Zone 1: 0-45 radius miles from the main post office
 Zone 2: Outside a 45 mile radius from the main post office

TRUCK DRIVERS CLASSIFICATIONS

GROUP 3: Trucks, side, end, bottom and articulated end dump
 (3 yards to and including 6 yds.)

GROUP 4: Trucks, side, end, bottom and articulated end dump
 (over 6 yds. to & including 12 yds.)

GROUP 5: Trucks, side, end, bottom and articulated end dump
 (over 12 yds. to & including 20 yds.)

GROUP 6: Trucks, side, end, bottom and articulated end dump
 (over 20 yds. to & including 40 yds.)

GROUP 7: Truck, side, end, bottom and articulated end dump
 (over 40 yds. to & including 100 yds.)

GROUP 8: Trucks, side, end, bottom and articulated end dump
 (over 100 yds.)

FOOTNOTE A - Anyone working on a HAZMAT job, where HAZMAT
 certification is required, shall be compensated as a
 premium, in addition to the classification working in as
 follows:

LEVEL C-D: - \$.50 PER HOUR - This level may use an air

purifying respirator or additional protective clothing.

LEVEL A-B: - \$1.00 PER HOUR - Uses supplied air in conjunction with a chemical splash suit or fully encapsulated suit with a self-contained breathing apparatus.

Employees shall be paid Hazmat pay in increments of four(4) and eight(8) hours.

 SUWA2009-018 05/22/2009

	Rates	Fringes
FLOOR LAYER: Carpet and Vinyl.....	\$ 19.90	4.83
INSULATOR - BATT.....	\$ 13.58	0.21
LABORER: Handheld Drill.....	\$ 17.17	5.36
LABORER: Irrigation.....	\$ 11.58	0.00
LABORER: Landscape.....	\$ 11.48	0.00
LABORER: Mason Tender - Cement/Concrete.....	\$ 9.00	0.00
METAL BUILDING ERECTOR.....	\$ 12.23	3.86
OPERATOR: Bobcat/Skid Steer/Skid Loader.....	\$ 16.86	0.00
OPERATOR: Concrete Pumper.....	\$ 22.30	5.27
OPERATOR: Mechanic.....	\$ 24.33	4.33
PAINTER: Brush Only.....	\$ 14.50	0.50
PAINTER: Roller.....	\$ 22.62	0.25
PAINTER: Spray.....	\$ 22.47	0.00
TILE SETTER.....	\$ 13.50	0.00
TRUCK DRIVER: Semi-Trailer Truck.....	\$ 20.59	5.56

 WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.
 =====

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

 The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage

determination. The classifications are listed in alphabetical order of "identifiers" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than "SU" or "UAVG" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the "SU" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION

PLAN FOR NOTIFYING EMPLOYEES
NOT TO REPORT TO WORK

The Hanford Administrative Committee, in accordance with Article XIII, Section 4., has determined that the following plan will be implemented by the EMPLOYER for the purpose of notifying employees covered by the Hanford Site Stabilization Agreement not to report to work.

The EMPLOYER will cause an announcement to be made over local radio stations broadcasting within the Tri-Cities and Yakima areas at least two hours prior to the employees' regular starting time advising that construction operations are closed and that the EMPLOYERS' employees should not report to work.

A general announcement will be considered to apply to all employees of the EMPLOYER, and to all activities of the EMPLOYER, except for those employees and/or activities which are specifically identified as not be affected by the announcement.

Further, employees will recognize and adhere to a similar announcement issued by the OWNER, the U.S. Department of Energy, and will assume that such general announcements addressing the Hanford site and/or Hanford employees will include employees of the EMPLOYERS.

The announcement will apply only to the shift immediately following the time of the announcement unless the announcement gives instructions to the contrary.

Every effort will be made by the EMPLOYER (or OWNER) to get the announcement on the following radio stations:

TRI-CITIES

KALE - FM 95
KZZK - FM 102.7
KONA - FM 105.3
KHWK - FM 106.5

KONA - AM 169
KORD - AM 870
KIOK - AM 960
KOTY - AM 1340

YAKIMA

KUTI - AM 980
KIT - AM 1280

Travel Pay
Effective: 09/01/08

APPENDIX “A”

HANFORD DAILY TRAVEL PAY

Daily Travel Pay for Construction Crafts will be paid as follows:

<u>Area</u>	<u>Daily Pay</u>
300	\$18.50
400	\$18.50
200 East	\$22.00
200 West	\$22.75
100 (All)	\$23.50

**BOILERMAKERS
APPENDIX A**

WAGE RATES

	<u>01/01/13</u>	<u>10/01/13</u>	<u>01/01/14</u>
General Foreman	Rate to be negotiated	Rate to be negotiated	Rate to be negotiated
Foreman	\$37.90	\$39.75	\$38.94
Assistant Foreman	\$36.65	\$38.50	\$37.69
Boilermaker/Blacksmith	\$35.40	\$37.25	\$36.44

FRINGE PAYMENTS

	<u>01/01/13</u>	<u>01/01/14</u>	<u>10/01/14</u>
Health and Welfare (per hour)	\$8.57		
Pensions (per hour)	\$13.28	\$14.34	
Apprenticeship (per hour)	\$0.75		\$1.50
Vacation (per hour)	\$3.00		
National Annuity Trust (per hour)	\$1.00		
MOST (per hour)	\$0.34		

APPRENTICE RATES

Percentage of
Journeyman Wage Rates

<u>Period</u>	<u>Indentured After 09/02/96</u>
Level 1 0 - 1000 hrs.	70%
Level 1 1001 - 2000 hrs.	75%
Level 2 2001 - 3000 hrs.	80%
Level 2 3001 - 4000 hrs.	85%
Level 3a 4001 - 5000 hrs.	90%
Level 3b 5001 - 6000 hrs.	95%
Journeyman	100%

**BRICK AND ALLIED CRAFTS
APPENDIX A**

WAGE RATES

	<u>06/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>
Journeyman Bricklayer	\$27.83	\$28.33	\$29.73

Foreman shall receive a minimum of **\$2.50** over the hourly wage.

FRINGE PAYMENTS

	<u>10/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>
Health & Welfare	\$7.14	\$7.34	\$7.50
Northwest Pension Plan	\$4.35	\$4.49	\$5.25
International Pension Trust	\$1.61	\$1.67	\$1.74
International Apprenticeship & Training		\$0.28	\$0.29
Local Apprenticeship		\$0.11	
Dues check off	(\$2.10)	(\$2.14)	(\$2.20)
A-2 Dues check off	(\$1.90)	(\$1.94)	(\$2.00)
A-1 Dues check off	(\$1.70)	(\$1.74)	(\$1.80)
C.U. / Vacation		(\$1.50)	

APPRENTICE RATES

06/01/15

Six Month <u>Period</u>	Percent <u>%</u>	Basic <u>Hrs</u>	<u>Wages</u>
A-1	50%	* 0 - 750 hours	\$14.87
A-2	55%	751 - 2250 hours	\$16.35
A-2	60%	2251 - 3000 hours	\$17.84
A-2	70%	3001 - 3750 hours	\$20.81
A-2	80%	3751 - 4500 hours	\$23.78
A-2	90%	4501 - 5250 hours	\$26.76
A-2	95%	5251 - 6000 hours	\$28.24

**No pension contributions will be made on behalf of apprentices during their first 750-hour period.*

**CARPENTERS/MILLWRIGHTS
APPENDIX A**

WAGE RATES

CARPENTERS	<u>06/01/14</u>	<u>06/01/15</u>
JOURNEYMAN CLASSIFICATION	\$31.27	\$31.94
PILEDRIEVERS	<u>06/01/14</u>	<u>06/01/15</u>
JOURNEYMAN CLASSIFICATION	\$32.27	\$32.97

FOREMAN - *Receives an additional \$1.75 an hour above the highest paid Journeyman working under him.*
 GENERAL FOREMAN - *Receives an additional \$1.00 an hour above the Foreman*

MILLWRIGHTS AND MACHINE ERECTORS	<u>06/01/14</u>	<u>06/01/15</u>
JOURNEYMAN CLASSIFICATION	\$39.78	\$41.86
FOREMAN CLASSIFICATION	\$43.76	\$46.05

DIVERS	<u>06/01/13</u>	<u>06/01/15</u>
Diver	\$35.39	\$36.72
Diver Diving	\$70.78	\$73.44
Tender	\$34.39	\$35.02

FRINGE PAYMENTS

Carpenters/Piledrivers/Divers:	<u>06/01/14</u>	<u>06/01/15</u>	Millwrights:	<u>06/01/14</u>	<u>06/01/15</u>
Health & Security	\$5.25		Health and Security	\$7.41	
Pension*	\$6.33		Pension*	\$6.33	
401(k)	\$1.00		Apprenticeship & Training	\$0.73	\$0.75
**401(k) matched	\$0.25	\$0.85			
Apprenticeship & Training	\$0.56	\$0.57			

***In order for members to receive the 401(k) matched contribution, the member must contribute a minimum of \$0.50 of their own money to the 401(k) program. Without this election the member would not receive the "401(k) matched funds".*

Millwrights - Certified Welder \$0.50 per hour while performing welds required by the plans or specifications to be certified.

APPRENTICE RATES

*1 st Period	3 months - 60%	5 th Period	6 months - 80%
*2 nd Period	3 months - 65%	6 th Period	6 months - 85%
3 rd Period	6 months - 70%	7 th Period	6 months - 90%
4 th Period	6 months - 75%	8 th Period	12 months - 95%

*Carpenters/Piledrivers: *No pension or 401k contributions to be paid for Apprentices 1st and 2nd periods*

*Millwrights: *No pension contributions to be paid for Apprentices 1st periods*

**CEMENT MASONS
APPENDIX A**

WAGE RATES

	<u>06/01/12</u>	<u>06/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>
GROUP I	\$25.76*	\$26.01	\$26.41	\$27.01
GROUP II	\$26.38	\$26.63	\$27.03	\$27.63
GROUP III	\$26.89	\$27.14	\$27.54	\$28.14

**a \$0.25 difference in total package between Local 72 and 478 was created in 06/01/2010 and 06/01/2011, due to Local 72 contractors conducting a maintenance of benefits on training, versus Local 478 contractors taking a total of \$0.25 from wages to training. Correct totals are reflected above.*

FOREMAN - \$1.50 per hour above highest paid worker on his crew
GENERAL FOREMAN - \$1.50 per hour above the highest paid Foreman on their crew

FRINGE PAYMENTS

	<u>06/01/12</u>	<u>06/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>
Health and Security	\$5.30	\$5.70	\$6.00	\$6.10
Pension	\$5.84			
Training	\$0.50	\$0.60		
Int. Training				\$0.05

Deductions, upon written authorization of employee:

Credit Union	(\$1.40)
Dues	(\$2.25)
NWFCA	(\$0.04)

APPRENTICE RATES

(Program changed January 1, 2011)

	<u>06/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>
50% (0 - 900 hours)	\$13.01	\$13.21	\$13.51
60% (901 - 1800 hours)	\$15.61	\$15.85	\$16.21
70% (1801 - 2700 hours)	\$18.21	\$18.49	\$18.91
80% (2701 - 3600 hours)	\$20.81	\$21.13	\$21.61
90% (3601 - 4500 hours)	\$23.41	\$23.77	\$24.31
95% (4501 - 5400 hours)	\$24.71	\$25.09	\$25.66

CLASSIFICATIONS

GROUP I

- Rodding, tamping, floating, troweling, patching, stoning, rubbing, sack rubbing
- All exposed aggregate finishing and sealing. All architectural finishing, staining, stamping and coloring, washing and power washing of concrete, polymer, latex and composite materials
- Setting of screeds, screed forms, curb & gutter & sidewalk forms
- Preparation of all concrete for caulking of the joints and the caulking of expansion joints
- Preparation of concrete for the application of hardners, sealers and curing compounds and their application
- Grouting and dry packing of machine base
- Removal of snap ties and she bolts, and other form devises prior to patching of concrete

GROUP II

- Power Troweling Machine Operator
- Troweling of magnesite, torganal, or material with epoxy bases of oxicholoride base
- All Power Grinders, Bushing Hammer, Chipping Gun, Gunitite Nozzleman
- All sandblasting for architectural finishes, patch preparation, and exposing of aggregate for finish
- Concrete Sawing and Cutting for control and expansion joints and scoring for decorative patterns
- Operating of Clary-type Floats, Longitudinal Floats, Rodding Machines and Belting Machines
- Scarifiers
- Working on scaffolds

GROUP III

- Grinding, bushing or chipping of toxic materials or high density concrete
- Operating of power tools on a scaffold

ELECTRICIANS APPENDIX A

WAGE RATES

		<u>06/01/14</u>	<u>06/01/15</u>
Journeyman Wireman		\$38.05	\$38.80
Journeyman Wireman Cable Splicer	5% above Journeyman**	\$39.95	\$40.74
Journeyman Wireman Welder	10% above Journeyman*	\$41.86	\$42.68
Foreman	10% above Journeyman	\$41.86	\$42.68
Foreman (<i>Supervising 6 or more Journeymen or when 20 or more Journeyman are on a project, all Foreman will be paid @ 15%</i>)	15% above Journeyman	\$43.76	\$44.62
General Foreman	25% above Journeyman	\$47.56	\$48.50

Vacation allowance deduct 10% at option of Employee

* Journeyman Wireman when Welding - 10% above Journeyman Wireman rate when welding for a minimum of 2 hours.

** Journeyman Wireman Cable Splicer - Cable splicing and stress cones by whatever method on voltage over 2300 volts will be paid 5% above Journeyman Wireman rate for a minimum of 2 hours.

FRINGE PAYMENTS

	<u>06/01/13</u>	<u>07/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>
Health and Welfare	\$8.13	\$8.88	\$8.98	\$9.08
Pension - National (<i>NEBF gross wages</i>)	3%			
Pension Plans	\$6.95		\$7.25	\$7.75
Apprentice Training	\$0.35		\$0.45	\$0.60
Vacation (<i>Optional - included in gross</i>)	10%			

APPRENTICE RATES

effective 06/01/15

			Health & Welfare (06/01/14)	Health & Welfare	L.U. 112 Retirement	NEBF @ 3%	Appr. Training
<i>(Indentured after April 12, 2009)</i>							
0 - 1600	1st Period	45%	\$17.46	\$7.68	\$7.78	\$ -	\$0.60
1601-2000	2nd Period	50%	\$19.40	\$8.68	\$8.78	\$3.88	\$0.60
2001-3500	3rd Period	55%	\$21.34	\$8.71	\$8.81	\$4.26	\$0.60
3501-5000	4th Period	65%	\$25.22	\$8.77	\$8.87	\$5.04	\$0.60
5001-6500	5th Period	75%	\$29.10	\$8.83	\$8.93	\$5.81	\$0.60
6501-8000	6th Period	85%	\$32.98	\$8.89	\$8.99	\$6.59	\$0.60
<i>(Indentured after April 12, 2013)</i>							
0 - 1600	1st Period	40%	\$15.52	\$7.68	\$7.78	\$ -	\$0.60
1601-2500	2nd Period	45%	\$17.46	\$8.63	\$8.75	\$3.49	\$0.60
2501-3500	3rd Period	50%	\$19.40	\$8.68	\$8.78	\$3.88	\$0.60
3501-5000	4th Period	65%	\$25.22	\$8.77	\$8.87	\$5.04	\$0.60
5001-6500	5th Period	80%	\$31.04	\$8.86	\$8.96	\$6.20	\$0.60
6501-8000	6th Period	85%	\$32.98	\$8.89	\$8.99	\$6.59	\$0.60

INSULATORS & ALLIED WORKERS APPENDIX A

WAGE RATES

	<u>08/01/14</u>	<u>09/15/14</u>	<u>01/01/15</u>	<u>08/01/15</u>
Journeyman	\$33.57	\$33.42	\$33.42	\$34.42
<i>Journeyman IAP adjustment</i>			(\$0.50)	(\$0.50)
Journeyman <i>adjusted</i>	\$33.57	\$33.42	\$32.92	\$33.92
Foreman	10% above the Journeyman's base rate of pay			
General Foreman	Negotiated to be more than ten percent (10%+) above journeyman base rate			

FRINGE PAYMENTS

	<u>07/29/13</u>	<u>09/15/14</u>	<u>01/01/15</u>
Health and Welfare	\$8.44	\$8.84	
Occupational Health	\$0.12		
Pension (Class II JM & higher)	\$8.01		\$8.51
Pension (Appr)	\$8.01		
Apprenticeship	\$0.88		
Safety Training	\$0.02		
Int'l Labor Management Coop Trust	\$0.05		
Credit Union (Vacation deduct)	\$2.25 <i>(option of employee)</i>		

There is one (1) classification for the pension contribution, as follows:

		<u>01/01/15</u>
		Class II
		(JM & higher)
IAP (Individual Account) Rate	(Appr.) \$2.50	\$3.00
Defined Benefit	<u>\$5.51</u>	<u>\$5.51</u>
Total	\$8.01	\$8.51

APPRENTICE RATES

<u>Period</u>	<u>Percentage</u>	<u>08/01/14</u>	<u>09/15/14</u>	<u>01/01/15</u>	<u>08/01/15</u>
		<u>Wage</u>	<u>Wage</u>	<u>Wage</u>	<u>Wage</u>
1 st year	60% of Journeyman wage	\$20.14	\$20.05	\$20.05	\$20.65
2 nd year	70% of Journeyman wage	\$23.50	\$23.39	\$23.39	\$24.09
3 rd year	80% of Journeyman wage	\$26.86	\$26.74	\$26.74	\$27.54
4 th year	90% of Journeyman wage	\$30.21	\$30.08	\$30.08	\$30.98

**IRONWORKERS
APPENDIX A**

WAGE RATES

<u>CLASSIFICATIONS</u>	<u>07/01/12</u>	<u>07/01/14</u>	<u>07/01/15</u>
Structural Ironworkers, Ornamental Ironworkers, Machinery Mover, Machine Erector, Riggers, Signal Men, Welders & Burners, Fence Erectors Sheeters, Reinforcing Ironworkers	\$31.60	\$32.33	\$32.76
	<u>09/01/08</u>		
FOREMEN -	\$3.00 per hour over Journeyman rate		
GENERAL FOREMAN -	\$4.00 per hour over Journeyman rate		

FRINGE PAYMENTS

	<u>07/01/13</u>	<u>07/01/14</u>	<u>07/01/15</u>
Health and Welfare	\$6.77		\$7.02
Pension	\$9.95		
Apprenticeship	\$0.63	\$0.65	\$0.67
Annuity	\$4.00	\$4.75	\$5.55
VACATION - (<i>Deduct from Net Wages</i>)	\$1.50 per hour		
IMPACT Fund	\$0.24		\$0.25

APPRENTICE RATES

<u>09/01/99</u>		
<u>Period</u>		<u>Percentage of Journeyman Wage Rates</u>
*1 st 6 months	65%	of Journeyman Ironworker Rates
*2 nd 6 months	70%	of Journeyman Ironworker Rates
3 rd 6 months	75%	of Journeyman Ironworker Rates
4 th 6 months	80%	of Journeyman Ironworker Rates
5 th 6 months	90%	of Journeyman Ironworker Rates
6 th 6 months	90%	of Journeyman Ironworker Rates
7 th 6 months	95%	of Journeyman Ironworker Rates
8 th 6 months	95%	of Journeyman Ironworker Rates

*No pension or annuity

**LABORERS
APPENDIX A**

WAGE RATES & FRINGES

	<u>06/01/14</u>	<u>06/01/15</u>
GROUP I	\$24.35	\$24.78
GROUP II	\$24.62	\$25.05
GROUP III	\$24.89	\$25.32
GROUP IV	\$25.17	\$25.60

GROUP V: Sand Hogs (Under Compressed Air Conditions)
(Computed by multiplying the increase x 8 hr. shift and add total to previous rate)

<u>LBS.</u>	<u>HRS. WORK</u>	<u>OT DIV</u>	<u>06/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>	
1-14	6	7-1/2	\$206.72	\$208.72	\$212.16	
14-18	6	7-1/2	\$211.65	\$213.65	\$217.09	
18-25	4	7-1/2	\$211.93	\$213.93	\$217.37	Rates to be
18-22	6	10	\$233.79	\$235.79	\$239.23	
22-26	4	7-1/2	\$216.25	\$218.25	\$221.69	recalculated
26-32	4	7-1/2	\$218.87	\$220.87	\$224.31	
32-38	3	7-1/2	\$221.83	\$223.83	\$227.27	as needed
38-44	2	7-1/2	\$222.24	\$224.24	\$227.68	
Outside Lock and Gauge Tender			\$199.36	\$201.36	\$204.80	

GROUP VI: Construction Specialist	\$25.07	\$25.50
GROUP VII: Hod Carriers <i>(Per Mason Contractors Assn. 06/01/12)</i>	\$25.04	\$26.07
GROUP VIII Powdermen <i>(Previously misidentified as Group V)</i>	\$26.54	\$26.97
GROUP IX: Grade Checker	\$26.88	\$27.31

FOREMAN \$1.50 above highest rate supervised
GENERAL FOREMAN \$1.50 above highest rate supervised

FRINGE PAYMENTS

	<u>06/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>
Health and Welfare	\$5.70	\$6.00	\$6.10
Pension	\$4.50		
Training	\$0.45	\$0.50	\$0.55
Training (Hod Carriers)	\$0.40	\$0.40	\$0.45
LECET (Training Fund)	\$0.06		\$0.08
Credit Union (deduct from net wages)	(\$1.00)		

NEW ENTRANT TRAINING PROGRAM

(Percent Computed on Group II Rates)

<i>Apprentices registered prior to June 1, 2012</i>				<i>Apprentices registered Beginning June 1, 2012 (6000 hr program)</i>			
Step	Hours	%	<u>Wage</u>	Step	Hours	%	<u>Wage</u>
I	0 to 1000 hours	60%	\$14.87	I	0 to 1000 hours	60%	\$14.87
II	1001 to 2000 hours	70%	\$17.35	II	1001 to 2000 hours	70%	\$17.35
III	2001 to 3000 hours	80%	\$19.82	III	2001 to 3000 hours	80%	\$19.82
IV	3001 to 4000 hours	90%	\$22.30	IV	3001 to 4000 hours	85%	\$21.06
				V	4001 to 5000 hours	90%	\$22.30
				VI	5001 to 6000 hours	95%	\$23.54

CLASSIFICATIONS:

Group I

Flagman*	Dry Stack Walls ⁸	Lead Abatement Worker
Landscape Laborer	Traffic Control Laborer ¹	Miner, Class "A" ⁵
Scalemán	Window Washer/Cleaner**	Mold Abatement Worker
Traffic Control Supervisor	Pilot Car	Nipper
Asbestos Abatement Worker	Hazardous Waste Worker	Riprap Man
Brick Pavers ²	Dumpman	Sandblast Tailhoseman
Brush Hog Feeder	Erosion Control Laborer	Scaffold Erector, Wood or Steel
Carpenter Tender	Fence Erector	Stake Jumper
Cement Handler	Firewatch	Structural Mover ⁹
Clean-up Laborer	Form Cleaning Machine Feeder, Stacker	Tailhoseman (water nozzle)
Concrete Crewman ⁶	General Laborer	Timber Bucker & Faller (by hand)
Concrete Signal Man	Group Machine Header Tender	Track Laborer (RR)
Confined Space Attendant	Guard Rail ³	Truck Loader
Crusher Feeder	(Deleted) ⁴	Well-Point Man
Demolition ⁷	HDPE or similar liner installer	

**Detail clean-up, such as, but not limited to, cleaning floors, ceilings, walls, windows, etc., prior to final acceptance by the Owner.

¹TO INCLUDE: But is not limited to, erection and maintenance of barricades, signs and relief of flag person.

²TO INCLUDE: the installation of brick or grass pavers for sidewalks, driveways, streets and parking lots.

³TO INCLUDE: Guard rails, guide and reference posts, signposts, and right-of-way markers.

⁴ Footnote deleted

⁵TO INCLUDE: Bull Gang, Concrete Crewman, Dumpman and Pumpcrete Crewman, including distributing pipe, assembly & dismantle, and Nipper.

⁶TO INCLUDE: Stripping of forms, hand operating jacks on slip form construction, application of concrete curing compounds, pumpcrete machine. Signaling, handling the nozzle of squeeze crete or similar machine - 6 inches or smaller.

⁷TO INCLUDE: Clean-up, burning, loading, wrecking and salvage of all material.

⁸TO INCLUDE: Including all dray stack walls, including keystone walls and others using blocks and interlocking pegs.

⁹TO INCLUDE: Separating foundation, preparation, cribbing, shoring, jacking and unloading of structures

NOTE: All other work classifications not specifically listed shall be classified as General Laborer Group I.

Group II

Asphalt roller, walking	Nozzleman, water, (to include fire hose) air, or steam	Railroad Power Spiker or Puller, dual mobile
Cement Finisher Tender	Pavement Breaker, under 90 lbs.	Rigger/Signal Person
Concrete Saw, walking	Pipelayer, corrugated metal and multi-plate	Rodder & Spreader
Demolition Torch	Pot Tender	Compaction Equipment ¹²
Dope Pot Fireman, non-mechanical	Powderman Helper	Trencher, Shawnee
Driller Helper (when required to move & position machine)	Power Buggy Operator	Tugger Operator
Form Setter, paving	Power Tool Operator, gas, electric, pneumatic	Wagon Drills
Deleted ¹⁰	Railroad Equipment, power driven, <u>except</u> dual mobile power spiker or puller	Water Pipe Liner
Jackhammer Operator Miner, Class "B" ¹¹		Wheelbarrow, power driven
		Remote Equipment Operator ¹³

¹⁰ Deleted

¹¹TO INCLUDE: Brakeman, Finisher, Vibrator, Form Setter.

¹²TO INCLUDE: All hand operated power compaction equipment.

¹³ i.e. Compaction and Demolition.

Group III

Air and Hydraulic Track Drill	High Scaler	Pipelayer ²¹
Asphalt Raker	Laser Beam Operator ¹⁸	Pipewrapper
Brush Machine ¹⁴	Miner, Class "C" ¹⁹	Plasterer Tenders
Caisson Worker, free air	Monitor Operator, air track or similar	Trenchless Technology
Chain Saw Operator & Faller	mounting	Technician
Concrete Stack ¹⁵	Mortar Mixer	Vibrators, <u>ALL</u>
Gunite ¹⁶	Nozzleman ²⁰	
Deleted ¹⁷	Pavement Breaker, 90 lbs. & over	

¹⁴TO INCLUDE: Horizontal construction joint clean-up brush machine, power propelled.

¹⁵TO INCLUDE: Laborers when working on free standing concrete stacks for smoke or fume control above 40 feet high.

¹⁶TO INCLUDE: Operation of machine and nozzle.

¹⁷Deleted.

¹⁸TO INCLUDE: Elevation control.

¹⁹TO INCLUDE: Miner, Nozzelman for concrete. Laser Beam Operator and Rigger on tunnels.

²⁰TO INCLUDE: Jet Blasting Nozzelman, over 1200 lbs., jet blast machine power-propelled, sandblast nozzle, Squeeze and Flo-crete nozzle.

²¹TO INCLUDE: Working topman, caulker, collarman, jointer, mortarman, rigger, jacker, shorer, valve or meter installer, temper. Including pressurized and non-pressurized ductile pipe, gravity pipe and HDPE (fused and non-fused).

Group IV

Drills with dual masts	Miner, Class "D" ²³	Welder, electric, manual or automatic ²⁴
Deleted ²²	Remote Equipment Operator	

²²Deleted

²³TO INCLUDE: Raise and Shaft Miner, Laser Beam Operator on raises and shafts.

²⁴TO INCLUDE: HDPE or similar pipe and liner.

Group V

Sand Hogs under compressed air conditions
(Computed by multiplying the increase x 8 hr. shift and add total to previous rate)

Group VI

Construction Specialist²⁵

²⁵TO INCLUDE: Work requiring special skills not addressed in the above classifications mutually agreed to between the Union and the Employer.

Group VII

Hod Carrier²⁵

²⁶Wages, Fringes and Promotional Fund as per Spokane Masonry Association Agreement.

Group VIII

Powderman

Group IX

Grade Checker

**OPERATING ENGINEERS
APPENDIX A
CLASSIFICATIONS
WAGE RATES**

	<u>06/01/14</u>	<u>06/01/15</u>
Group I	\$25.86	\$26.16
Group II	\$26.18	\$26.48
Group III	\$26.79	\$27.09
Group IV	\$27.11	\$27.41
Group V	\$27.39	\$27.69
Group VI	\$27.66	\$27.96
Group VII	\$28.76	\$29.06
Group VIII	\$30.10	\$30.40

FOREMAN Shall be paid **\$1.50 per hour** over the scale of the highest scale supervised.

GENERAL

FOREMAN Shall be paid **\$1.50 per hour** over the Foreman's scale.

FRINGE PAYMENTS

	<u>06/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>
Health and Welfare	\$5.55	\$5.80	\$6.15
Pension	\$6.75		
Apprenticeship & Training	\$0.55	\$0.60	\$0.65

APPRENTICE RATES

(Computed on GROUP V Rates)

09/03/07

BASE RATE: (Group V)

65%	0 - 1000 hours
70%	1001 - 2000 hours
75%	2001 - 3000 hours
80%	3001 - 4000 hours
85%	4001 - 5000 hours
90%	5001 - 8000 hours

<p><u>GROUP I</u></p> <ul style="list-style-type: none"> Bit Grinders Bolt Threading Machine Compressors (under 2000 CFM, gas, diesel, or electric power) Crusher Feeder (mechanical) Deck Hand Drillers Helper Fireman & Heater Tender Helper, Mechanic or Welder, H.D. Hydro-seeder, Mulcher, Nozzleman Oiler Oiler & Cable Tender, Mucking Machine Pumpman Steam Cleaner Welding Machine Rollers, all types on subgrade (farm type, Case, John Deere & similar, or Compacting Vibrator), except when pulled by Dozer with operable blade 	<p><u>GROUP II</u></p> <ul style="list-style-type: none"> A-Frame Truck (single drum) Assistant Refrigeration Plant (under 1000 ton) Assistant Plant Operator, Fireman or Pugmixer (asphalt) Bagley or Stationary Scraper Belt Finishing Machine Blower Operator (cement) Cement Hog Compressor (2000 CFM or over, 2 or more, gas, diesel, or electric power) Concrete Saw (multiple cut) Distributor Leverman Ditch Witch or similar Elevator Hoisting Materials Dope Pots (power agitated) Fork Lift or Lumber Stacker, Hydra-lift, and similar Gin Trucks (pipeline) Hoist, single drum Loaders (bucket elevators and conveyors) Longitudinal Float Mixer (portable - concrete) Pavement Breaker, Hydra-Hammer and similar Power Broom Railroad Ballast Regulation Operator (self-propelled) Railroad Power Tamper Operator (self-propelled) Railroad Tamper Jack Operator (self-propelled) Spray Curing Machine (concrete) Spreader Box (self-propelled) Straddle Buggy (Ross and Similar on construction job only) Tractor (Farm type R/T with attachments, except Backhoe) Tugger Operator
<p><u>GROUP III</u></p> <ul style="list-style-type: none"> A-Frame Truck (2 or more drums) Assistant Refrigeration Plant & Chiller Operator (over 1000 ton) Backfillers (Cleveland and similar) Batch Plant & Wet Mix Operator, single unit (concrete) Belt-Crete Conveyors with power pack or similar Belt Loader (Kocal or similar) Bend Machine Bob Cat Boring Machine (earth) Boring Machine (rock under 8" bit) (Quarry Master, Joy, or similar) Bump Cutter (Wayne, Saginaw, or similar) Canal Lining Machine (concrete) 	<p><u>GROUP IV</u></p> <ul style="list-style-type: none"> Blade Operator (motor patrol and attachments) Concrete Pumps (squeeze-crete, flow-crete, pump-crete, Whitman and similar) Drilling Equipment (8" bit and over) (Robbins, reverse circulation and similar) Drills (churn, core, calyx, or diamond) Equipment Serviceman, Greaser, and Oiler Grade Checker Hoe Ram Hoist (2 or more drums or Tower Hoist) Loaders (overhead and front-end, under 4 yds R/T) Paving (dual drum) Rubber Tire Railroad Track Liner Operator (self-propelled) Refrigeration Plant Engineers (under 1000 ton)

<p><u>GROUP III (continued)</u></p> <p>Chipper (without crane) Cleaning and Doping Machine (pipeline)</p> <p>Curb Extruder (Asphalt and concrete) Deck Engineer Elevating Belt-type Loader (Euclid, Barber Green, and similar) Elevating Grader-type Loader (Dumor, Adams, or similar) Generator Plant Engineers (diesel, electric) Guniting Combination Mixer and Compressor Locomotive Engineer Mixermobile Posthole Auger or Punch Pump (grout or jet) Soil Stabilizer (P and H or similar) Spreader Machine Surface Heater and Planer Machine Tractor (to D-6 or equivalent) and Traxcavator Traverse Finish Machine Turnhead Operator</p>	<p><u>GROUP IV (continued)</u></p> <p>Screed Operator Signalman (Whirleys, Highline, Hammerheads or similar) Skidders (R/T with or without attachments) Trenching Machines (under 7 ft. depth capacity) Vacuum Drill (reverse circulation drill under 8" bit)</p>
<p><u>GROUP V</u></p> <p>Automatic Subgrader (Ditches & Trimmers) (Autograde, ABC, R. A. Hansen, and similar on grade wire Backhoe (under 1 yd)</p> <p>Batch Plant (over 4 units) Batch and Wet Mix Operator (multiple units, 2 and including 4) Boat Operator Cableway Controller (dispatcher) Concrete Pump Boom Truck (Less than 42M) Conveyor Aggregate Placement Equipment Crane (25 tons and under) Derricks and Stifflegs (under 65 tons) Drill Doctor Multiple Dozer Units with single blade Paving Machine (asphalt and concrete) Piledriving Engineers Rollerman (finishing pavement)</p> <p>Trenching Machines (7 ft. depth and over)</p>	<p><u>GROUP VI</u></p> <p>Asphalt Plant Operator Backhoes (1 yd. to 3 yds.) Blade (finish and bluetop) Automatic, CMI, ABC, & similar when used as automatic Boom Cats (side) Cableway Operators Clamshell Operator (under 3 yds.) Concrete Slip Form Paver Concrete Pump Boom Truck (42M to Less than 63M) Cranes (over 25 tons, including 45 tons) Crusher, Grizzle and Screening Plant Operator Draglines (under 3 yds.) Elevating Belt (Holland type) Gradeall (1 yd. to 3 yds.) H. D. Mechanic H. D. Welder Heavy Equipment Robotics Operator Loader Operator (front-end and overhead, 4 yds, including 8 yds.) Mucking Machine Quad-track or similar equipment Rubber-tired Scrapers Shovels (under 3 yds.) Tractors (D-6 and equivalent and over) Vactor Guzzler, Super Sucker Concrete Cleaning/Decontamination Machine Master Environmental Maintenance Technician Ultra High Pressure Waterjet Cutting Tool System (30,000 psi)</p>

<p><u>GROUP VII</u></p> <p>Backhoes (3 yds. and over) HD Welder/HD Mechanic Concrete Pump Boom Truck (63M or greater) Cranes (ALL Cranes over 45 tons, including 100 tons) Climbing, Rail and Tower Cranes up to and including 45 tons Clamshell Operator (3 yds. and over) Derricks and Stifflegs (65 tons and over) Draglines (3 yds and over) Lead Water Well Driller Loader (360 degrees revolving Koehring Scooper or similar) Loaders (overhead and front-end, over 8 yds) Helicopter Pilot Shovels (3 yards and over) Whirleys and Hammerheads, <u>ALL</u></p>	<p><u>GROUP VI (continued)</u></p> <p>Vacuum Blasting Machine Operator</p> <hr/> <p><u>GROUP VIII</u></p> <p>Cranes (All cranes over 100 tons) Climbing, Rail and Tower Cranes over 45 tons</p>
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ALL CRANE BOOMS, INCLUDING TOWER CRANES:

	<u>09/04/06</u>	<u>09/03/07</u>
Measure from center of rotation to center of shaft (radius):		
130' to 200'	\$.30 hr. Additional to classification	\$0.50
Over 200'	\$.60 hr. Additional to classification	\$0.80

06/01/13

Certified Crane Operators shall be paid \$0.50 per hour above their classification

**PAINTERS/TAPERS
APPENDIX A**

WAGE RATES

	<u>07/01/13</u>	<u>07/01/14</u>	<u>04/01/15</u>	<u>07/01/15</u>
Painters:	\$22.79	\$22.65	\$23.40	\$24.15
Painters Foreman:	\$25.07	\$24.92	\$25.74	\$26.57

Soft Floor Coverers, Glazers, Spray Painters, Steel Painters, Steam Clean, Acid Etching, Sign Writers

	<u>01/01/14</u>	<u>06/01/14</u>	<u>06/01/15</u>
Drywall Finisher:	\$22.25	\$23.00	\$23.80
Drywall Finisher Foreman:	\$24.00	\$24.75	\$25.55

FRINGE PAYMENTS

Painters:	<u>07/01/14</u>	<u>04/01/15</u>	<u>07/01/15</u>	Drywall Finisher:	<u>01/01/14</u>	<u>07/01/14</u>	<u>07/01/15</u>
Health & Welfare	\$6.03		\$6.13	Health and Welfare	\$5.89	\$6.03	\$6.13
Pension	\$4.13			Pension	\$5.54		
Apprenticeship	\$0.27	\$0.37	\$0.47	Apprenticeship	\$0.28		\$0.43
				Int'l Appr.	\$0.05		\$0.10

07/01/12

District Council No. 5 Administration Fee check-off shall be **3.3%** of the current Painters' basic wage, which is deducted from the wages, computed on actual hours worked.

APPRENTICE RATES

Painters:				Finishers:				
Period	% of JM's	<u>04/01/15</u> <u>Wages</u>	<u>07/01/15</u> <u>Wages</u>	Fringes	Period	% of JM's <u>Wages</u>	<u>06/01/15</u> <u>Wages</u>	Fringes
1 st	55%	\$12.87	\$13.28	H&W (medical only)	1 st	60%	\$14.28	H&W only
2 nd	60%	\$14.04	\$14.49	H&W + 50% Pension	2 nd	65%	\$15.47	H&W only
3 rd	65%	\$15.21	\$15.70	H&W + 50% Pension	3 rd	70%	\$16.66	H&W + 50% Pension
4 th	70%	\$16.38	\$16.91	Full Benefits	4 th	75%	\$17.85	H&W + 50% Pension
5 th	80%	\$18.72	\$19.32	Full Benefits	5 th	85%	\$20.23	Full Benefits
6 th	90%	\$21.06	\$21.74	Full Benefits	6 th	90%	\$21.42	Full Benefits

PIPEFITTERS APPENDIX A

WAGE RATES

	<u>06/01/12</u>	<u>06/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>
Basic Hourly Wage Rate	\$38.85	\$40.10	\$40.72	\$41.24
Vacation	\$8.00			

Vacation pay shall be included in the basic rate for all computation of overtime, shift differential, working dues, or any rate of pay for all employees covered by this agreement.

FOREMAN - 10% above basic rate inclusive of vacation.
On jobs with more than (8) pipefitters, 15% above basic rate inclusive of vacation

GENERAL FOREMAN - 25% above basic rate inclusive of vacation.
On jobs with more than (8) pipefitters, 25% above basic rate inclusive of vacation

FRINGE PAYMENTS

	<u>06/01/12</u>	<u>06/01/13</u>	<u>04/07/14</u>	<u>06/01/14</u>	<u>06/01/15</u>
Health & Welfare	\$10.40	\$10.40		\$11.40	\$11.90
National Pension	\$4.23	\$4.23		\$4.23	
State Pension	\$3.76	\$4.52		\$4.52	\$5.02
Supplemental Pension	\$4.81	\$5.00		\$5.00	\$5.50
JATC	\$1.69	\$1.74	\$1.64	\$2.04	
International Training Fund			\$0.10	\$0.10	

APPRENTICE RATES *effective 06/01/14*

Six Month	Percent	Basic		Health &	National	State	Suppl		
<u>Period</u>	<u>%</u>	<u>Wage</u>	<u>Vacation</u>	<u>Welfare</u>	<u>Pension</u>	<u>Pension</u>	<u>Pension</u>	<u>JATC</u>	<u>ITF</u>
1st	45%	\$18.56	\$8.00	\$11.90	\$1.90	\$5.02	\$5.50	\$2.04	\$0.10
2nd	50%	\$20.62	\$8.00	\$11.90	\$2.12	\$5.02	\$5.50	\$2.04	\$0.10
3rd	55%	\$22.68	\$8.00	\$11.90	\$2.33	\$5.02	\$5.50	\$2.04	\$0.10
4th	60%	\$24.74	\$8.00	\$11.90	\$2.54	\$5.02	\$5.50	\$2.04	\$0.10
5th	65%	\$26.81	\$8.00	\$11.90	\$2.75	\$5.02	\$5.50	\$2.04	\$0.10
6th	70%	\$28.87	\$8.00	\$11.90	\$2.96	\$5.02	\$5.50	\$2.04	\$0.10
7th	75%	\$30.93	\$8.00	\$11.90	\$3.17	\$5.02	\$5.50	\$2.04	\$0.10
8th	80%	\$32.99	\$8.00	\$11.90	\$3.38	\$5.02	\$5.50	\$2.04	\$0.10
9th	85%	\$35.05	\$8.00	\$11.90	\$3.60	\$5.02	\$5.50	\$2.04	\$0.10
10th	85%	\$35.05	\$8.00	\$11.90	\$3.60	\$5.02	\$5.50	\$2.04	\$0.10

Apprentices shall receive the following percentage of the Journeyman's rate plus 100% fringe benefits (vacation and all other fringe benefits) and as indicated above for National Pension:

APPRENTICE RATES *effective 06/01/14*

(Incoming Apprentice After 05/31/2013)

Six Month	Percent	Basic		Health &	National	State	Suppl		
<u>Period</u>	<u>%</u>	<u>Wage</u>	<u>Vacation</u>	<u>Welfare</u>	<u>Pension</u>	<u>Pension</u>	<u>Pension</u>	<u>JATC</u>	<u>ITF</u>
1st	45%	\$18.56	\$3.60	\$11.90	\$1.90	\$2.26	\$2.48	\$2.04	\$0.10
2nd	50%	\$20.62	\$4.00	\$11.90	\$2.12	\$2.51	\$2.75	\$2.04	\$0.10
3rd	55%	\$22.68	\$4.40	\$11.90	\$2.33	\$2.76	\$3.03	\$2.04	\$0.10
4th	60%	\$24.74	\$4.80	\$11.90	\$2.54	\$3.01	\$3.30	\$2.04	\$0.10
5th	65%	\$26.81	\$5.20	\$11.90	\$2.75	\$3.26	\$3.58	\$2.04	\$0.10
6th	70%	\$28.87	\$5.60	\$11.90	\$2.96	\$3.51	\$3.85	\$2.04	\$0.10
7th	75%	\$30.93	\$6.00	\$11.90	\$3.17	\$3.77	\$4.13	\$2.04	\$0.10
8th	80%	\$32.99	\$6.40	\$11.90	\$3.38	\$4.02	\$4.40	\$2.04	\$0.10
9th	85%	\$35.05	\$6.80	\$11.90	\$3.60	\$4.27	\$4.68	\$2.04	\$0.10
10th	85%	\$35.05	\$6.80	\$11.90	\$3.60	\$4.27	\$4.68	\$2.04	\$0.10

**ROOFERS, WATERPROOFERS, AND ALLIED WORKERS
APPENDIX A**

WAGE RATES

	<u>07/01/14</u>	<u>12/01/14</u>	<u>07/01/15</u>
Journeyman Roofer, Waterproofer, Kettleman	\$25.38	\$25.26	\$25.65
Foreman - 10% above Journeyman rate			

FRINGE PAYMENTS

	<u>07/01/13</u>	<u>12/01/14</u>
Health and Security	\$6.90	\$7.15
National Pension	\$3.05	
Joint Education Trust	\$0.02	
JATC	\$0.30	

APPRENTICE RATES

(Registered apprentices indentured before July 1, 2010, stay at current apprentice rate until completed)

Pre-Apprentice	60%	4 th 700 hours	85%
1 st 700 hours	70%	5 th 700 hours	90%
2 nd 700 hours	75%	6 th 700 hours	95%
3 rd 700 hours	80%		

Effective 07/01/10

*(Registered apprentice wage scale shall be as follows, as stated in the Standards of Apprenticeship adopted by
Inland Empire Roofers and Employers Apprenticeship Committee)*

<u>Period</u>	<u>Percentage of Journeyman Wage Rates</u>
1 st 0 - 700 hours	60%
2 nd 700 - 1400 hours	70%
3 rd 1400 - 2100 hours	80%
4 th 2100 - 2800 hours	85%
5 th 2800 - 3500 hours	90%
6 th 3500 - 4200 hours	95%

SHEET METAL APPENDIX A

WAGE RATES

	<u>06/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>
Journeyman	\$32.83	\$33.33	\$33.53
FOREMAN	Journeyman Scale plus 10%		
GENERAL FOREMAN	Journeyman Scale plus 20%		

FRINGE PAYMENTS

<u>JOURNEYMAN</u>	<u>06/01/13</u>	<u>06/01/14</u>	<u>06/01/15</u>
Health and Welfare	\$9.11	\$9.77	\$10.50
Northwest Pension	\$5.07	\$5.27	\$5.54
National Pension	\$1.52		
*Northwest Supplemental Plan ⁽¹⁾	\$0.68		
Local Training Fund	\$0.66		
National Training Fund	\$0.17		
Vacation (Deduct)	\$1.00		
Apprentices at 2 nd year (Deduct)	\$0.50		

⁽¹⁾Contributions for each hour worked:

Foreman	\$0.73
General Foreman	\$0.80

Employee deduction may be added in \$0.50 increments up to \$7.00 with written authorization, employees over the age of 50 may deduct the same up to the maximum of \$9.00.

APPRENTICE RATE

Effective 06/01/2015

<u>Classification</u>	<u>Wage%</u>	<u>Nat'l Pen.</u>	<u>H&W</u>	<u>NW Pen.</u>	<u>NW Supp.</u>	<u>Ntl Tng</u>	<u>APPR</u>	<u>Vac.</u>	<u>Dues</u>	<u>Scholarship</u>
1 st Year - 1st Half	50%	\$0.76	\$9.50	-0-	-0-	\$0.17	\$1.50	-0-	\$0.73	\$0.01
1 st Year - 2 nd Half	55%	\$0.84	\$9.50	\$0.52	\$0.25	\$0.17	\$1.50	-0-	\$0.78	\$0.01
2 nd Year	60%	\$0.91	\$10.50	\$1.40	\$0.28	\$0.17	\$1.50	\$0.50	\$0.86	\$0.01
3 rd Year	70%	\$1.06	\$10.50	\$2.34	\$0.35	\$0.17	\$1.50	\$0.50	\$0.96	\$0.01
4 th Year	75%	\$1.22	\$10.50	\$3.25	\$0.47	\$0.17	\$1.50	\$0.50	\$1.01	\$0.01
5 th Year	85%	\$1.37	\$10.50	\$4.35	\$0.54	\$0.17	\$1.50	\$0.50	\$1.10	\$0.01

NOTE: No voluntary deductions to NW Supplemental Pension allowed until beginning of 6th 6-month period.

**TEAMSTERS
APPENDIX A**

WAGE RATES & FRINGES

<u>GROUP</u>	<u>09/03/07</u>	<u>09/01/08</u>	<u>09/01/12</u>
I	\$20.08	\$20.83	\$22.31
II	\$22.35	\$22.10	\$24.95
III	\$22.39	\$23.14	\$25.06
IV	\$22.68	\$23.43	\$25.39
V	\$22.79	\$23.54	\$25.50
VI	\$22.96	\$23.71	\$25.50
VII	\$23.49	\$24.24	\$26.04
VIII	\$23.82	\$24.57	\$26.36

Foreman or Dispatcher - \$1.00 over highest scale supervised
General Foreman - \$1.50 over highest foreman supervised

Truck-tractor pulling 2 trailers Add \$.10 yardage scale (for second trailer)
Truck-tractor pulling 3 trailers Add \$.20 yardage scale (for second trailer)
Truck pulling Farm, Tilt, Drop, Utility and Pole Trailer, except semi-trucks or Lowboys Add \$.15 over yardage scale

FRINGE PAYMENTS

	<u>09/01/12</u>	<u>01/01/13</u>	<u>01/01/14</u>	<u>01/01/15</u>
Health and Security	\$8.36	\$8.86	\$9.14	\$9.42
Pension	\$5.00*		\$5.45	\$5.89
Training	\$0.25			
Program for Enhanced Early Retirement (P.E.E.R.)	\$0.82		\$0.90	\$0.97

**09/01/12 reflects a diversion of \$0.25 from wage to pension by vote of the membership*

APPRENTICESHIP RATES

0 - 1000 hours	70% Journeyman Rate
1001 - 2000 hours	80% Journeyman Rate
2001 - 3000 hours	90% Journeyman Rate

CLASSIFICATIONS:

GROUP I

Escort Driver or Pilot Car
Helper or Swamper
Pickup hauling employees or material

GROUP III

Bus Driver or employee haul
Flat Bed Truck, dual rear axle
Power Boat hauling employees or material

GROUP IV

Buggy Mobile and similar
Bulk Cement Tanks and Spreader
Power Operated Sweeper
Straddle Carrier (Ross, Hyster, and similar)
Water Tank Truck: 0 - 4,000 gallons

GROUP VI

A-Frame
Service Greaser
Tire person
Trucks, side, end, bottom, and articulated end dump: up to and including 12 yds.
Warehouseperson, to include shipping and receiving
Water Tank Truck, 4,001 - 8,000 gallons

GROUP VIII

Helicopter Pilot, hauling employees or materials
Lowboy, over 50 tons
Prime Movers and Stinger Truck
Transit Mixers and Trucks hauling concrete, over 20 yds.
Trucks, side, end, bottom, and articulated end dump, over 100 yds.

GROUP II

Ambulance Driver (when in operation)
Fish Truck
Flat Bed Truck, single rear axle
Fork Lift, 3,000 lbs. and under
Leverperson, loading trucks at bunkers
Seeder and Mulcher
Shop Mechanic
Stationary Fuel Operator
Team Driver
Tractor (small, rubber-tired, pulling trailer or similar equipment)
Trailer Mounted Hydro Seeder and Mulcher
Water Tank Truck, up to 1,800 gallons

GROUP V

Auto Crane: 2,000 lbs. capacity
Dumptor: 6 yds. and under
Flat Bed Truck with hydraulic system
Fork Lift: 3,001-16,000 lbs.
Fuel Truck Driver, Steam Cleaner, and Washer
Rubber-tired Tunnel Jumbo
Scissors Truck
Slurry Truck Driver
Transit Mixers and Mixers hauling concrete: 3 yds. to and including 6 yds.
Wrecker and Tow Truck

GROUP VII

Dumps, semi-end
Flaherty Spreader Box Driver
Flowboys
Fork Lift, 16,000 lbs. and over
Lowboy, 50 tons and under
Mechanic, Field
Oil Distributor Driver (road, bootperson, leverperson, helper) and Oil Tank Driver
Self-loading Roll Off and Dumpster over 6 yds.
Semi-truck and Trailer, 50 tons and under Lowboy
Stringer Truck (cable operated trailer)
*Tractor with Steer Trailer *(both Operators to receive same rate and not to conflict with DW's and similar classification Group VI pulling trailer)
Transfer Truck and Trailer
Transit Mixers and Trucks Hauling Concrete: over 6 yds. to and including 20 yds
Truck and Pup
Trucks, side, end, bottom, and articulated end dump: over 12 yds. to and incl. 100 yds.
Truck-mounted Crane (with load-bearing surface, either mounted or pulled) up to 14 tons
Turnarocker, DW's and similar, with 2 or more 4 wheel-power tractor with trailer, gallonage or yardage scale, whichever is greater
Vacuum Truck (super sucker, guzzler, etc.)
Water Tank Truck, 8,001 - 14,000 gallons

IMPLEMENTATION OF THE HANFORD SITE STABILIZATION AGREEMENT

(a) The Hanford Site Stabilization Agreement (HSSA) for all construction work for the U. S. Department of Energy (DOE) at the Hanford Site, which is referenced in this Clause, consists of a Basic Agreement dated September 10, 1984, plus Appendix A, both of which may be periodically amended. The HSSA is hereby incorporated into this Contract by reference. The Contractor is responsible for obtaining the most current text from DOE.

(b) This Clause applies to employees performing work under Contracts (or subcontracts) administered by DOE which are subject to the *Davis-Bacon Act*, in the classifications set forth in the HSSA for work performed at the Hanford Site.

(c) Contractors and subcontractors at all tiers who are parties to an agreement(s) for construction work with a Local Union having jurisdiction over DOE construction work performed at the Hanford Site, or who are parties to a national labor agreement for such construction work, shall become signatory to the HSSA and shall abide by all of its provisions, including its Appendix A. Subcontractors at all tiers who have subcontracts with a signatory Contractor or subcontractor shall become signatory to the HSSA and shall abide by all of its provisions, including its Appendix A.

(d) Contractors and subcontractors at all tiers who are not signatory to the HSSA and who are not required under paragraph (c) above to become signatory to the HSSA, shall pay not less and no more than the wages, fringe benefits, and other employee compensation set forth in Appendix A thereto and shall adhere, except as otherwise directed by the Contracting Officer, to the following provisions of the Agreement:

- (1) Article VII Employment (Section 2 only);
- (2) Article XII Non-Signatory Contractor Requirements;
- (3) Article XIII Hours of Work, Shifts, and Overtime;
- (4) Article XIV Holidays;
- (5) Article XV Wage Scales and Fringe Benefits (Sections 1 and 2 only);
- (6) Article XVII Payment of Wages-Checking In and Out (Section 3 only);
- (7) Article XX General Working Conditions; and
- (8) Article XXI Safety and Health.

(e) The Contractor agrees to make no contributions in connection with this Contract to Industry Promotion Funds, or similar funds, except with the prior approval of the Contracting Officer.

(f) The obligation of the Contractor and its subcontractors to pay fringe benefits shall be discharged by making payments required by this Contract in accordance with the provisions of the amendments to the *Davis-Bacon Act* contained in the Act of July 2, 1964 (Public Law 88-349-78 Statutes 238-239), and U.S. Department of Labor regulations in implementation thereof (Code of Federal Regulations Title 29 Parts 1 and 5).

(g) The Contracting Officer may direct the Contractor to pay amounts for wages, fringe benefits, and other employee compensation if the HSSA, including its Appendix A, is modified by the involved parties.

(h) In the event of failure to comply with paragraphs (c) (d) (e) (f) and (g), or failure to perform any of the obligations imposed upon the Contractor and its subcontractors hereunder, the

Contracting Officer may withhold any payments due to the Contractor and may terminate the Contract for default.

(i) The rights and remedies of the Government provided in this Clause shall not be exclusive and are in addition to any other rights and remedies of the Government provided by law or under this Contract.

(j) The requirements of this Clause are in addition to, and shall not relieve the Contractor of, any obligation imposed by other Clauses of this Contract, including Section I Clauses entitled, *FAR 52.222-4, Contract Work Hours and Safety Standards Act—Overtime Compensation, FAR 52.222-6, Davis-Bacon Act, FAR 52.222-7, Withholding of Funds, FAR 52.222-8, Payrolls and Basic Records, FAR 52.222-10, Compliance with Copeland Act Requirements, and FAR 52.222-12, Contract Termination – Debarment.*

(k) The Contractor agrees to maintain its bid or proposal records showing rates and amounts used for computing wages and other compensation, and its payroll and personnel records during the course of work subject to this Clause, and to preserve such records for a period of three (3) years thereafter, for all employees performing such work. Such records will contain the name and address of each such employee, his/her correct classification, rate of pay, daily and weekly number of hours worked, and dates and hours of the day within which work was performed, deductions made, and amounts for wages and other compensation covered by paragraphs (c) (d) (e) (f) and (g) hereof. The Contractor agrees to make these records available for inspection by the Contracting Officer and will permit him/her to interview employees during working hours on the job.

(l) The Contractor agrees to insert the provisions of this Clause including this paragraph (k) in all subcontracts for the performance of work subject to the *Davis-Bacon Act*.

A copy of the *Hanford Site Stabilization Agreement* is located at: <http://www.hanford.gov>

The U.S. Department of Labor wage determinations for the *Davis-Bacon Act* and *Service Contract Act* are located at: <http://www.wdol.gov>



Installation, Operation, and Maintenance

Series R[®] Air-Cooled Helical Rotary Liquid Chillers



⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.



Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠ WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury. It could also be used to alert against unsafe practices.

NOTICE Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs such as HCFCs and HFCs.

Important Responsible Refrigerant Practices

Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠ WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring **MUST** be performed by qualified personnel. Improperly installed and grounded field wiring poses **FIRE** and **ELECTROCUTION** hazards. To avoid these hazards, you **MUST** follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes.

⚠ WARNING

Personal Protective Equipment (PPE) Required!

Installing/servicing this unit could result in exposure to electrical, mechanical and chemical hazards.

- Before installing/servicing this unit, technicians **MUST** put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). **ALWAYS** refer to appropriate Material Safety Data Sheets (MSDS)/Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.
- When working with or around hazardous chemicals, **ALWAYS** refer to the appropriate MSDS/SDS and OSHA/GHS (Global Harmonized System of Classification and Labeling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.
- If there is a risk of energized electrical contact, arc, or flash, technicians **MUST** put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, **PRIOR** to servicing the unit. **NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

Failure to follow instructions could result in death or serious injury.

Factory Warranty Information

Compliance with the following is required to preserve the factory warranty:

All Unit Installations

Startup **MUST** be performed by Trane, or an authorized agent of Trane, to **VALIDATE** this **WARRANTY**. Contractor must provide a two-week startup notification to Trane (or an agent of Trane specifically authorized to perform startup).

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Revision History

RTAC-SVX01M-EN (30 Jan 2015)

- Correction to Model Number digit 5-7.
- Addition of seismic isolator option.
- Removal of duplicated information found in other locations (nameplate, catalog, submittal).
- Removal of detailed communication system information found in controls documents.



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Model Number Description

Nameplates

The RTAC outdoor unit nameplates are applied to the exterior of the Control Panel. A compressor nameplate is located on each compressor. When the unit arrives, if unit is not covered with a tarp, compare all nameplate data with ordering, submittal, and shipping information.

Outdoor Unit Nameplate

See [Figure 1, p. 6](#) for a typical unit nameplate. The outdoor unit nameplate provides the following information:

- Unit model and size description.
- Unit serial number.
- Identifies unit electrical requirements.
- Lists correct operating charges of R-134a and refrigerant oil (Trane OIL00048).
- Lists unit test pressures.
- Identifies installation, operation and maintenance and service data literature (Pueblo).
- Lists drawing numbers for unit wiring diagrams (Pueblo).

Model Number Coding System

The model numbers for the unit and the compressor are composed of numbers and letters that represent features of the equipment. Shown in the following table is a sample

of typical unit model number and the coding system for each.

Each position, or group of positions, in the model number is used to represent a feature. For example, in the first table, position 08 of the unit model number, Unit Voltage, contains the number "4". A 4 in this position means that the unit voltage is 460/60/3.

Unit Model Number. An example of a typical unit model number (M/N) is:

RTAC 350A UA0N NAFN N1NX 1TEN NN0N N01N

Model number digits are selected and assigned in accordance with the definitions as listed in "[Unit Model Number,](#)" p. 7.

Compressor Nameplate

The compressor nameplate provides following information:

- Compressor model number. See "[Compressor Model Number,](#)" p. 8.
- Compressor serial number. See "[Compressor Serial Number,](#)" p. 8.
- Compressor electrical characteristics.
- Utilization range.
- Recommended refrigerant.

Figure 1. Typical unit nameplate



Model Number Descriptions

Unit Model Number

Digits 1, 2 - Unit Model

RT = Rotary chiller

Digit 3 - Unit Type

A = Air-cooled

Digit 4 - Development Sequence

C = Development sequence

Digits 5, 6 & 7 - Nominal Capacity

120 = 120 Nominal tons
130 = 130 Nominal tons
140 = 140 Nominal tons
155 = 155 Nominal tons
170 = 170 Nominal tons
185 = 185 Nominal tons
200 = 200 Nominal tons
225 = 225 Nominal tons
250 = 250 Nominal tons
275 = 275 Nominal tons
300 = 300 Nominal tons
350 = 350 Nominal tons
375 = 375 Nominal tons
400 = 400 Nominal tons
450 = 450 Nominal tons
500 = 500 Nominal tons

Digit 8 - Unit Voltage

A = 200/60/3
C = 230/60/3
J = 380/60/3
D = 400/50/3
4 = 460/60/3
5 = 575/60/3

Digit 9 - Manufacturing Location

U = Water Chiller Business Unit, Pueblo, CO USA

Digits 10, 11 - Design Sequence

XX = Factory Input

Digit 12 - Unit Basic Configuration

N = Standard efficiency/performance
H = High efficiency/performance
A = Extra efficiency/performance

Digit 13 - Agency Listing

N = No agency listing
U = C/UL listing
S = Seismic rated - IBC and OSHPD
R = C/UL listed and seismic rated

Digit 14 - Pressure Vessel Code

A = ASME pressure vessel code
C = Canadian code
D = Australian code
L = Chinese code

Digit 15 - Evaporator Application

F = Standard (40-60 F) leaving temp
G = Low (Less than 40 F) leaving temp
R = Remote (40-60 F) leaving temp

Digit 16 - Evaporator Configuration

N = 2 pass, 0.75" insulation
P = 3 pass, 0.75" insulation
Q = 2 pass, 1.25" insulation
R = 3 pass, 1.25" insulation

Digit 17 - Condenser Application

N = Standard ambient (25-115°F)
H = High ambient (25-125°F)
L = Low ambient (0-115°F)
W = Wide ambient (0-125°F)

Digit 18 - Condenser Fin Material

1 = Standard aluminum slit fins
2 = Copper fins
4 = CompleteCoat™ epoxy coated fins

Digit 19 - Condenser Fan/Motor Configuration

T = STD fans with TEAO motors
W = Low noise fans

Digit 20 - Compressor Motor Starter Type

X = Across-the-line
Y = Wye-delta closed transition

Digit 21 - Incoming Power Line Connection

1 = Single point power connection
2 = Dual point power connection

Digit 22 - Power Line Connection Type

T = Terminal block connection
D = Non-fused disconnect switch(es)
C = Circuit breaker(s)

Digit 23 - Unit Operator Interface

D = DynaView operator interface

Digit 24 - Remote Operator Interface

N = No remote interface
C = Tracer™ Comm 3 interface
B = BACnet® interface
L = LonTalk® compatible (LCI-C) interface

Digit 25 - Control Input Accessories/Options

N = No remote inputs
R = Ext. evaporator leaving water setpoint
C = Ext. current limit setpoint
B = Ext. leaving water and current limit setpoint

Digit 26 - Control Output Accessories/Options

N = No output options
A = Alarm relay outputs
C = Ice making I/O
D = Alarm relay outputs and ice making I/O

Digit 27 - Electrical Protection Options

0 = No short circuit rating
5 = Default short circuit rating
6 = High amp short circuit rating

Digit 28 - Flow Switch

T = Factory installed flow switch - water
U = Factory installed flow switch glycol

Digit 29 - Control Panel Accessories

N = No convenience outlet
A = 15A 115V convenience outlet (60Hz)

Digit 30 - Service Valves

1 = With suction service valves

Digit 31 - Compressor Sound Attenuation Option

0 = No compressor sound attenuation
1 = Factory installed compressor sound attenuation

Digit 32 - Appearance Options

N = No appearance options
A = Architectural louvered panels
C = Half louvers

Digit 33 - Installation Accessories

N = No installation accessories
F = Flange kit for water connections
R = Neoprene in shear unit isolators
G = Neoprene isolators and flange kit
E = Seismic elastomeric isolation pads
S = Seismic spring isolators



Model Number Descriptions

Digit 34 - Factory Testing Options

- 0 = Standard functional test
- C = Customer-witnessed performance test with report
- C = Customer-witnessed performance test plus Rapid Restart test
- E = Non-witnessed performance test with report

Digit 35 – Control, Label & Literature

- C = Spanish
- E = English
- F = French

Digit 36 – Special Order

- X = Standard unit configuration
- S = Unit has special order feature

Digit 37 – Safety Devices

- N = Standard

Compressor Model Number

Digits 1-3 – Compressor Family

CHH= Positive displacement, refrigerant, helical rotary, hermetic compressor

Digit 4– Compressor Type

- T = GP2+

Digit 5

- 0 = All compressors

Digit 6 – Frame Size

- K = K Frame
- L = L Frame
- M = M Frame
- N = N Frame

Digit 7 – Compressor Capacity

- 3 = GP2+ Smaller capacity (minor)
- 4 = GP2+ Larger capacity (major)

Compressor Serial Number

Digits 1-2 – Year

YY = Last two digits of year of manufacture

Digits 3-4 – Week

WW= Week of build, from 00 to 52

Digit 5 – Day

- 1 = Monday
- 2 = Tuesday
- 3 = Wednesday
- 4 = Thursday
- 5 = Friday
- 6 = Saturday
- 7 = Sunday

Digits 6-8 – Coded Time Stamp

TTT= Used to ensure uniqueness of serial number

Digit 9 – Assembly Line

- L = Varies with facility

Digit 10– Build Location

- A = Monterrey



General Data

Unit Description

The 140 - 500 ton Model RTAC units are helical-rotary type, air-cooled liquid chillers designed for installation outdoors. The compressor circuits are completely assembled, hermetic packages that are factory-piped, wired, leak-tested, dehydrated, and tested for proper control operation before shipment.

Chilled water inlet and outlet openings are covered for shipment. Each compressor has a separate compressor motor starter. The RTAC series features Trane's exclusive Adaptive Control™ logic, which monitors the control variables that govern the operation of the chiller unit. Adaptive Control logic can adjust capacity variables to avoid chiller shutdown when necessary, and keep producing chilled water. The units feature two independent refrigerant circuits. Compressor unloaders are solenoid actuated and oil pressure operated. Each refrigerant circuit is provided with filter, sight glass, electronic expansion valve, and charging valves. The shell-and-tube type evaporator is manufactured in accordance with ASME standards or other international codes. Each evaporator is fully insulated and is equipped with water drain and vent connections. Packaged units have heat tape protection to - 20°F (-28.9°C) as standard. As an option, a convenience outlet can be supplied.

Note: Packaged units are factory charged with refrigerant and oil.

Figure 2. Typical RTAC packaged unit and components



Accessory/Option Information

Check all the accessories and loose parts which are shipped with the unit against the shipping list. Included in these items will be water vessel drain plugs, rigging and electrical diagrams, and service literature, which are placed inside the control panel and/or starter panel for shipment.

Isolator Shipping Location

If optional neoprene isolators (model number digit 33) are ordered with unit, they are shipped mounted on the unit. See Figure 3 and Figure 4.

Figure 3. Isolator shipping locations 140-250T units

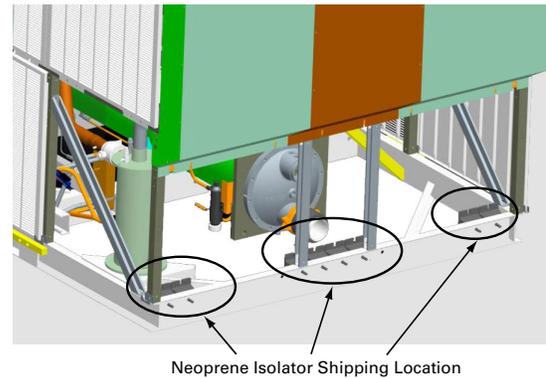
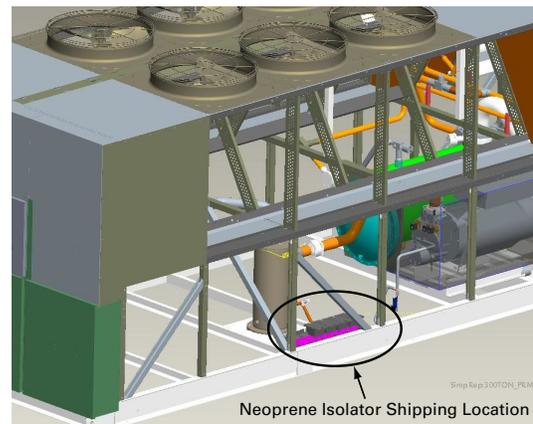


Figure 4. Isolator shipping locations 275-500T units





General Data

Table 1. General Data - 60 hz units - standard efficiency - IP

Size		140	155	170	185	200	225	250	275	300	350	400	450	500
Compressor		Screw												
Quantity	#	2	2	2	2	2	2	2	3	3	3	4	4	4
Nominal size @60Hz	(tons)	70/70	85/70	85/85	100/85	100/100	120/100	120/120	85-85/100	100-100/100	120-120/100	100-100/100-100	120-120/100-100	120-120/120-120
Evaporator		Flooded												
Water storage	(gal)	29	32	34	36	40	39	43	62	67	72	83	86	91
2 pass arrangement														
Min flow	(gpm)	193	214	202	217	241	217	241	309	339	375	404	422	461
Max flow	(gpm)	709	785	741	796	883	796	883	1134	1243	1374	1483	1548	1690
Water conn	(NPS-in)	4	4	6	6	6	6	6	8	8	8	8	8	8
3 pass arrangement														
Min flow	(gpm)	129	143	135	145	161	145	161	206	226	250	270	282	307
Max flow	(gpm)	473	523	494	531	589	531	589	756	829	916	989	1032	1127
Water conn	(NPS-in)	3.5	3.5	4	4	4	4	4	6	6	6	8	8	8
Condenser		Fin and tube												
Qty of coils	#	4	4	4	4	4	4	4	8	8	8	8	8	8
Coil length	(in)	156/156	180/156	180/180	216/180	216/216	252/216	252/252	180/108	216/108	252/108	216/216	252/216	252/252
Coil height	(in)	42	42	42	42	42	42	42	42	42	42	42	42	42
	(mm)	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067
# of rows	#	3	3	3	3	3	3	3	3	3	3	3	3	3
Fins per foot	(fpf)	192	192	192	192	192	192	192	192	192	192	192	192	192
Fan		Direct drive propeller												
Quantity	#	4/4	5/4	5/5	6/5	6/6	7/6	7/7	10/6	12/6	14/6	12/12	14/12	14/14
Diameter	(in)	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Air flow per fan	(cfm)	9625	9394	9209	9209	9209	9210	9210	9209	9209	9208	9209	9210	9214
Power/motor	(hp)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Fan speed	(rpm)	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140
Tip speed	(Ft/min)	8954	8954	8954	8954	8954	8954	8954	8954	8954	8954	8954	8954	8954
General Unit		HFC-134a												
# Refrig ckts	#	2	2	2	2	2	2	2	2	2	2	2	2	2
% min load	%	15	15	15	15	15	15	15	15	15	15	15	15	15
Refrigerant charge	(lb)	165/165	175/165	175/175	215/210	215/215	225/215	225/225	365/200	415/200	460/200	415/415	460/415	460/460
Oil charge	(gal)	1.3/1.3	1.3/1.3	1.3/1.3	1.9/1.3	1.9/1.9	1.9/1.9	1.9/1.9	4.2/1.9	4.6/2.9	4.6/1.9	4.6/4.6	4.6/4.6	4.6/4.6
Min ambient-std	(°F)	25	25	25	25	25	25	25	25	25	25	25	25	25
Min ambient-low	(°F)	0	0	0	0	0	0	0	0	0	0	0	0	0

1. Data containing information on two circuits is shown as follows: ckt 1/ ckt 2.
2. Minimum start-up/operating ambient is based on a 5 mph wind across the condenser.
3. RTAC units must only operate with refrigerant R-134a and Trane Oil 00048.

Table 2. General Data - 60 hz units - high efficiency - IP

Size		140	155	170	185	200	225	250	275	300	350	400
Compressor		Screw										
Quantity	#	2	2	2	2	2	2	2	3	3	4	4
Nominal size @60Hz	(tons)	70/70	85/70	85/85	100/85	100/100	120/100	120/120	85-85/100	100-100/100	85-85/85/85	100-100/100-100
Evaporator		Flooded										
Water storage	(gal)	34	36	40	39	43	43	43	72	72	83	91
2 pass arrangement												
Min flow	(gpm)	202	217	241	217	241	241	241	375	375	404	461
Max flow	(gpm)	741	796	883	796	883	883	883	1374	1374	1483	1690
Water conn	(NPS-in)	6	6	6	6	6	6	6	8	8	8	8
3 pass arrangement												
Min flow	(gpm)	135	145	161	145	161	161	161	250	250	270	307
Max flow	(gpm)	494	531	589	531	589	589	589	916	916	989	1127
Water conn	(NPS-in)	4	4	4	4	4	4	4	6	6	8	8
Condenser		Fin and tube										
Qty of coils	#	4	4	4	4	4	8	8	8	8	8	8
Coil length	(in)	180/180	216/180	216/216	252/216	252/252	144/144	144/144	216/144	252/144	216/216	252/252
Coil height	(in)	42	42	42	42	42	42	42	42	42	42	42
Number of rows	#	3	3	3	3	3	3	3	3	3	3	3
Fins per foot	(fpf)	192	192	192	192	192	192	192	192	192	192	192
Fan		Direct drive propeller										
Quantity	#	5/5	6/5	6/6	7/6	7/7	8/6	8/8	12/6	14/6	12/12	14/14
Diameter	(in)	30	30	30	30	30	30	30	30	30	30	30
Air flow/fan	(cfm)	9199	9199	9199	9200	9201	9783	9203	9652	9605	9199	9201
Power/motor	(hp)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Fan speed	(rpm)	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140	1140
Tip speed	(Ft/Min)	8954	8954	8954	8954	8954	8954	8954	8954	8954	8954	8954
General unit		HFC-134a										
# Refrig ckts	#	2	2	2	2	2	2	2	2	2	2	2
% min load	%	15	15	15	15	15	15	15	15	15	15	15
Refrigerant charge	(lb)	175/175	215/205	215/215	225/215	225/225	235/235	235/235	415/200	460/200	415/415	460/460
Oil charge	(gal)	1.3/1.3	1.3/1.3	1.3/1.3	1.9/1.3	1.9/1.9	1.9/1.9	1.9/1.9	2.1-2.1/1.9	2.3-2.3/1.9	2.1-2.1/2.1-2.1	2.3-2.3/2.3-2.3
Min ambient-std	(°F)	25	25	25	25	25	25	25	25	25	25	25
Min ambient-low	(°F)	0	0	0	0	0	0	0	0	0	0	0

1. Data containing information on two circuits is shown as follows: ckt 1/ ckt 2.
2. Minimum start-up/operating ambient is based on a 5 mph wind across the condenser.
3. RTAC units must only operate with refrigerant R-134a and Trane Oil 00048.



General Data

Table 3. General Data - 60 hz units - extra efficiency - IP

Size		140	155	170	185	200	250	275	300	350
Compressor		Screw								
Quantity	#	2	2	2	2	2	3	3	4	4
Nominal size @60Hz	(tons)	70/70	85/70	85/85	100/85	100/100	70-70/85	85-85/85	70-70/70-70	85-85/85-85
Evaporator		Flooded								
Water storage	(gal)	40	39	43	43	43	72	72	83	91
2 pass arrangement										
Min flow	(gpm)	241	217	241	241	241	375	375	404	461
Max flow	(gpm)	883	796	883	883	883	1374	1374	1483	1690
Water conn	(NPS-in)	6	6	6	6	6	8	8	8	8
3 pass arrangement										
Min flow	(gpm)	161	145	161	161	161	250	250	270	307
Max flow	(gpm)	589	531	589	589	589	916	916	989	1127
Water conn	(NPS-in)	4	4	4	4	4	6	6	8	8
Condenser		Fin and tube								
Qty of coils	#	4	4	4	8	8	8	8	8	8
Coil length	(in)	216/216	252/216	252/252	144/144	144/144	216/144	252/144	216/216	252/252
Coil height	(in)	42	42	42	42	42	42	42	42	42
Number of rows	#	3	3	3	3	3	3	3	3	3
Fins per foot	(fpf)	192	192	192	192	192	192	192	192	192
Fan		Direct drive propeller								
Quantity	#	6/6	7/6	7/7	8/6	8/8	12/6	14/6	12/12	14/14
Diameter	(in)	30	30	30	30	30	30	30	30	30
Air flow/fan	(cfm)	9199	9200	9201	9783	9203	9652	9605	9199	9201
Power/motor	(hp)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Fan speed	(rpm)	1140	1140	1140	1140	1140	1140	1140	1140	1140
Tip speed	(Ft/Min)	8954	8954	8954	8954	8954	8954	8954	8954	8954
General unit		HFC-134a								
# Refrig ckts	#	2	2	2	2	2	2	2	2	2
% min load	%	15	15	15	15	15	15	15	15	15
Refrigerant charge	(lb)	215/215	225/215	225/225	235/235	235/235	415/200	460/200	415/415	460/460
Oil charge	(gal)	1.3/1.3	1.9/1.3	1.9/1.9	1.9/1.9	1.9/1.9	2.1-2.1/1.9	2.1-2.1/1.9	2.1-2.1/2.1-2.1	2.1-2.1/2.1-2.1
Min ambient-std	(°F)	25	25	25	25	25	25	25	25	25
Min ambient-low	(°F)	0	0	0	0	0	0	0	0	0

1. Data containing information on two circuits is shown as follows: ckt 1/ ckt 2.
2. Minimum start-up/operating ambient is based on a 5 mph wind across the condenser.
3. RTAC units must only operate with refrigerant R-134a and Trane Oil 00048.

Table 4. General Data - 60 hz units - standard efficiency - SI

Size		140	155	170	185	200	225	250	275	300	350	400	450	500
Compressor		Screw												
Quantity	#	2	2	2	2	2	2	2	3	3	3	4	4	4
Nominal size (tons) @60Hz		70/70	85/70	85/85	100/85	100/100	120/100	120/120	85-85/100	100-100/100	120-120/100	100-100/100-100	120-120/100-100	120-120/120-120
Evaporator		Flooded												
Water storage	(L)	110.0	121	129	136	151	148	163	235	254	273	314	326	344
2 pass arrangement														
Min flow	(L/s)	12	14	13	14	15	14	15	19	21	24	25	27	29
Max flow	(L/s)	45	50	47	50	56	50	56	72	78	87	94	98	107
Water conn (NPS-in)		4	4	6	6	6	6	6	8	8	8	8	8	8
3 pass arrangement														
Min flow	(L/s)	8	9	9	9	10	9	10	13	14	16	17	18	19
Max flow	(L/s)	30	33	31	34	37	34	37	48	52	58	62	65	71
Water conn (NPS-in)		3.5	3.5	4	4	4	4	4	6	6	6	8	8	8
Condenser		Fin and tube												
Qty of coils	#	4	4	4	4	4	4	4	8	8	8	8	8	8
Coil length	(mm)	3962/3962	4572/3962	4572/4572	5486/4572	5486/5486	6400/5486	6400/6400	4572/2743	5486/2743	6400/2743	5486/5486	6400/5486	6400/6400
Coil height	(mm)	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067
# of rows	#	3	3	3	3	3	3	3	3	3	3	3	3	3
Fins per foot	(fpf)	192	192	192	192	192	192	192	192	192	192	192	192	192
Fan		Direct drive propeller												
Quantity	#	4/4	5/4	5/5	6/5	6/6	7/6	7/7	10/6	12/6	14/6	12/12	14/12	14/14
Diameter	(mm)	726.0	726.0	726.0	726.0	726.0	726.0	726.0	726.0	726.0	726.0	726.0	726.0	726.0
Air flow per fan	(m ³ /hr)	16351	15958	15644	15644	15644	15646	15647	15644	15645	15642	15645	15646	15653
Power/motor	(kW)	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12
Fan speed	(rps)	19	19	19	19	19	19	19	19	19	19	19	19	19
Tip speed	M/S	45	45	45	45	45	45	45	45	45	45	45	45	45
General Unit		HFC-134a												
# Refrig ckts	#	2	2	2	2	2	2	2	2	2	2	2	2	2
% min load	%	15	15	15	15	15	15	15	15	15	15	15	15	15
Refrigerant charge	(kg)	75/75	79/75	79/79	98/95	98/98	102/98	102/102	166/91	188/91	209/91	188/188	209/188	209/209
Oil charge	(L)	5/5	5/5	5/5	7/5	7/7	7/7	7/7	8-8/7	9-9/11	9-9/11	9-9/9-9	9-9/9-9	9-9/9-9
Min ambient-std	(°C)	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9
Min ambient-low	(°C)	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8

1. Data containing information on two circuits is shown as follows: ckt 1/ ckt 2.
2. Minimum start-up/operating ambient is based on a 5 mph wind across the condenser.
3. RTAC units must only operate with refrigerant R-134a and Trane Oil 00048.



General Data

Table 5. General Data - 60 hz units - high efficiency - SI

Size		140	155	170	185	200	225	250	275	300	350	400
Compressor		Screw										
Quantity	#	2	2	2	2	2	2	2	4	4	4	4
Nominal size @60Hz	(tons)	70/70	85/70	85/85	100/85	100/100	70-70/85	85-85/85	70-70/70-70	85-85/85-85	85-85/85/85	100-100/100-100
Evaporator		Flooded										
Water storage	(L)	129	136	151	148	163	163	163	273	273	314	344
2 Pass arrangement												
Min flow	(L/s)	13	14	15	14	15	15	15	24	24	25	29
Max flow	(L/s)	47	50	56	50	56	56	56	87	87	94	107
Water conn	(NPS-in)	6	6	6	6	6	6	6	8	8	8	8
3 Pass arrangement												
Min flow	(L/s)	9	9	10	9	10	10	10	16	16	17	19
Max flow	(L/s)	31	34	37	34	37	37	37	58	58	62	71
Water conn	(NPS-in)	4	4	4	4	4	4	4	6	6	8	8
Condenser		Fin and tube										
Qty of coils	#	4	4	4	4	4	8	8	8	8	8	8
Coil length	(mm)	4572/4572	5486/4572	5486/5486	6400/5486	6400/6400	3657/3657	3657/3657	5486/3657	6400/3657	5486/5486	6400/6400
Coil height	(mm)	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067
Number of rows	#	3	3	3	3	3	3	3	3	3	3	3
Fins per foot	(fpf)	192	192	192	192	192	192	192	192	192	192	192
Fan		Direct drive propeller										
Quantity	#	5/5	6/5	6/6	7/6	7/7	8/6	8/8	12/6	14/6	12/12	14/14
Diameter	(mm)	762	762	762	762	762	762	762	762	762	762	762
Air per fan	(m ³ /hr)	15628	15628	15628	15629	15631	16619	15634	16397	16317	15628	15631
Power/motor	(kW)	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12
Fan speed	(rps)	19	19	19	19	19	19	19	19	19	19	19
Tip speed	M/S	45	45	45	45	45	45	45	45	45	45	45
General unit		HFC-134a										
# refrig ckts	#	2	2	2	2	2	2	2	2	2	2	2
% min load	%	15	15	15	15	15	15	15	15	15	15	15
Refrig charge	(kg)	79/79	98/93	98/98	102/98	102/102	107/107	107/107	188/91	209/91	188/188	209/209
Oil charge	(L)	5/5	5/5	5/5	7/5	7/7	7/7	7/7	8-8/7	9-9/7	8-8/8-8	9-9/9-9
Min ambient-std	(°C)	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9
Min ambient-low	(°C)	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8

1. Data containing information on two circuits is shown as follows: ckt 1/ ckt 2.
2. Minimum start-up/operating ambient is based on a 5 mph wind across the condenser.
3. RTAC units must only operate with refrigerant R-134a and Trane Oil 00048.

Table 6. General Data - 60 hz units - extra efficiency - SI

Size		140	155	170	185	200	250	275	300	350
Compressor										
Quantity	#	2	2	2	2	2	3	3	4	4
Nominal size @60Hz	(tons)	85/85	100/85	100/100	120/100	120/120	85-85/100	100-100/100	85-85/85/85	100-100/100-100
Evaporator										
						Flooded				
Water storage	(L)	151	148	163	163	163	273	273	314	344
2 Pass arrangement										
Min flow	(L/s)	15	14	15	15	15	24	24	25	29
Max flow	(L/s)	56	50	56	56	56	87	87	94	107
Water conn	(NPS-in)	6	6	6	6	6	8	8	8	8
3 Pass arrangement										
Min flow	(L/s)	10	9	10	10	10	16	16	17	19
Max flow	(L/s)	37	34	37	37	37	58	58	62	71
Water conn	(NPS-in)	4	4	4	4	4	6	6	8	8
Condenser										
						Fin and tube				
Qty of coils	#	4	4	4	8	8	8	8	8	8
Coil length	(mm)	5486/5486	6400/5486	6400/6400	3657/3657	4572/2743	5486/3657	6400/3657	5486/5486	6400/6400
Coil height	(mm)	1067	1067	1067	1067	1067	1067	1067	1067	1067
Number of rows	#	3	3	3	3	3	3	3	3	3
Fins per foot	(fpf)	192	192	192	192	192	192	192	192	192
Fan										
						Direct drive propeller				
Quantity	#	6/6	7/6	7/7	8/6	8/8	12/6	14/6	12/12	14/14
Diameter	(mm)	762	762	762	762	762	762	762	762	762
Air per fan	(m ³ /hr)	15628	15629	15631	16619	15634	16397	16317	15628	15631
Power/motor	(kW)	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12	1.12
Fan speed	(rps)	19	19	19	19	19	19	19	19	19
Tip speed	M/S	45	45	45	45	45	45	45	45	45
General unit										
						HFC-134a				
# refrig ckts	#	2	2	2	2	2	2	2	2	2
% min load	%	15	15	15	15	15	15	15	15	15
Refrig charge	(kg)	98/98	102/98	102/102	107/107	107/107	188/91	209/91	188/188	209/209
Oil charge	(L)	5/5	7/5	7/7	7/7	7/7	8-8/7	8-8/7	8-8/8-8	8-8/8-8
Min ambient-std	(°C)	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9
Min ambient-low	(°C)	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8

1. Data containing information on two circuits is shown as follows: ckt 1/ ckt 2.
2. Minimum start-up/operating ambient is based on a 5 mph wind across the condenser.
3. RTAC units must only operate with refrigerant R-134a and Trane Oil 00048.



General Data

Table 7. General Data - 50 hz units - standard efficiency - IP

Size		140	155	170	185	200	250	275	300	350	375	400
Compressor		Screw										
Quantity	#	2	2	2	2	2	3	3	3	4	4	4
Nominal size@50Hz	(tons)	70/70	85/70	85/85	100/85	100/100	70-70 / 100	85-85 / 100	100-100/ 100	85-85/ 85-85	100-100/ 85-85	100-100/ 100-100
Evaporator		Flooded										
Water storage	(gal)	29	32	34	36	40	56	62	67	75	79	83
2 pass arrangement												
Min flow	(gpm)	193	214	202	217	241	265	309	339	351	381	404
Max flow	(gpm)	709	785	741	796	883	970	1134	1243	1287	1396	1483
Water conn	(NPS-in)	4	4	6	6	6	8	8	8	8	8	8
3 pass arrangement												
Min flow	(gpm)	129	143	135	145	161	176	206	226	234	254	270
Max flow	(gpm)	473	523	494	531	589	647	756	829	858	930	989
Water conn	(NPS-in)	3.5	3.5	4	4	4	6	6	6	8	8	8
Condenser		Fin and tube										
Qty of coils	#	4	4	4	4	4	8	8	8	8	8	8
Coil length	(in)	156/156	180/156	180/180	216/180	216/216	156/108	180/108	216/108	180/180	216/180	216/216
Coil height	(in)	42	42	42	42	42	42	42	42	42	42	42
Number of rows	#	3	3	3	3	3	3	3	3	3	3	3
Fins per foot	(fpf)	192	192	192	192	192	192	192	192	192	192	192
Fan		Direct drive propeller										
Quantity	#	4/4	5/4	5/5	6/5	6/5	8/6	10/6	12/6	10/10	12/10	12/12
Diameter	(in)	30	30	30	30	30	30	30	30	30	30	30
Air flow per fan	(cfm)	7918	7723	7567	7567	7567	7764	7566	7567	7567	7567	7567
Power per motor	(hp)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Fan speed	(rpm)	950	950	950	950	950	950	950	950	950	950	950
Tip speed	(Ft/min)	7461	7461	7461	7461	7461	7461	7461	7461	7461	7461	7461
General unit		HFC-134a										
# refrig ckts	#	2	2	2	2	2	2	2	2	2	2	2
% min load	%	15	15	15	15	15	15	15	15	15	15	15
Refrig charge	(lb)	175/175	215/205	215/215	225/215	225/225	235/235	235/235	415/200	460/200	415/415	460/460
Oil charge	(gal)	1.3/1.3	1.3/1.3	1.3/1.3	1.9/1.3	1.9/1.9	2.1-2.1/ 1.9	2.1-2.1/ 1.9	2.3-2.3/ 1.9	2.1-2.1/ 2.1-2.1	2.3-2.3/ 2.1-2.1	2.3-2.3/ 2.3-2.3
Min ambient-std	(°F)	25	25	25	25	25	25	25	25	25	25	25
Min ambient-low	(°F)	0	0	0	0	0	0	0	0	0	0	0

1. Data containing information on two circuits is shown as follows: ckt 1/ ckt 2.
2. Minimum start-up/operating ambient is based on a 5 mph wind across the condenser.
3. RTAC units must only operate with refrigerant R-134a and Trane Oil 00048.

Table 8. General Data - 50 hz units - high efficiency - IP

Size		120	130	140	155	170	185	200	250	275	300	350	375	400
Compressor		Screw												
Quantity	#	2	2	2	2	2	2	2	3	3	3	4	4	4
Nominal size@50Hz	(tons)	60/60	70/60	70/70	85/70	85/85	100/85	100/100	70-70 / 100	85-85 / 100	100-100/ 100	85-85 / 85-85	100-100/ 85-85	100-100/ 100-100
Evaporator		Flooded												
Water storage	(gal)	29	32	34	36	40	39	43	67	72	72	83	86	91
2 pass arrangement														
Min flow	(gpm)	193	214	202	217	241	217	241	339	375	375	404	422	461
Max flow	(gpm)	709	785	741	796	883	796	883	1243	1374	1374	1483	1548	1690
Water conn	(NPS-in)	4	4	6	6	6	6	6	8	8	8	8	8	8
3 pass arrangement														
Min flow	(gpm)	129	143	135	145	161	145	161	226	250	250	270	282	307
Max flow	(gpm)	473	523	494	531	589	531	589	829	916	916	989	1032	1127
Water conn	(NPS-in)	3.5	3.5	4	4	4	4	4	6	6	6	8	8	8
Condenser		Fin and tube												
Qty of coils	#	4	4	4	4	4	4	4	8	8	8	8	8	8
Coil length	(in)	156/ 156	180/ 156	180/ 180	216/ 180	216/ 216	252/ 216	252/ 252	180/108	216/144	252/144	216/216	252/216	252/252
Coil height	(in)	42	42	42	42	42	42	42	42	42	42	42	42	42
Number of rows	#	3	3	3	3	3	3	3	3	3	3	3	3	3
Fins per foot	(fpf)	192	192	192	192	192	192	192	192	192	192	192	192	192
Fan		Direct drive propeller												
Quantity	#	4/4	5/4	5/5	6/5	6/6	7/6	7/7	10/6	12/6	14/6	12/12	14/12	14/14
Diameter	(in)	30	30	30	30	30	30	30	30	30	30	30	30	30
Air flow per fan	(cfm)	62484	68819	7558	7557	7557	7558	7559	7561	7943	7906	7557	7490	7559
Power/motor	(hp)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Fan speed	(rpm)	950	950	950	950	950	950	950	950	950	950	950	950	950
Tip speed	(Ft/min)	7461	7461	7461	7461	7461	7461	7461	7461	7461	7461	7461	7461	7461
General unit		HFC-134a												
# refrig ckts	#	2	2	2	2	2	2	2	2	2	2	2	2	2
% min load	%	15	15	15	15	15	15	15	15	15	15	15	15	15
Refrig charge	(lb)	165/ 165	175/ 165	175/ 175	215/ 205	215/ 215	225/ 215	225/ 225	365/200	415/ 200	460/ 200	415/ 415	460/ 415	460/ 460
Oil charge	(gal)	1.3/1.3	1.3/1.3	1.3/1.3	1.3/1.3	1.3/1.3	1.9/1.3	1.9/1.9	2.1-2.1/ 1.9	2.1-2.1/ 1.9	2.3-2.3/ 1.9	2.1-2.1/ 2.1-2.1	2.3-2.3/ 2.3-2.3	2.3-2.3/ 2.3-2.3
Min ambient-std	(°F)	25	25	25	25	25	25	25	25	25	25	25	25	25
Min ambient-low	(°F)	0	0	0	0	0	0	0	0	0	0	0	0	0

1. Data containing information on two circuits is shown as follows: ckt 1/ ckt 2.
2. Minimum start-up/operating ambient is based on a 5 mph wind across the condenser.
3. RTAC units must only operate with refrigerant R-134a and Trane Oil 00048.



General Data

Table 9. General Data - 50 hz units - standard efficiency - SI

Size		140	155	170	185	200	250	275	300	350	375	400
Compressor		Screw										
Quantity	#	2	2	2	2	2	3	3	3	4	4	4
Nominal size@50Hz	(tons)	70/70	85/70	85/85	100/85	100/100	70-70 / 100	85-85 / 100	100-100/ 100	85-85/ 85-85	100-100/ 85-85	100-100/ 100-100
Evaporator		Flooded										
Water storage	(L)	110	121	129	136	151	212	235	254	284	299	314
2 pass arrangement												
Min flow	(L/s)	12	14	13	14	15	17	19	21	22	24	25
Max flow	(L/s)	45	50	47	50	56	61	72	78	81	88	94
Water conn	(NPS-in)	4	4	6	6	6	8	8	8	8	8	8
3 pass arrangement												
Min flow	(L/s)	8	9	9	9	10	11	13	14	15	16	17
Max flow	(L/s)	30	33	31	34	37	41	48	52	54	59	62
Water conn	(NPS-in)	3.5	3.5	4	4	4	6	6	6	8	8	8
Condenser		Fin and tube										
Qty of coils	#	4	4	4	4	4	8	8	8	8	8	8
Coil length	(mm)	3962/ 3962	4572/ 3962	4572/ 4572	5486/ 4572	5486/ 5486	3962/ 2743	4572/ 2743	5486/ 2743	4572/ 4572	5486/ 4572	5486/ 5486
Coil height	(mm)	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067
Number of rows	#	3	3	3	3	3	3	3	3	3	3	3
Fins per foot	(fpf)	192	192	192	192	192	192	192	192	192	192	192
Fan		Direct drive propeller										
Quantity	#	4/4	5/4	5/5	6/5	6/6	8/6	10/6	12/6	10/10	12/10	12/12
Diameter	(mm)	762	762	762	762	762	762	762	762	762	762	762
Air flow per fan	(m ³ /hr)	13452	13120	12855	12855	12855	13190	12853	12856	12854	12855	12855
Power per motor	(kW)	.74	.74	.74	.74	.74	.74	.74	.74	.74	.74	.74
Fan speed	(rps)	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8
Tip speed	M/S	38	38	38	38	38	38	38	38	38	38	38
General unit		HFC-134a										
# refriger ckt	#	2	2	2	2	2	2	2	2	2	2	2
% min load	%	15	15	15	15	15	15	15	15	15	15	15
Refriger charge	(kg)	79/79	98/93	98/98	102/98	102/102	107/107	107/107	188/91	209/91	188/188	209/209
Oil charge	(L)	5/5	5/5	5/5	7/5	7/7	8-8/7	8-8/7	8-8/7	8-8/8-8	9-9/8-8	9-9/9-9
Min ambient-std	(°C)	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9
Min ambient-low	(°C)	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8

1. Data containing information on two circuits is shown as follows: ckt 1/ ckt 2.
2. Minimum start-up/operating ambient is based on a 5 mph wind across the condenser.
3. RTAC units must only operate with refrigerant R-134a and Trane Oil 00048.

Table 10. General Data - 50 hz units - high efficiency - SI

Size		120	130	140	155	170	185	200	250	275	300	350	375	400
Compressor		Screw												
Quantity	#	2	2	2	2	2	2	2	3	3	3	4	4	4
Nominal size@50Hz	(tons)	60/60	70/60	70/70	85/70	85/85	100/85	100/100	70-70 / 100	85-85 / 100	100-100/ 100	85-85 / 85-85	100-100/ 85-85	100-100/ 100-100
Evaporator		Flooded												
Water storage	(L)	110	121	129	136	151	148	163	254	273	273	314	326	344
2 pass arrangement														
Min flow	(L/s)	12	14	13	14	15	14	15	21	24	24	25	27	29
Max flow	(L/s)	45	50	47	50	56	50	56	78	87	87	94	98	107
Water conn	(NPS-in)	4	4	6	6	6	6	6	8	8	8	8	8	8
3 pass arrangement														
Min flow	(L/s)	8	9	9	9	10	9	10	14	16	16	17	18	19
Max flow	(L/s)	30	33	31	34	37	34	37	52	58	58	62	65	71
Water conn	(NPS-in)	3.5	3.5	4	4	4	4	4	6	6	6	8	8	8
Condenser		Fin and tube												
Qty of coils	#	4	4	4	4	4	4	4	8	8	8	8	8	8
Coil length	(mm)	3962/ 3962	4572/ 3962	4572/ 4572	5486/ 4572	5486/ 5486	6400/ 5486	6400/ 6400	4572/ 2743	5486/ 3657	6400/ 3657	5486/ 5486	6400/ 5486	6400/ 6400
Coil height	(mm)	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067	1067
Number of rows	#	3	3	3	3	3	3	3	3	3	3	3	3	3
Fins per foot	(fpf)	192	192	192	192	192	192	192	192	192	192	192	192	192
Fan		Direct drive propeller												
Quantity	#	4/4	5/4	5/5	6/5	6/6	7/6	7/7	10/6	12/6	14/6	12/12	14/12	14/14
Diameter	(mm)	762	762	762	762	762	762	762	762	762	762	762	762	762
Air flow per fan	(m ³ /hr)	62484	68819	12839	12839	12839	12840	12842	12844	13493	13430	12838	12724	12841
Power/motor	(kW)	.74	.74	.74	.74	.74	.74	.74	.74	.74	.74	.74	.74	.74
Fan speed	(rps)	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8	15.8
Tip speed	M/S	38	38	38	38	38	38	38	38	38	38	38	38	38
General unit		HFC-134a												
# refrigerant	#	2	2	2	2	2	2	2	2	2	2	2	2	2
% min load	%	15	15	15	15	15	15	15	15	15	15	15	15	15
Refrigerant charge	(kg)	75/75	79/75	79/79	98/93	98/98	102/95	102/ 102	166/91	188/91	209/ 91	188/ 188	209/ 188	209/ 209
Oil charge	(L)	5/5	5/5	5/5	5/5	5/5	7/5	7/7	8-8/ 7	8-8/ 7	8-8/ 7	8-8/ 8-8	9-9/ 9-9	9-9/ 9-9
Min ambient-std	(°C)	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9	-3.9
Min ambient-low	(°C)	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8	-17.8

1. Data containing information on two circuits is shown as follows: ckt 1/ ckt 2.
2. Minimum start-up/operating ambient is based on a 5 mph wind across the condenser.
3. RTAC units must only operate with refrigerant R-134a and Trane Oil 00048.



Pre-installation

Unit Inspection

When unit is delivered, verify it is the correct unit and is properly equipped.

If unit is covered with optional tarp, confirm unit was ordered with a tarp. Inspect tarp for any visible damage.

If unit does not have optional tarp, compare information on unit nameplate with ordering and submittal information. Inspect all exterior components for visible damage.

Report any apparent damage or material shortage to carrier and make a "unit damage" notation on carrier's delivery receipt. Specify extent and type of damage found and notify Trane Sales Office. Do not proceed with installation of a damaged unit without sales office approval.

Inspection Checklist

To protect against loss due to damage in transit, complete this checklist upon receipt of unit.

- Inspect the individual pieces of the shipment before accepting the unit. Check for obvious damage to the unit or packing material.
- Inspect the unit for concealed damage as soon as possible after delivery and before it is stored. Concealed damage must be reported within 15 days.
- If concealed damage is discovered, stop unpacking the shipment. Do not remove damaged material from the receiving location. Take photos of the damage, if possible. The owner must provide reasonable evidence that the damage did not occur after delivery.
- Notify the carrier's terminal of the damage immediately, by phone and by mail. Request an immediate, joint inspection of the damage with the carrier and the consignee.

Notify Trane sales representative and arrange for repair. Do not repair unit until damage is inspected by the carrier's representative.

Storage

Extended storage of outdoor unit prior to installation requires these precautionary measures:

- Store the outdoor unit in a secure area.
- At least every three months (quarterly), check the pressure in the refrigerant circuits to verify that the refrigerant charge is intact. If it is not, contact a qualified service organization and the appropriate Trane sales office.
- Close the discharge and liquid line isolation valves.

Installation Responsibilities

Generally, the contractor must do the following when installing an RTAC unit:

- Install unit on a flat foundation, level (within 1/4" [6 mm] across the length and width of the unit), and strong enough to support unit loading.
- Install unit per the instructions contained in the Installation-Mechanical and Installation-Electrical sections of this manual.
- Install any optional sensors and make electrical connections at the CH530.
- Where specified, provide and install valves in water piping upstream and downstream of evaporator water connections to isolate evaporator for maintenance, and to balance/trim system.
- Furnish and install pressure gauges in inlet and outlet piping of the evaporator.
- Furnish and install a drain valve to the bottom of the evaporator waterbox.
- Supply and install a vent cock to the top of the evaporator waterbox.
- Furnish and install strainers ahead of all pumps and automatic modulating valves, and at inlet of evaporator.
- Provide and install field wiring.
- Install heat tape and insulate the chilled water lines and any other portions of the system, as required, to prevent sweating under normal operating conditions or freezing during low ambient temperature conditions.
- Install evaporator drain plug. The plug ships in unit control panel.
- Start unit under supervision of a qualified service technician.

General

Report any damage incurred during handling or installation to the Trane sales office immediately.



Dimensions and Weights

Dimensions

See unit submittals for specific unit dimensions and water connection locations.

Clearances

Provide enough space around the outdoor unit to allow the installation and maintenance personnel unrestricted

access to all service points. Refer to submittal drawings for the unit dimensions. A minimum of 4 feet (1.2 m) is recommended for compressor service. Provide sufficient clearance for the opening of control panel doors. See [Figure 5, p. 21](#) through [Figure 9, p. 23](#) for minimum clearances. In all cases, local codes which require additional clearances will take precedence over these recommendations.

Figure 5. Recommended unit clearance – 15 foot bases

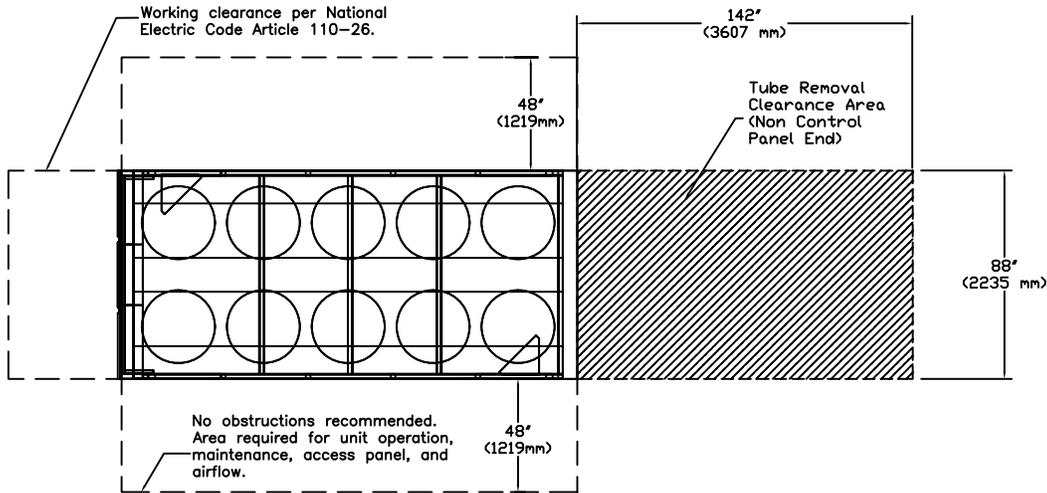


Figure 6. Recommended unit clearances 18-21 foot bases

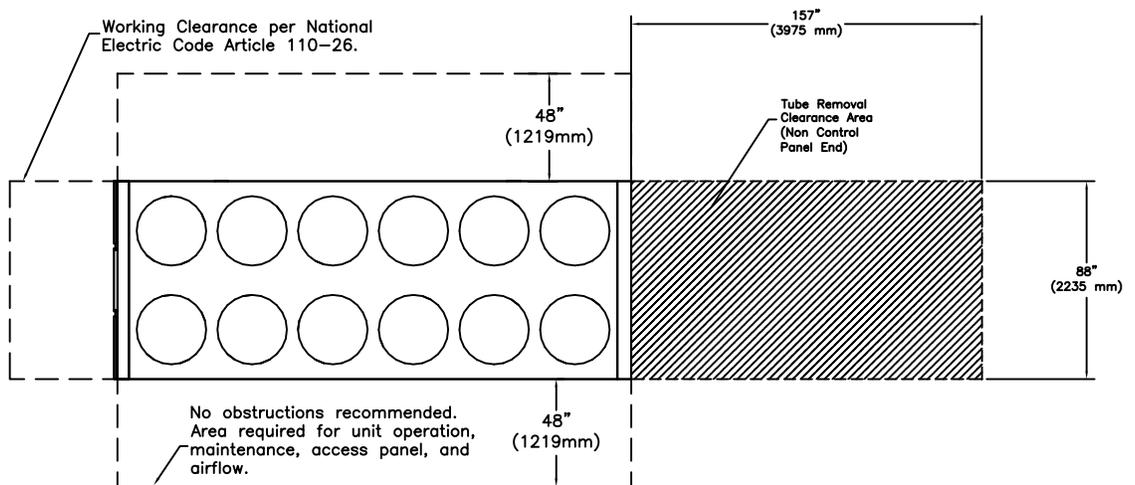


Figure 7. Recommended unit clearances 30-45 foot bases

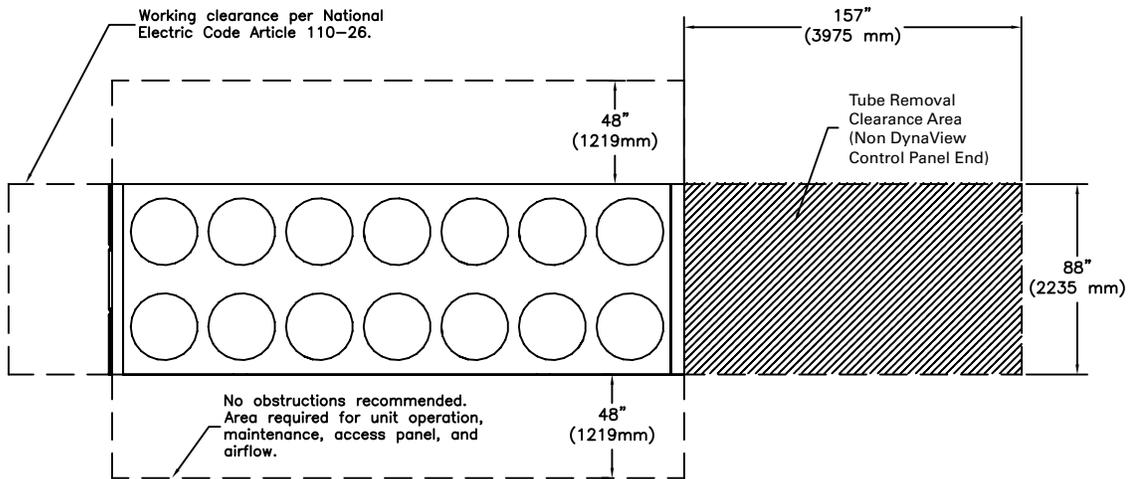


Figure 8. Recommended remote evaporator unit clearances – 15-30 foot bases

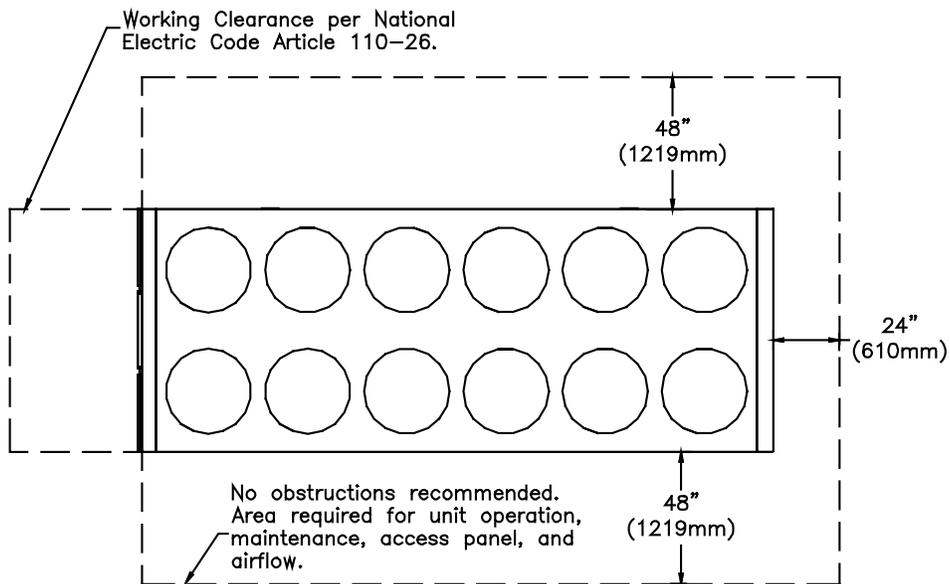
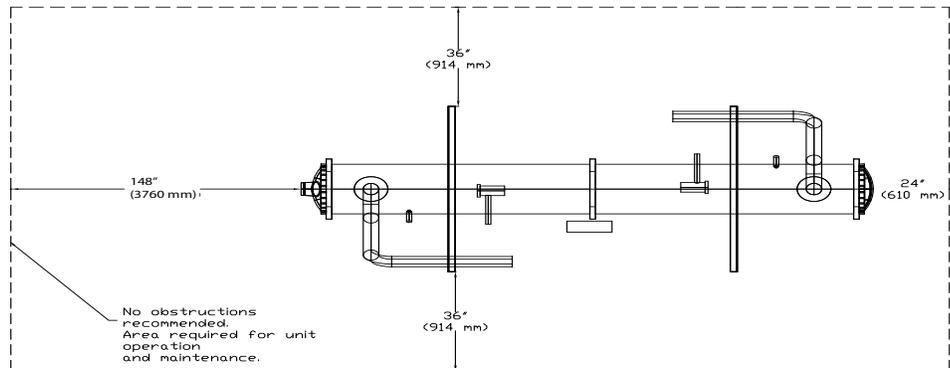


Figure 9. Recommended evaporator clearance


Unobstructed flow of condenser air is essential to maintain chiller capacity and operating efficiency. When determining unit placement, give careful consideration to assuring a sufficient flow of air across the condenser heat transfer surface. Two detrimental conditions are possible and must be avoided if optimum performance is to be achieved: warm air recirculation and coil starvation.

Warm air recirculation occurs when discharge air from the condenser fans is recycled back to the condenser coil inlet. Coil starvation occurs when free airflow to (or from) the condenser is restricted.

Both warm air recirculation and coil starvation cause reduction in unit efficiency and capacity due to the increased head pressures.

Debris, trash, supplies etc. should not be allowed to accumulate in the vicinity of the unit. Supply air movement may draw debris into the condenser coil, blocking spaces between coil fins and causing coil starvation. Special consideration should be given to low ambient units. Condenser coils and fan discharge must be kept free of snow or other obstructions to permit adequate airflow for satisfactory unit operation.

In situations where equipment must be installed with less clearance than recommended, such as frequently occurs in retrofit and rooftop applications, restricted airflow is common. The Main Processor will direct the unit to make as much chilled water as possible given the actual installed conditions. Consult your Trane sales engineer for more details.

Note: *If the outdoor unit configuration requires a variance to the clearance dimensions, contact your Trane Sales Office Representative. Also refer to Trane Engineering Bulletins for application information on RTAC chillers.*



Dimensions and Weights

Weights

Non-Seismically Rated Units

Table 11. Weight - packaged units - 60 Hz - aluminum or CompleteCoat coils

Unit Size (tons)	Standard Efficiency				High Efficiency				Extra Efficiency			
	Shipping		Operating		Shipping		Operating		Shipping		Operating	
	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
140	10832	4913	11146	5056	10859	4926	11160	5062	12171	5521	12585	5708
155	10910	4949	11146	5056	12114	5495	12445	5645	13984	6343	14293	6483
170	10877	4934	11218	5088	12171	5521	12585	5708	14454	6556	14721	6677
185	12479	5660	12899	5851	13984	6343	14293	6483	15915	7219	16413	7445
200	12884	5844	13193	5984	14454	6556	14721	6677	16016	7265	16413	7445
225	14635	6638	14966	6788	15915	7219	16413	7445	n/a			
250	14916	6766	15191	6890	16016	7265	16413	7445	20476	9288	21048	9547
275	19025	8630	19685	8929	20393	9250	21048	9547	21667	9828	22160	10052
300	20699	9389	21214	9622	21667	9828	22160	10052	24073	10919	24700	11204
350	21550	9775	22005	9981	24073	10919	24700	11204	27136	12309	27750	12587
400	25409	11525	25854	11727	27136	12309	27750	12587	n/a			
450	26816	12163	27393	12425	n/a				n/a			
500	27136	12309	27912	12661	n/a				n/a			

1. Operating weight includes refrigerant and water.
2. Shipping weight includes refrigerant.
3. All weights +/- 3%.

Table 12. Weight - packaged units - 60 Hz - copper coils

Unit Size (tons)	Standard Efficiency				High Efficiency				Extra Efficiency			
	Shipping		Operating		Shipping		Operating		Shipping		Operating	
	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
140	13407	6081	13734	6230	13426	6090	13734	6230	15590	7071	15998	7257
155	13420	6087	13734	6230	15647	7097	15854	7191	18250	8278	18613	8443
170	13442	6097	13733	6229	15590	7071	15998	7257	18701	8483	18958	8599
185	15870	7198	16253	7372	18250	8278	18613	8443	20794	9432	21290	9657
200	16304	7395	16630	7543	18701	8483	18958	8599	20881	9471	21290	9657
225	18739	8500	18156	8235	20794	9432	21290	9657	n/a			
250	18905	8575	19223	8719	20881	9471	21290	9657	26017	11801	26558	12046
275	23905	10843	24608	11162	26017	11801	26558	12046	27660	12546	28182	12783
300	26039	11811	26580	12056	27660	12546	28182	12783	30848	13992	31431	14257
350	27395	12426	27920	12664	30848	13992	31431	14257	35166	15951	35688	16188
400	32216	14613	32723	14843	35014	15882	35688	16188	n/a			
450	32682	14824	33178	15049	n/a				n/a			
500	35014	15882	35787	16233	n/a				n/a			

1. Operating weight includes refrigerant and water.
2. Shipping weight includes refrigerant.
3. All weights +/- 3%.

Table 13. Weight - packaged units - 50 Hz - aluminum or CompleteCoat coils

Unit Size (tons)	Standard Efficiency				High Efficiency			
	Shipping		Operating		Shipping		Operating	
	lb	kg	lb	kg	lb	kg	lb	kg
120		n/a			10832	4913	11146	5056
130		n/a			10910	4949	11146	5056
140	10844	4919	11146	5056	10871	4931	11160	5062
155	11131	5049	11397	5170	12466	5654	12786	5800
170	11426	5183	11632	5276	12742	5780	12990	5892
185	12797	5805	13111	5947	14383	6524	14754	6692
200	12962	5879	13304	6035	14516	6584	14967	6789
250	18051	8188	19186	8703	19176	8698	20483	9291
275	19715	8943	20240	9181	21944	9954	21532	9767
300	20242	9182	21027	9538	22272	10102	22185	10063
350	23231	10537	23799	10795	24924	11305	25812	11708
375	24360	11049	25213	11436	26298	11929	26963	12230
400	25222	11440	25854	11727	27120	12301	27751	12588

1. Operating weight includes refrigerant and water.
2. Shipping weight includes refrigerant.
3. All weights +/- 3%.

Table 14. Weight - packaged units - 50 Hz - copper coils

Unit Size (tons)	Standard Efficiency				High Efficiency			
	Shipping		Operating		Shipping		Operating	
	lb	kg	lb	kg	lb	kg	lb	kg
120		n/a			13407	6081	13734	6230
130		n/a			13426	6090	13734	6230
140	13417	6086	13734	6230	13446	6099	13734	6230
155	13851	6283	13962	6333	15772	7154	16192	7345
170	13856	6285	14366	6516	16162	7331	17421	7902
185	16216	7355	16463	7467	18570	8423	18979	8609
200	16381	7430	16721	7584	18833	8542	19223	8719
250	22058	10005	21837	9905	24015	10893	24056	10912
275	24584	11151	25095	11383	26617	12073	27135	12308
300	25893	11745	26336	11946	27617	12527	28182	12783
350	29084	13192	29527	13393	32037	14532	32712	14838
375	30432	13804	30971	14048	32463	14725	32971	14955
400	32112	14566	32787	14872	34982	15867	35525	16114

1. Operating weight includes refrigerant and water.
2. Shipping weight includes refrigerant.
3. All weights +/- 3%.



Dimensions and Weights

Seismically Rated Unit Weights

Table 15. Weight - seismically rated - packaged units - 60 Hz - aluminum or CompleteCoat coils

Unit Size (tons)	Standard Efficiency				High Efficiency				Extra Efficiency			
	Shipping		Operating		Shipping		Operating		Shipping		Operating	
	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg	lb	kg
140	11374	5159	11646	5283	11402	5172	11711	5312	12780	5797	13185	5981
155	11456	5196	11703	5308	12720	5770	13067	5927	14683	6660	15021	6813
170	11421	5180	11779	5343	12780	5797	13214	5994	15177	6884	15433	7000
185	13103	5943	13544	6143	14683	6660	15008	6807	16711	7580	17234	7817
200	13528	6136	13853	6284	15177	6884	15457	7011	16817	7628	17234	7817
225	15367	6970	15714	7128	16711	7580	17234	7817	n/a			
250	15662	7104	15951	7235	16817	7628	17234	7817	21500	9752	22100	10025
275	19976	9061	20669	9375	21413	9713	22100	10025	22750	10319	23268	10554
300	21734	9858	22275	10104	22750	10319	23268	10554	25277	11465	25935	11764
350	22628	10264	23105	10480	25277	11465	25935	11764	28493	12924	29138	13216
400	26679	12102	27147	12313	28493	12924	29138	13216	n/a			
450	28157	12772	28763	13046	n/a				n/a			
500	28493	12924	29308	13294	n/a				n/a			

1. Operating weight includes refrigerant and water.
2. Shipping weight includes refrigerant.
3. All weights +/- 3%.

Remote Evaporator Unit Weights

Table 16. Weights - condensing unit - 60 Hz

Unit Size (tons)	Standard Efficiency				High Efficiency			
	Shipping		Operating		Shipping		Operating	
	lb	kg	lb	kg	lb	kg	lb	kg
Aluminum or CompleteCoat™ coils								
140	8359	3792	8624	3912	8292	3761	8624	3912
155	8299	3764	8624	3912	9460	4291	9931	4505
170	8304	3767	8624	3912	10610	4813	9944	4510
185	10944	4964	10226	4638	11060	5017	11512	5222
200	11179	5071	10625	4819	11443	5190	11886	5391
225	11531	5230	11997	5442	-	-	-	-
250	11623	5272	12126	5500	-	-	-	-
Copper Coils								
140	10956	4970	11200	5080	10751	4877	11200	5080
155	10973	4977	11200	5080	12916	5859	13340	6051
170	10877	4934	11200	5080	13451	6101	13375	6067
185	13610	6173	13645	6189	15326	6952	15778	7157
200	13665	6198	14048	6372	15707	7125	16148	7325
225	15795	7164	16252	7372	-	-	-	-
250	15888	7207	16386	7433	-	-	-	-

1. Operating weight includes refrigerant and water.
2. Shipping weight includes nitrogen holding charge.
3. All weights +/- 3%.

Table 17. Weights - remote evaporator - 60 Hz

Nominal Tonnage	Standard Efficiency				High Efficiency			
	Shipping Weight (lb)	Shipping Weight (kg)	Operating Weight (lb)	Operating Weight (kg)	Shipping Weight (lb)	Shipping Weight (kg)	Operating Weight (lb)	Operating Weight (kg)
140	2486	1128	2730	1238	2528	1147	2805	1272
155	2525	1145	2790	1266	2556	1159	2850	1293
170	2528	1147	2805	1272	2600	1179	2920	1325
185	2556	1159	2850	1293	2797	1269	3114	1413
200	2600	1179	2920	1325	2846	1291	3192	1448
225	2797	1269	3114	1413	-	-	-	-
250	2846	1291	3192	1448	-	-	-	-

1. Operating weight includes refrigerant and water.
2. Shipping weight includes nitrogen holding charge.
3. All weights +/- 3%.



Installation - Mechanical

Location Requirements

Noise Considerations

Locate outdoor unit away from sound sensitive areas. If required, install rubber vibration isolators in all water piping and use flexible electrical conduit. Consult an acoustical engineer for critical applications. Also refer to Trane Engineering Bulletins for application information on RTAC chillers.

Foundation

A base or foundation is not required if unit location is level and strong enough to support unit's operating weight as listed in "General Data," p. 9, Table 1, p. 10 through Table 10, p. 19. Provide rigid, non-warping mounting pads or concrete foundation of sufficient strength and mass to support unit operating weight (including piping, and full operating charges of refrigerant, oil and water). Once in place, outdoor unit must be level within 1/4" (6 mm) over its length and width.

Trane Company is not responsible for equipment problems resulting from an improperly designed or constructed foundation.

Note: To allow for cleaning under the condensing coil, it is recommended that an opening be left between the unit base and the concrete pad.

Clearances

Provide enough space around the outdoor unit to allow the installation and maintenance personnel unrestricted access to all service points. Refer to submittal drawings for the unit dimensions. A minimum of 4 feet (1.2 m) is recommended for compressor service. Provide sufficient clearance for the opening of control panel doors. See Figure 5, p. 21 through Figure 9, p. 23 in "Dimensions and Weights," p. 21 for minimum clearances. In all cases, local codes which require additional clearances will take precedence over these recommendations.

Rigging

Lifting Procedure

⚠ WARNING

Heavy Objects!

Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift. Other lifting arrangements could cause equipment or property damage. Failure to follow instructions above or properly lift unit could result in unit dropping and possibly crushing operator/ technician which could result in death or serious injury.

⚠ WARNING

Improper Unit Lift!

Test lift unit approximately 24 inches to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level. Failure to properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury and possible equipment or property-only damage.

⚠ WARNING

Heavy Objects!

Ensure that all the lifting equipment used is properly rated for the weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift. Other lifting arrangements could cause equipment or property damage. Failure to follow instructions above or properly lift unit could result in unit dropping and possibly crushing operator/ technician which could result in death or serious injury.

Important: Do not fork lift unit.

See Table 18, p. 30 through Table 22, p. 32 for lifting weights and Table 23, p. 33 and Table 24, p. 33 for center of gravity (CG) dimensions.

Rigging

See Figure 10 through Figure 12, p. 29 for lifting point references, Table 19 through Table 21 for lifting weights, and unit submittals lift point dimensions.

Figure 10. Lifting the unit (packaged and remote) 15-21 foot base

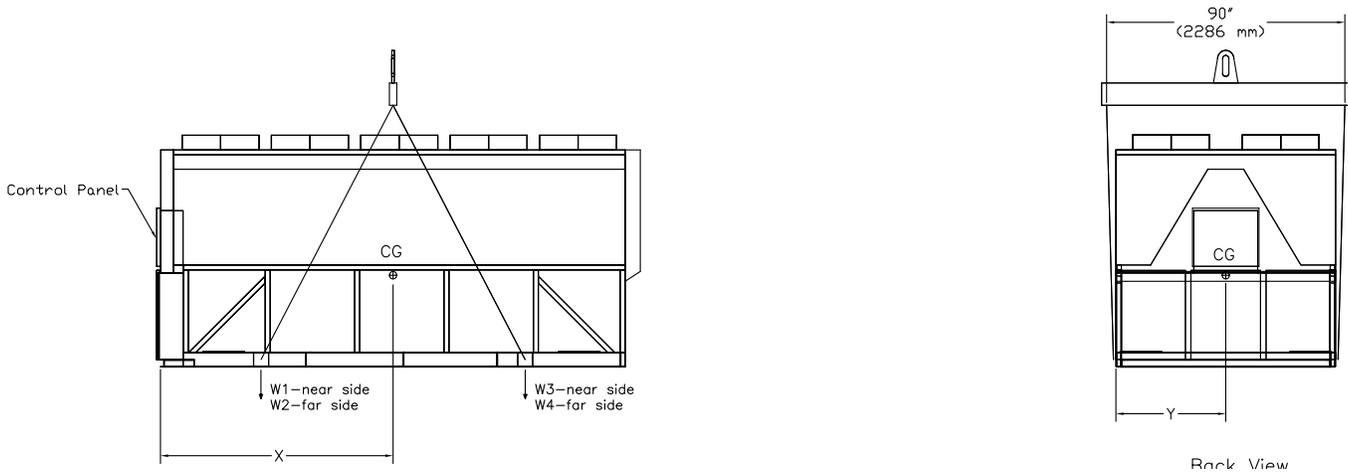


Figure 11. Lifting the unit (packaged and remote) 30-36 foot base

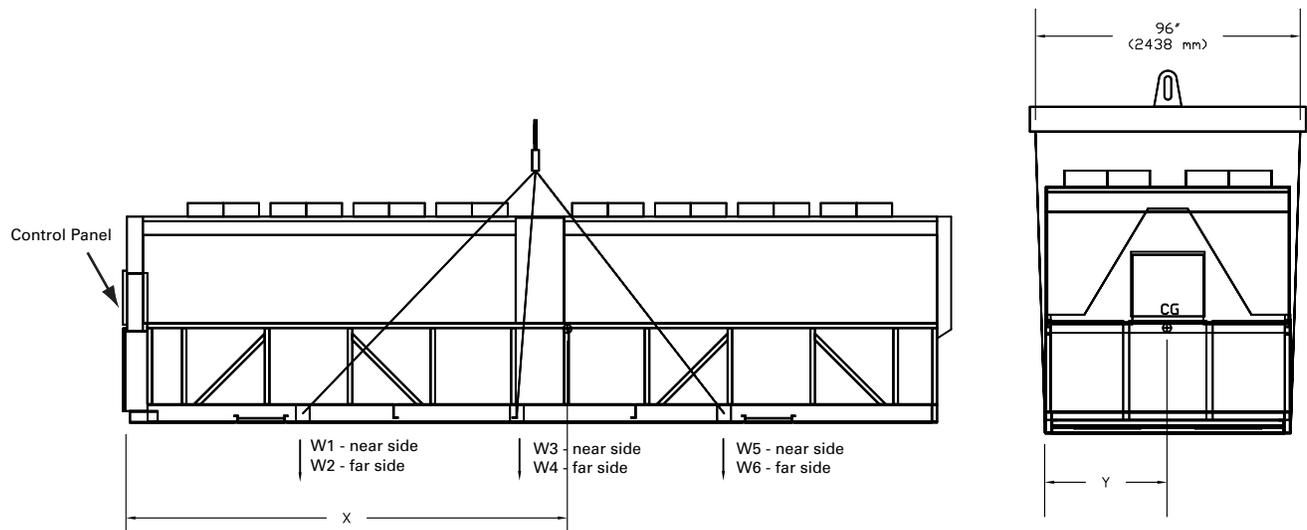


Figure 12. Lifting the unit (packaged and remote) 39-45 foot base

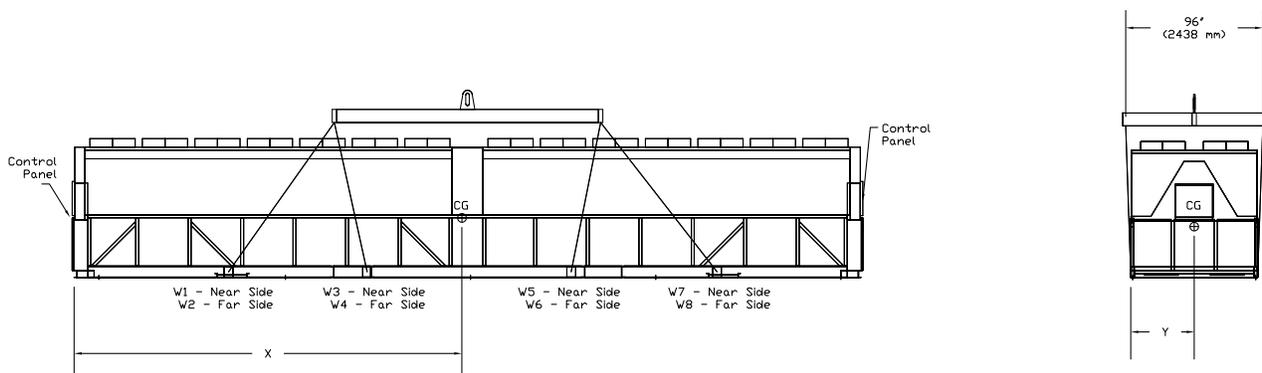
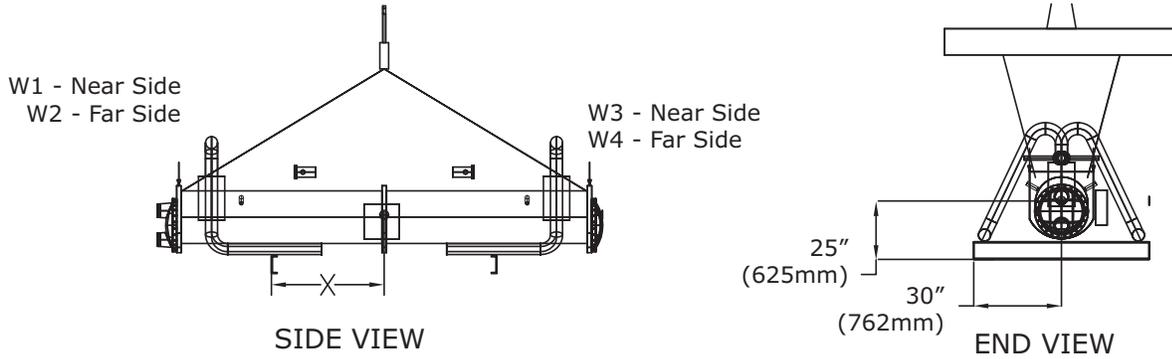


Figure 13. Lifting the remote evap



Lifting Weights Tables

Table 18. Lifting weights (lbs) - packaged units - 60 Hz

Size (tons)	Lifting Location							
	W1	W2	W3	W4	W5	W6	W7	W8
Aluminum Coils - Standard Efficiency								
140	2443	2814	2622	2953	-	-	-	-
155	2446	2881	2627	2956	-	-	-	-
170	2447	2831	2633	2966	-	-	-	-
185	3244	3584	2656	2995	-	-	-	-
200	3285	3701	2741	3157	-	-	-	-
225	3943	4177	3183	3332	-	-	-	-
250	3657	4167	3518	3574	-	-	-	-
275	3376	2957	3372	2975	3377	2968	-	-
300	3470	3099	3640	3258	3814	3418	-	-
350	3389	3023	3787	3382	4187	3782	-	-
400	3448	3315	3226	3205	3123	3102	3026	2964
450	3440	3419	3324	3303	3154	3133	3032	4011
500	3373	3299	3405	3331	3452	3378	3486	3412
Aluminum Coils - High Efficiency								
140	2446	2820	2630	2963	-	-	-	-
155	3114	3508	2549	2943	-	-	-	-
170	3124	3524	2561	2962	-	-	-	-
185	3469	4059	2933	3523	-	-	-	-
200	3657	4139	3135	3523	-	-	-	-
225	2581	2904	2489	2812	2400	2729	-	-
250	2607	2904	2518	2825	2433	2729	-	-
275	3272	2884	3592	3204	3915	3526	-	-
300	2974	2647	2911	2584	2801	2514	2785	2451
350	2936	2876	3003	2943	3075	3015	3143	3082
400	3373	3299	3405	3331	3452	3378	3486	3412
Aluminum Coils - Extra Efficiency								
140	3124	3524	2561	2962	-	-	-	-
155	3469	4059	2933	3523	-	-	-	-
170	3657	4139	3135	3523	-	-	-	-
185	2581	2904	2489	2812	2400	2729	-	-
200	2607	2904	2518	2825	2433	2729	-	-
250	3272	2884	3592	3204	3998	3526	-	-
275	2974	2647	2911	2584	2801	2514	2785	2451
300	2936	2876	3003	2943	3075	3015	3143	3082
350	3373	3299	3405	3331	3452	3378	3486	3412

Table 18. Lifting weights (lbs) - packaged units - 60 Hz

Size (tons)	Lifting Location							
	W1	W2	W3	W4	W5	W6	W7	W8
Copper Coils - Standard Efficiency								
140	2916	3405	3346	3740	-	-	-	-
155	2919	3405	3352	3744	-	-	-	-
170	2920	3412	3357	3753	-	-	-	-
185	3991	4450	3500	3929	-	-	-	-
200	4032	4567	3585	4120	-	-	-	-
225	4593	5261	4101	4784	-	-	-	-
250	4639	5261	4149	4856	-	-	-	-
275	4319	3898	4170	3772	4078	3668	-	-
300	4513	3980	4552	4169	4618	4207	-	-
350	4289	3892	4769	4363	5244	4838	-	-
400	4220	4198	4100	4078	3975	3953	3857	3835
450	4549	4526	4290	4268	3909	3887	3638	3615
500	4369	4293	4395	4319	4434	4358	4461	4385
Copper Coils - High Efficiency								
140	2919	3410	3354	3743	-	-	-	-
155	3973	4374	3393	3907	-	-	-	-
170	3870	4390	3405	3925	-	-	-	-
185	4404	5144	3981	4721	-	-	-	-
200	4593	5223	4101	4784	-	-	-	-
225	3189	3625	3247	3685	3303	3745	-	-
250	3214	3625	3276	3685	3336	3745	-	-
275	4235	3898	4522	4132	4810	4420	-	-
300	3818	3527	3708	3379	3545	3216	3398	3069
350	4054	4035	3930	3911	3800	3781	3678	3659
400	4369	4293	4395	4319	4434	4358	4461	4385
Copper Coils - Extra Efficiency								
140	3870	4390	3405	3925	-	-	-	-
155	4404	5144	3981	4721	-	-	-	-
170	4593	5223	4101	4784	-	-	-	-
185	3189	3625	3247	3685	3303	3745	-	-
200	3214	3625	3276	3685	3336	3745	-	-
250	4235	3898	4522	4132	4810	4420	-	-
275	3818	3527	3708	3379	3545	3216	3398	3069
300	4054	4035	3930	3911	3800	3781	3678	3659
350	4521	4293	4395	4319	4434	4358	4461	4385

Table 19. Lifting weights (lbs) - packaged units - 50 Hz

Size (tons)	Lifting Location							
	W1	W2	W3	W4	W5	W6	W7	W8
Aluminum Coils - Standard Efficiency								
140	2445	2817	2625	2957	-	-	-	-
155	2556	2837	2750	2988	-	-	-	-
170	2554	2946	2793	3133	-	-	-	-
185	3287	3708	2690	3112	-	-	-	-
200	3302	3721	2760	3179	-	-	-	-
250	2972	2538	3254	2825	3446	3016	-	-
275	4084	3574	3618	3109	2920	2410	-	-
300	3340	2929	3576	3165	3814	3418	-	-
350	3043	3023	2958	2939	2869	2849	2785	2765
375	3347	3315	3135	3101	2911	2878	3005	2668
400	3311	3291	3226	3192	3123	3089	3026	2964
Aluminum Coils - High Efficiency								
120	2443	2814	2622	2953	-	-	-	-
130	2446	2881	2627	2956	-	-	-	-
140	2448	2822	2634	2967	-	-	-	-
155	3230	3537	2696	3003	-	-	-	-
170	3253	3666	2705	3118	-	-	-	-
185	3589	4139	3053	3602	-	-	-	-
200	3703	4139	3100	3574	-	-	-	-
250	3376	2957	3406	2975	3446	3016	-	-
275	4322	3018	3710	3304	3998	3592	-	-
300	2974	2647	2911	2584	2831	3089	2785	2451
350	3311	3291	3204	3184	3100	2847	3005	2982
375	3412	3391	3297	3276	3154	3105	3679	2984
400	3373	3299	3389	3331	3452	3378	3486	3412
Copper Coils - Standard Efficiency								
140	2918	3407	3349	3743	-	-	-	-
155	3030	3428	3474	3919	-	-	-	-
170	3027	3536	3518	3775	-	-	-	-
185	4033	4574	3534	4075	-	-	-	-
200	4048	4586	3604	4143	-	-	-	-
250	3550	3120	3934	3504	4190	3760	-	-
275	4632	4157	4297	3822	4078	3598	-	-
300	4387	4130	4488	4076	4618	4194	-	-
350	3803	3782	3700	3679	3591	3570	3490	3469
375	4351	4317	4003	3969	3637	3603	3293	3259
400	4207	4185	4087	4065	3962	3940	3844	3822
Copper Coils - High Efficiency								
120	2916	3405	3346	3740	-	-	-	-
130	2919	3405	3352	3750	-	-	-	-
140	2921	3413	3358	3754	-	-	-	-
155	3863	4403	3540	3966	-	-	-	-
170	4000	4532	3549	4081	-	-	-	-
185	4525	5223	4101	4721	-	-	-	-
200	4639	5261	4149	4784	-	-	-	-
250	4319	3898	4204	3772	4127	3695	-	-
275	4387	3980	4639	4232	4893	4486	-	-
300	3845	3517	3698	3369	3535	3206	3388	3059
350	4198	4177	4078	4057	3952	3930	3833	3812
375	4521	4498	4263	4240	3882	3860	3611	3588
400	4369	4293	4395	4319	4418	4358	4461	4369

Table 20. Lifting weights (lbs) - seismically rated units

Size (tons)	Lifting Location							
	W1	W2	W3	W4	W5	W6	W7	W8
Aluminum Coils - Standard Efficiency								
140	2565	2955	2753	3101	-	-	-	-
155	2568	3025	2758	3104	-	-	-	-
170	2569	2973	2765	3114	-	-	-	-
185	3406	3763	2789	3145	-	-	-	-
200	3449	3886	2878	3315	-	-	-	-
225	4140	4386	3342	3499	-	-	-	-
250	3840	4375	3694	3753	-	-	-	-
275	3545	3105	3541	3124	3546	3116	-	-
300	3644	3254	3822	3421	4005	3589	-	-
350	3558	3174	3976	3551	4396	3971	-	-
400	3620	3481	3387	3365	3279	3257	3177	3112
450	3612	3590	3490	3468	3312	3290	3184	4212
500	3542	3464	3575	3498	3625	3547	3660	3583
Aluminum Coils - High Efficiency								
140	2568	2961	2762	3111	-	-	-	-
155	3270	3683	2676	3090	-	-	-	-
170	3280	3700	2689	3110	-	-	-	-
185	3642	4262	3080	3699	-	-	-	-
200	3840	4346	3292	3699	-	-	-	-
225	2710	3049	2613	2953	2520	2865	-	-
250	2737	3049	2644	2966	2555	2865	-	-
275	3436	3028	3772	3364	4111	3702	-	-
300	3123	2779	3057	2713	2941	2640	2924	2574
350	3083	3020	3153	3090	3229	3166	3300	3236
400	3542	3464	3575	3498	3625	3547	3660	3583
Aluminum Coils - Extra Efficiency								
140	3280	3700	2689	3110	-	-	-	-
155	3642	4262	3080	3699	-	-	-	-
170	3840	4346	3292	3699	-	-	-	-
185	2710	3049	2613	2953	2520	2865	-	-
200	2737	3049	2644	2966	2555	2865	-	-
250	3436	3028	3772	3364	4198	3702	-	-
275	3123	2779	3057	2713	2941	2640	2924	2574
300	3083	3020	3153	3090	3229	3166	3300	3236
350	3542	3464	3575	3498	3625	3547	3660	3583



Installation - Mechanical

Table 21. Lifting weights (lbs) - remote evaporator condensing units - 60 Hz

Size (tons)	Standard Efficiency Lifting Location				High Efficiency Lifting Location			
	W1	W2	W3	W4	W1	W2	W3	W4
Aluminum Coils								
140	1993	2303	1899	2164	1993	2236	1899	2164
155	1996	2236	1903	2164	1552	2844	1904	3160
170	1994	2239	1903	2168	2551	2848	1903	3308
185	2682	2920	2011	3331	2837	3315	2215	2693
200	2713	3025	2083	3358	3025	3390	2335	2693
225	3025	3430	2335	2741	-	-	-	-
250	3071	3430	2381	2741	-	-	-	-
Copper Coils								
140	2466	2827	2624	3039	2466	2711	2624	2950
155	2569	2827	2627	2950	3298	3710	2748	3160
170	2467	2829	2627	2954	3417	3845	2881	3308
185	3474	3913	2892	3331	3773	4399	3264	3890
200	3489	3891	2927	3358	3960	4474	3383	3890
225	3960	4514	3383	3938	-	-	-	-
250	4006	4514	3430	3938	-	-	-	-

Table 22. Lifting weights (lbs) - remote evaporators

Size (tons)	Standard Efficiency Lifting Location				High Efficiency Lifting Location			
	W1	W2	W3	W4	W1	W2	W3	W4
Aluminum Coils								
140	621	621	622	622	632	632	632	632
155	632	631	631	631	639	639	639	639
170	632	632	632	632	650	650	650	650
185	639	639	639	639	699	699	699	700
200	650	650	650	650	711	711	712	712
225	699	699	699	700	-	-	-	-
250	711	711	712	712	-	-	-	-

Center of Gravity

Table 23. Center of gravity (in) - 60 Hz

Unit Size (tons)	Packaged			Remote			Remote Evap		
	X	Y	Z	X	Y	Z	X	Y	Z
Aluminum Coils - Standard Efficiency									
140	88	45	35.5	85	45	37.25	39	30	25
155	88	45	35.5	85	45	37.25	39	30	25
170	88	45	35.5	85	45	37.25	39	30	25
185	106	44	35.5	103	44	39	53	30	25
200	106	45	35.5	107	45	39	53	30	25
225	124	45	35.5	121	45	41.5	53	30	25
250	124	45	35.5	121	45	41.5	53	30	25
275	176	42	35.5	-	-	-	-	-	-
300	199	42	35.5	-	-	-	-	-	-
350	205	42	35.5	-	-	-	-	-	-
400	234	44	35.5	-	-	-	-	-	-
450	266	44	35.5	-	-	-	-	-	-
500	274	44	35.5	-	-	-	-	-	-
Aluminum Coils - High Efficiency									
140	88	45	35.5	85	45	37.25	39	30	25
155	106	45	35.5	103	45	39	53	30	25
170	106	45	35.5	103	45	39	53	30	25
185	124	46	35.5	122	46	41.5	53	30	25
200	124	45	35.5	121	45	41.5	53	30	25
225	167	45	35.5	-	-	-	-	-	-
250	167	45	35.5	-	-	-	-	-	-
275	203	42	35.5	-	-	-	-	-	-
300	222	42	35.5	-	-	-	-	-	-
350	234	44	35.5	-	-	-	-	-	-
400	274	44	35.5	-	-	-	-	-	-
Aluminum Coils - Extra Efficiency									
140	106	45	35.5	-	-	-	-	-	-
155	124	46	35.5	-	-	-	-	-	-
170	124	45	35.5	-	-	-	-	-	-
185	167	45	35.5	-	-	-	-	-	-
200	167	45	35.5	-	-	-	-	-	-
250	203	42	35.5	-	-	-	-	-	-
275	222	42	35.5	-	-	-	-	-	-
300	234	44	35.5	-	-	-	-	-	-
350	274	44	35.5	-	-	-	-	-	-
Copper Coils - Standard Efficiency									
140	90	45	38	88	45	37.25	39	30	25
155	90	45	38	88	45	37.25	39	30	25
170	90	45	38	88	45	37.25	39	30	25
185	108	44	38	106	44	39	53	30	25
200	108	45	38	107	45	39	53	30	25
225	126	45	38	125	45	41.5	53	30	25
250	126	45	38	125	45	41.5	53	30	25
275	174	42	38	-	-	-	-	-	-
300	195	43	38	-	-	-	-	-	-
350	204	43	38	-	-	-	-	-	-
400	235	44	38	-	-	-	-	-	-
450	261	44	38	-	-	-	-	-	-
500	273	44	38	-	-	-	-	-	-

Table 23. Center of gravity (in) - 60 Hz (continued)

Unit Size (tons)	Packaged			Remote			Remote Evap		
	X	Y	Z	X	Y	Z	X	Y	Z
Copper Coils - High Efficiency									
140	90	45	38	88	45	37.25	39	30	25
155	108	45	38	106	45	39	53	30	25
170	108	45	38	106	45	39	53	30	25
185	126	46	38	125	46	41.5	53	30	25
200	126	45	38	124	45	41.5	53	30	25
225	170	45	38	-	-	-	-	-	-
250	170	45	38	-	-	-	-	-	-
275	201	42	38	-	-	-	-	-	-
300	219	42	38	-	-	-	-	-	-
350	234	44	38	-	-	-	-	-	-
400	273	44	38	-	-	-	-	-	-
Copper Coils - Extra Efficiency									
140	108	45	38	-	-	-	-	-	-
155	126	46	38	-	-	-	-	-	-
170	126	45	38	-	-	-	-	-	-
185	170	45	38	-	-	-	-	-	-
200	170	45	38	-	-	-	-	-	-
250	201	42	38	-	-	-	-	-	-
275	219	42	38	-	-	-	-	-	-
300	234	44	38	-	-	-	-	-	-
350	273	44	38	-	-	-	-	-	-

Table 24. Center of gravity (in) - packaged units - 50 Hz

Unit Size (tons)	Standard Efficiency			High Efficiency		
	X	Y	Z	X	Y	Z
Aluminum Coils						
120	-	-	-	88	45	35.5
130	-	-	-	88	45	35.5
140	88	45	35.5	88	45	35.5
155	88	44	35.5	106	44	35.5
170	89	45	35.5	106	45	35.5
185	106	45	35.5	124	45	35.5
200	106	45	35.5	124	45	35.5
250	182	41	35.5	177	41	35.5
275	172	41	35.5	202	42	35.5
300	201	42	35.5	222	42	35.5
350	235	44	35.5	234	44	35.5
375	229	44	35.5	266	44	35.5
400	234	44	35.5	274	44	35.5
Copper Coils						
120	-	-	-	90	45	38
130	-	-	-	90	45	38
140	90	45	38	90	45	38
155	90	44	38	108	44	38
170	90	45	38	108	45	38
185	108	45	38	126	45	38
200	108	45	38	126	45	38
250	183	42	38	174	42	38
275	171	42	38	200	42	38
300	197	42	38	220	42	38
350	235	44	38	235	44	38
375	227	44	38	261	44	38
400	235	44	38	273	44	38

Isolation and Sound Emission

The most effective form of isolation is to locate the unit away from any sound sensitive area. Structurally transmitted sound can be reduced by elastomeric vibration eliminators. Spring isolators are not recommended for non-seismically rated applications. Consult an acoustical engineer in critical sound applications.

For maximum isolation effect, isolate water lines and electrical conduit. Wall sleeves and rubber isolated piping hangers can be used to reduce the sound transmitted through water piping. To reduce the sound transmitted through electrical conduit, use flexible electrical conduit.

State and local codes on sound emissions should always be considered. Since the environment in which a sound source is located affects sound pressure, unit placement must be carefully evaluated. Sound power levels for Trane air-cooled Series R® chillers are available on request.

Figure 14. RTAC elastomeric isolator

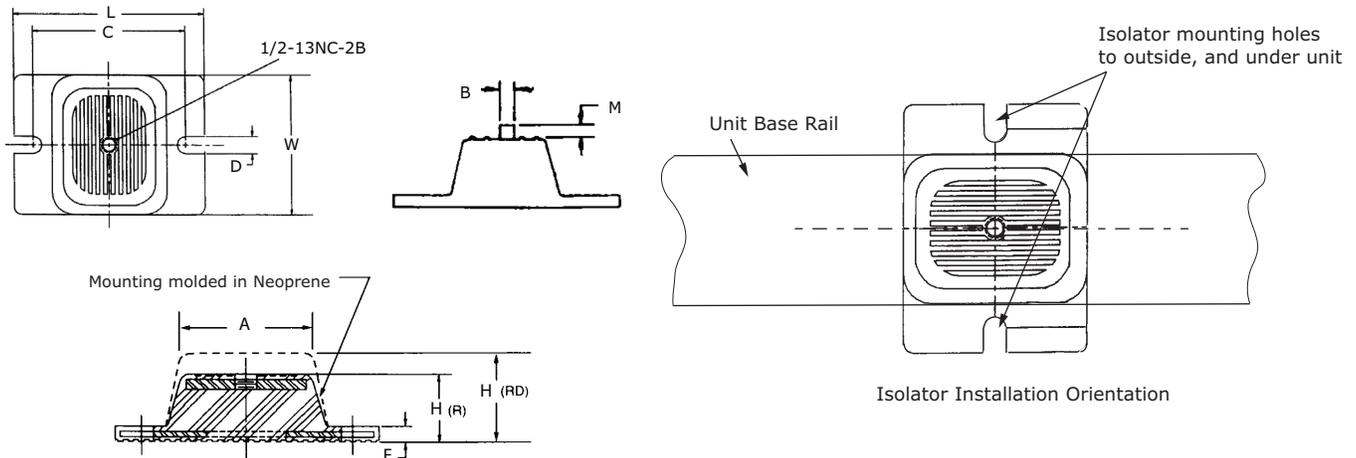


Table 25. RTAC elastomeric isolator details

EXT	Max Load Each (lbs)	Color	Maximum Deflection (in)	A	B	C	D	E	H	L	M	W	Type
61	1500	BROWN	0.50	3.00	0.50	5.00	0.56	0.38	2.75	6.25	1.60± .25	4.63	RDP-4
62	2250	RED											
63	3000	GREEN											
64	4000	GRAY											

See "Elastomeric Isolator Mounting Units without Seismic Rating," p. 37 for isolator selection, placement and point weights.

1. Secure the isolators to the mounting surface using the mounting slots in the isolator base plate. Do not fully tighten the isolator mounting bolts at this time.

Important: For proper operation, isolator must be oriented as shown in Figure 14. Mounting holes must be to the outside, and under the unit.

Mounting and Leveling

For additional reduction of sound and vibration, install the optional elastomeric isolators, seismic isolation pads or seismic spring isolators. See "Unit Isolation," p. 34 for details.

Construct an isolated concrete pad for the unit or provide concrete footings at the unit mounting points. Mount the unit directly to the concrete pads or footings.

Level the unit using the base rail as a reference. The unit must be level within 1/4-in (6 mm) over the entire length and width. Use shims as necessary to level the unit.

Unit Isolation

Elastomeric Isolators (Optional for units without seismic rating)

See Figure 14 and Table 25 for description of elastomeric isolators (model number digit 33 = R or G).

2. Align the mounting holes in the base of the unit with the threaded positioning pins on the top of the isolators.
3. Lower the unit onto the isolators and secure the isolator to the unit with a nut.
4. Level the unit carefully. Fully tighten the isolator mounting bolts.

Unit Isolation for Seismically Rated Units

Seismic Elastomeric Isolation Pads

Elastomeric pads are provided with an isolation washer and 3/4" free hole in the center of the plate. Isolation pads are shipped inside the unit control panel. See [Table 26](#) for pad specifications.

Table 26. Seismically rated elastomeric isolation pad

Model	Max Load	Dimension (in)		
		Length	Width	Height
B-36	2520	6	6	.625

See [Table 27](#) for quantity of isolation pads required and "Seismic Isolator Mounting," p. 44 or unit submittal for isolator placement dimensional information.

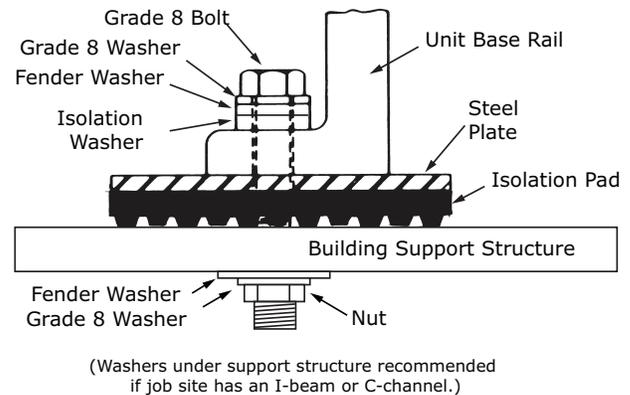
Table 27. Seismic elastomeric isolation pad quantities

Unit Size (tons)	Efficiency		
	Std	High	Extra
120	-	-	-
130	-	-	-
140	8	8	8
155	8	8	10
170	8	8	10
185	8	10	10
200	8	10	10
225	10	10	-
250	10	10	12
275	10	12	12
300	12	12	12
350	12	12	14
375	-	-	-
400	12	14	-
450	14	-	-
500	14	-	-

Set isolation pads on mounting surface, ensuring that all isolator centerlines match the submittal drawing.

Place unit on pads, and secure as shown in [Figure 15](#) using provided isolation washer and additional hardware obtained locally.

Figure 15. Seismic isolation pad — installed^(a)



(a) Not to scale.

- With the exception of the isolation washer, hardware is not included.
- Recommended use of Grade 8 hardware
- Units have a tapered base rail that requires a tapered washer
- Support structure may vary
 - If job site has an I-beam or C-channel, a fender washer and grade 8 washer should be installed under the support structure.

NOTICE:

Replace Isolation Pads and Hardware after Seismic Event!

If unit experiences a seismic event, isolation pads and hardware must be replaced. Failure to replace isolation pads and hardware would compromise the installation and could result in equipment damage during future seismic events.

Seismic Spring Isolators

See "Seismic Isolator Mounting," p. 44 for mounting locations, isolator selection and point weights.

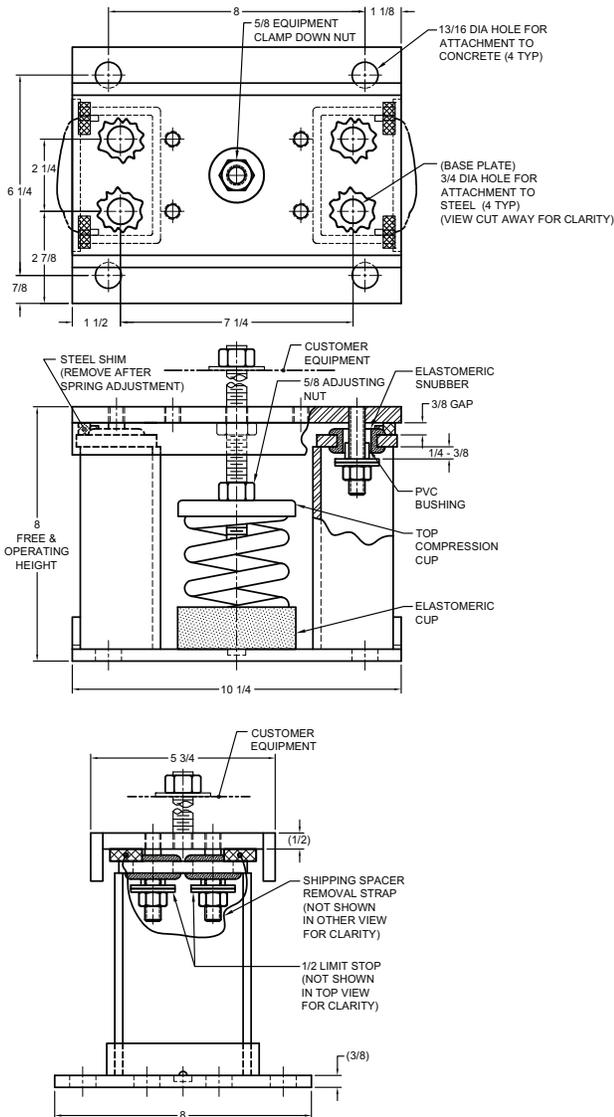
Seismically rated isolators are optional for IBC and OSHPD seismically rated units.

Isolators are identified by part number and color as shown in Table 28. For dimensions, see Figure 16.

Table 28. RTAC seismically rated isolator

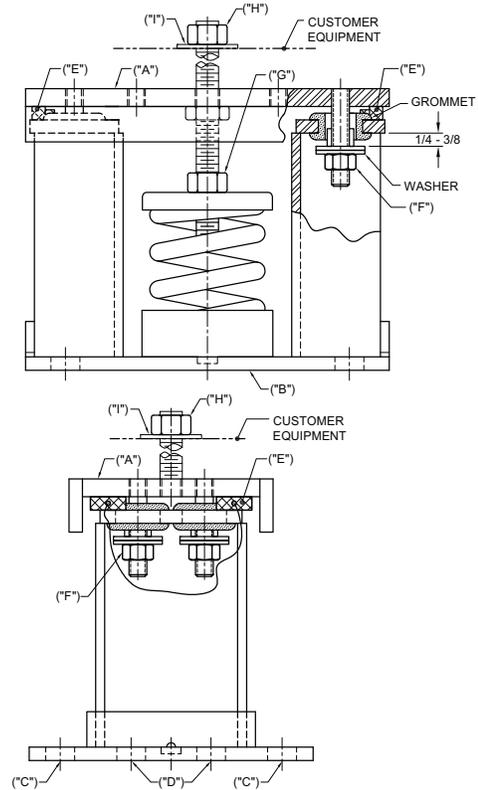
Model	Rated Load (lbs)	Rated Deflection (in)	Spring Rate (lbs/in)	Color Code
MSSH-1E-2000	2000	1.11	1800	White
MSSH-1E-2575N	2575	1.11	2313	White/Dk Purple
MSSH-1E-2990N	2990	1.11	2682	White/Dk Green

Figure 16. MSSH seismically rated isolator



Install the optional seismically rated isolators at each mounting location specified in section "Seismic Isolator Mounting," p. 44.

Figure 17. MSSH Seismic isolator installation reference



1. Set isolators on mounting surface, ensuring that all isolator centerlines match the submittal drawing. All isolator base plates (B) must be installed on a level surface. Shim or grout as required, leveling all isolator or base plates at the same elevation.
2. Anchor all isolators to the surface using thru holes (C) for concrete or (D) for steel as required. Welding to steel is permitted providing the weld achieves the required strength.
3. Remove clamp down nut (H) and washer (I). Isolators are shipped with (2) removable spacer shims (E) between the top plate and the housing.

Important: These shims **MUST** be in place when the equipment is positioned over the isolators.

4. With all shims (E) in place, place the equipment onto the top plate (A) of the isolators.
5. Bolt equipment securely to the isolators using washer (I) and nut (H).

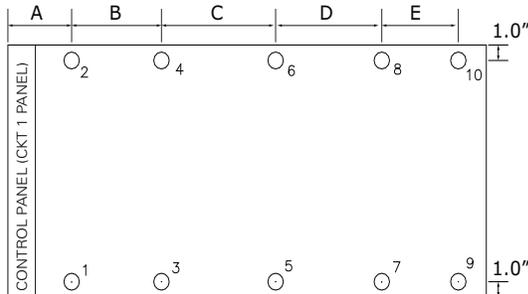
Important: The following adjustment process can only begin after the equipment or machine is at its full operating weight.

6. Back off each of the (2) or (4) limit stop locknuts (F) per isolator 1/4-3/8"
7. Adjust each isolator in sequence by turning adjusting nut(s) (G) one full clockwise turn at a time. Repeat this procedure on all isolators, one at a time. check the limit stop locknuts (F) periodically to ensure that clearance between the washer and rubber grommet is maintained. Stop adjustment of an isolator only when the top plate (A) has risen just above the shim (E).
8. Remove all spacer shims (E).
9. Fine adjust isolators to level equipment.
10. Adjust all limit stop locknuts (F) per isolator to obtain 3/8" gap. the limit stop nuts must be kept at this 3/8" gap to ensure uniform bolt loading during uplift.

Isolator Selection and Mounting Locations

Elastomeric Isolator Mounting Units without Seismic Rating

Figure 18. Mounting locations (without seismic rating)



**Table 29. Mounting locations —
60 Hz units without seismic rating**

Size (tons)	Dimension (in)				
	A	B	C	D	E
Standard Efficiency					
140	15.13	46	53	53	-
155	15.13	46	53	53	-
170	15.13	46	53	53	-
185	15.08	48	76	76	-
200	15.08	48	76	76	-
225	15.08	39	69	64	64
250	15.08	39	69	64	64
275	18.70	76	90	90	75
300	18.70	71	90	100	140
350	18.70	71	90	100	140
400	18.70	139	103	67	128
450	18.70	128	127	127	127
500	18.70	128	127	127	127
High Efficiency					
140	15.13	46	53	53	-
155	15.13	48	76	76	-
170	15.13	48	76	76	-

**Table 29. Mounting locations —
60 Hz units without seismic rating (continued)**

Size (tons)	Dimension (in)				
	A	B	C	D	E
185	15.13	39	69	64	64
200	15.13	39	69	64	64
225	15.59	56	95	75	105
250	15.59	56	95	75	105
275	18.70	71	90	100	140
300	18.70	87	110	125	115
350	18.70	139	103	67	128
400	18.70	127	127	127	127
Extra Efficiency					
140	15.08	48	76	76	-
155	15.08	39	69	64	64
170	15.08	39	69	64	64
185	15.59	56	95	75	105
200	15.59	56	95	75	105
250	18.70	71	90	100	140
275	18.70	87	110	125	115
300	18.70	139	103	67	128
350	18.70	128	127	127	127

**Table 30. Mounting locations —
50 Hz units without seismic rating**

Size (tons)	Dimension (in)				
	A	B	C	D	E
Standard Efficiency					
140	15.13	46	53	53	-
155	15.13	46	53	53	-
170	15.13	46	53	53	-
185	15.08	48	76	76	-
200	15.08	48	76	76	-
250	18.70	76	90	90	75
275	18.70	76	90	90	75
300	18.70	71	90	100	140
375	18.70	139	103	67	128
350	18.70	139	103	67	128
400	18.70	139	103	67	128
High Efficiency					
120	15.13	46	53	53	-
130	15.13	46	53	53	-
140	15.13	46	53	53	-
155	15.13	48	76	76	-
170	15.13	48	76	76	-
185	15.13	39	69	64	64
200	15.13	39	69	64	64
250	15.59	76	90	90	75
275	15.59	71	90	100	140
300	18.70	87	110	125	115
350	18.70	139	103	67	128
375	18.70	128	127	127	127
400	18.70	128	127	127	127



Installation - Mechanical

Elastomeric Isolator Selection

Table 31. Elastomeric isolator selections - packaged units - 60 Hz

Size (tons)	Location									
	1	2	3	4	5	6	7	8	9	10
Standard Efficiency										
140	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
155	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
170	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
185	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
200	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
225	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
250	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
275	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
300	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
350	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
400	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
450	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
500	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
High Efficiency										
140	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
155	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
170	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
185	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
200	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
225	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
250	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
275	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
300	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
350	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
400	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
Extra Efficiency										
140	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
155	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
170	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
185	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
200	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
250	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
275	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
300	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
350	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64

Table 32. Elastomeric isolator selections - packaged units - 50 Hz

Size (tons)	Location									
	1	2	3	4	5	6	7	8	9	10
Standard Efficiency										
140	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
155	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
170	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
185	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
200	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
250	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
275	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
300	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
350	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
400	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
High Efficiency										
120	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
130	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
140	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
155	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
170	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	-	-
185	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
200	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62	Red 62
250	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
275	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
300	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
350	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64
400	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64	Gray 64

Table 33. Elastomeric isolator selections - remote units - 60 Hz

Size (tons)	Location									
	1	2	3	4	5	6	7	8	9	10
Standard Efficiency										
140	Brown 61	-	-							
155	Brown 61	-	-							
170	Brown 61	-	-							
185	Brown 61	-	-							
200	Brown 61	-	-							
225	Brown 61									
250	Brown 61									
High Efficiency										
140	Brown 61	-	-							
155	Brown 61	-	-							
170	Brown 61	-	-							
185	Brown 61									
200	Brown 61									



Installation - Mechanical

Point Weights (Units without Seismic Rating)

See Table 34, p. 40 through Table 36, p. 43 for point weights of units that are NOT seismically rated.

See Table 40, p. 46 for seismically rated units (unit model number digit 13 = S or E).

Table 34. Point weights (lbs) - packaged units - 60 Hz- units not seismically rated

Size (tons)	Isolator Location									
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10
Aluminum Coils - Standard Efficiency										
140	1402	1450	1383	1430	1361	1408	1333	1379	-	-
155	1402	1450	1383	1430	1361	1408	1333	1379	-	-
170	1461	1450	1383	1430	1361	1408	1339	1386	-	-
185	1657	1673	1734	1638	1564	1584	1519	1530	-	-
200	1674	1733	1646	1701	1604	1658	1561	1616	-	-
225	1521	1571	1503	1554	1472	1522	1443	1494	1413	1473
250	1539	1601	1522	1584	1493	1522	1465	1527	1438	1500
275	1925	2188	1887	2148	1870	2082	1787	2062	1750	1986
300	1936	2173	1974	2198	1994	2230	2029	2266	2080	2334
350	1907	2144	1977	2213	2065	2301	2163	2399	2300	2536
400	2744	2758	2667	2646	2584	2564	2531	2510	2428	2422
450	2812	2774	2791	2753	2770	2733	2750	2712	2729	2569
500	2777	2719	2787	2744	2812	2768	2836	2792	2860	2817
Aluminum Coils - High Efficiency										
140	1402	1450	1383	1430	1361	1408	1339	1387	-	-
155	1588	1648	1565	1609	1505	1558	1465	1507	-	-
170	1657	1652	1565	1622	1515	1579	1465	1530	-	-
185	1419	1523	1405	1510	1381	1496	1358	1466	1335	1400
200	1497	1552	1479	1539	1446	1496	1417	1466	1389	1440
225	1661	1686	1649	1674	1629	1654	1613	1639	1591	1617
250	1661	1686	1649	1674	1629	1654	1613	1639	1591	1617
275	1829	2070	1891	2134	1960	2201	2093	2282	2193	2395
300	2147	2392	2120	2391	2087	2357	2049	2319	2014	2284
350	2647	2629	2535	2517	2452	2434	2512	2380	2294	2300
400	2744	2705	2773	2729	2797	2754	2822	2778	2846	2802
Aluminum Coils - Extra Efficiency										
140	1657	1652	1565	1622	1515	1579	1465	1530	-	-
155	1419	1523	1405	1510	1381	1496	1358	1466	1335	1400
170	1497	1552	1479	1539	1446	1496	1417	1466	1389	1440
185	1661	1686	1649	1674	1629	1654	1613	1639	1591	1617
200	1661	1686	1649	1674	1629	1654	1613	1639	1591	1617
250	1829	2070	1891	2134	1960	2201	2093	2282	2193	2395
275	2147	2392	2120	2391	2087	2357	2049	2319	2014	2284
300	2647	2629	2535	2517	2452	2434	2512	2380	2294	2300
350	2744	2705	2773	2729	2797	2754	2822	2778	2846	2802

Table 34. Point weights (lbs) - packaged units - 60 Hz- units not seismically rated (continued)

Size (tons)	Isolator Location									
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10
Copper Coils - Standard Efficiency										
140	1658	1720	1675	1737	1695	1757	1715	1777	-	-
155	1658	1720	1675	1737	1695	1757	1715	1777	-	-
170	1658	1720	1675	1737	1695	1757	1715	1776	-	-
185	2025	2061	2012	2052	1997	2098	1984	2024	-	-
200	2042	2121	2040	2114	2038	2129	2036	2110	-	-
225	1868	1954	1865	1945	1861	1951	1859	1049	1857	1947
250	1891	1961	1890	1960	1887	1957	1885	1956	1883	1953
275	2505	2768	2458	2700	2358	2589	2215	2501	2130	2384
300	2550	2787	2458	2786	2547	2784	2545	2782	2543	2798
350	2467	2704	2548	2785	2651	2888	2765	3003	2946	3163
400	3474	3498	3372	3350	3272	3207	3207	3184	3082	3077
450	3576	3602	3465	3468	3332	3199	3199	3202	3066	3069
500	3552	3513	3575	3536	3597	3620	3620	3580	3642	3552
Copper Coils - High Efficiency										
140	1658	1720	1675	1737	1695	1757	1715	1777	-	-
155	1956	2029	1958	2022	1949	2011	1928	2001	-	-
170	1965	2040	1958	2035	1949	2098	1939	2014	-	-
185	1788	1914	1792	1916	1796	1951	1800	1924	1804	1928
200	1868	1928	1865	1936	1861	1932	1859	1928	1853	1928
225	2077	2125	2090	2135	2105	2152	2118	2166	2137	2185
250	2077	2125	2090	2135	2105	2152	2118	2166	2137	2185
275	2410	2652	2458	2700	2519	2761	2587	2828	2720	2923
300	2825	3097	2766	3037	2690	2962	2605	2876	2526	2798
350	3377	3357	3241	3221	3139	3074	3074	3054	2948	2946
400	3531	3498	3561	3521	3583	3606	3606	3566	3628	3588
Copper Coils - Extra Efficiency										
140	1965	2040	1958	2035	1949	2098	1939	2014	-	-
155	1788	1914	1792	1916	1796	1951	1800	1924	1804	1928
170	1868	1928	1865	1936	1861	1932	1859	1928	1853	1928
185	2077	2125	2090	2135	2105	2152	2118	2166	2137	2185
200	2077	2125	2090	2135	2105	2152	2118	2166	2137	2185
250	2410	2652	2458	2700	2519	2761	2587	2828	2720	2923
275	2825	3097	2766	3037	2690	2962	2605	2876	2526	2798
300	3377	3357	3241	3221	3139	3074	3074	3054	2948	2946
350	3531	3498	3561	3521	3583	3606	3606	3566	3628	3588



Installation - Mechanical

Table 35. Point weights (lbs) - packaged units - 50 Hz

Size (tons)	Isolator Location									
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10
Aluminum Coils - Standard Efficiency										
140	1402	1450	1383	1430	1361	1408	1333	1379	-	-
155	1461	1457	1444	1435	1414	1411	1389	1386	-	-
170	1402	1503	1444	1491	1431	1478	1418	1465	-	-
185	1674	1733	1646	1699	1586	1645	1532	1596	-	-
200	1674	1742	1662	1716	1621	1675	1580	1634	-	-
250	1936	1642	1963	2356	1997	1703	2030	1736	2059	1764
275	2059	2353	1973	2266	1870	2201	1787	2062	1683	1986
300	1936	2104	1890	2198	1994	2196	2029	2266	2080	2334
350	2539	2520	2451	2421	2368	2349	2320	2301	2230	2300
375	2437	2386	2491	2440	2519	2678	2562	2511	2620	2569
400	2744	2758	2667	2646	2584	2564	2531	2510	2428	2422
Aluminum Coils - High Efficiency										
120	1402	1450	1383	1430	1361	1408	1333	1379	-	-
130	1402	1450	1383	1430	1361	1408	1333	1379	-	-
140	1402	1450	1383	1430	1361	1408	1339	1387	-	-
155	1657	1648	1617	1622	1585	1579	1541	1537	-	-
170	1597	1712	1629	1684	1586	1645	1541	1596	-	-
185	1468	1552	1455	1539	1446	1522	1417	1494	1389	1472
200	1521	1571	1503	1554	1472	1522	1443	1494	1414	1473
250	1926	2187	1888	2685	1833	2100	1786	2063	2000	2015
275	1907	2174	1973	2209	2022	2273	2093	2244	2193	2444
300	2147	2417	2120	2391	2087	2357	2049	2319	2014	2284
350	2392	2340	2522	2470	2591	2538	2695	2643	2837	2784
375	2755	2718	2735	2698	2715	2678	2695	2658	2674	2637
400	2744	2705	2773	2729	2797	2754	2822	2779	2846	2802
Copper Coils - Standard Efficiency										
140	1658	1720	1675	1737	1695	1757	1715	1777	-	-
155	1717	1728	1737	1742	1748	1750	1765	1775	-	-
170	1717	1774	1737	1798	1765	1827	1893	1855	-	-
185	2042	2121	2034	2112	2020	2038	2006	2090	-	-
200	2056	2130	2055	2130	2055	2112	2054	2129	-	-
250	2078	2332	2089	1669	2118	2385	2146	2413	2170	2437
275	2638	2933	2529	2805	2358	2653	2215	2501	2079	2384
300	2462	2718	2477	2732	2495	2784	2545	2782	2543	2798
350	3158	3137	3039	3018	2951	2894	2894	2873	2784	2779
375	3576	3579	3291	3255	3083	2948	2948	2912	2689	2690
400	3538	3498	3372	3350	3272	3207	3207	3184	3082	3077
Copper Coils - Standard Efficiency										
120	1658	1720	1675	1737	1695	1757	1715	1777	-	-
130	1658	1720	1675	1737	1695	1757	1715	1777	-	-
140	1658	1720	1675	1737	1695	1757	1715	1777	-	-
155	2025	2040	2012	2035	2009	2033	2007	2031	-	-
170	2025	2100	3034	2098	2020	2038	2016	2090	-	-
185	1839	1954	1842	1945	1846	1920	1859	1956	1857	1961
200	1891	1961	1890	1960	1887	1957	1885	1956	1883	1953
250	2506	2767	2418	2134	2321	2588	2224	2491	2170	2437
275	2488	2740	2529	2805	2581	2833	2639	2828	2720	2972
300	2825	3097	2766	3037	2690	2962	2605	2876	2526	2798
350	3000	2934	3184	3118	3281	3214	3429	3362	3628	3562
375	3576	3579	3442	3445	3309	3176	3176	3179	3043	3046
400	3445	3396	3516	3467	3587	3538	3658	3609	3628	3681

Table 36. Point weights (lbs) - condensing units - 60 Hz

Size (tons)	Isolator Location									
	1	2	3	4	5	6	7	8	9	10
Aluminum Coils - Standard Efficiency										
140	1150	1183	1095	1128	1032	1065	969	1002	-	-
155	1150	1183	1095	1128	1032	1065	969	1002	-	-
170	1150	1183	1095	1128	1032	1065	969	1002	-	-
185	1381	1384	1325	1331	1241	1246	1156	1162	-	-
200	1397	1437	1351	1391	1279	1318	1206	1246	-	-
225	1251	1307	1222	1279	1172	1229	1126	1190	1081	1140
250	1274	1312	1246	1283	1196	1233	1149	1190	1103	1140
Aluminum Coils - High Efficiency										
140	1150	1183	1095	1128	1032	1065	969	1002	-	-
155	1321	1361	1270	1301	1190	1230	1109	1149	-	-
170	1321	1361	1270	1314	1190	1230	1109	1149	-	-
185	1175	1267	1151	1242	1107	1199	1067	1159	1027	1118
200	1251	1295	1222	1259	1172	1207	1122	1159	1081	1118
Copper Coils - Standard Efficiency										
140	1406	1454	1388	1435	1366	1414	1345	1392	-	-
155	1406	1454	1388	1435	1366	1414	1345	1392	-	-
170	1406	1454	1388	1435	1366	1414	1345	1392	-	-
185	1749	1772	1718	1744	1675	1700	1631	1656	-	-
200	1768	1825	1745	1805	1713	1772	1680	1740	-	-
225	1622	1697	1608	1686	1587	1665	1568	1645	1549	1625
250	1644	1702	1633	1690	1611	1668	1591	1648	1571	1628
Copper Coils - High Efficiency										
140	1406	1454	1388	1435	1366	1414	1345	1392	-	-
155	1689	1749	1664	1714	1624	1673	1583	1644	-	-
170	1689	1749	1664	1727	1624	1695	1583	1644	-	-
185	1546	1657	1537	1649	1523	1634	1509	1621	1495	1607
200	1622	1686	1608	1666	1587	1642	1568	1621	1549	1599

Seismic Isolator Mounting

Figure 19. Mounting locations — seismic spring isolators or seismic elastomeric pads

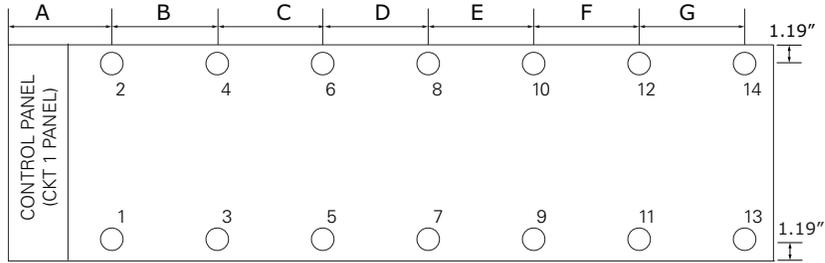


Table 37. Mounting locations — 60 Hz units with seismic rating

Size (tons)	Dimension (in)						
	A	B	C	D	E	F	G
Standard Efficiency							
140	17	46	53	53	-	-	-
155	17	46	53	53	-	-	-
170	17	46	53	53	-	-	-
185	17	48	76	76	-	-	-
200	17	48	76	76	-	-	-
225	17	39	69	64	64	-	-
250	17	39	69	64	64	-	-
275	17	76	90	90	75	-	-
300	17	80.25	80.25	80.25	80.25	80.25	-
350	17	80.25	80.25	80.25	80.25	80.25	-
400	17	87.5	87.5	87.5	87.5	87.5	-
450	17	84.85	84.85	84.85	84.85	92.75	78
500	17	84.85	84.85	84.85	84.85	92.75	78
High Efficiency							
140	17	46	53	53	-	-	-
155	17	48	76	76	-	-	-
170	17	48	76	76	-	-	-
185	17	39	69	64	64	-	-
200	17	39	69	64	64	-	-
225	17	56	95	75	105	-	-
250	17	56	95	75	105	-	-
275	17	80.25	80.25	80.25	80.25	80.25	-
300	17	87.5	87.5	87.5	87.5	87.5	-
350	17	87.5	87.5	87.5	87.5	87.5	-
400	17	84.85	84.85	84.85	84.85	92.75	78
Extra Efficiency							
140	17	48	76	76	-	-	-
155	17	39	69	64	64	-	-
170	17	39	69	64	64	-	-
185	17	56	95	75	105	-	-
200	17	56	95	75	105	-	-
250	17	80.25	80.25	80.25	80.25	80.25	-
275	17	87.5	87.5	87.5	87.5	87.5	-
300	17	87.5	87.5	87.5	87.5	87.5	-
350	17	84.85	84.85	84.85	84.85	92.75	78

Table 38. Mounting locations — 50 Hz units with seismic rating

Size (tons)	Dimension (in)						
	A	B	C	D	E	F	G
Standard Efficiency							
140	17	46	53	53	-	-	-
155	17	46	53	53	-	-	-
170	17	46	53	53	-	-	-
185	17	48	76	76	-	-	-
200	17	48	76	76	-	-	-
250	17	76	90	90	75	-	-
275	17	76	90	90	75	-	-
300	17	80.25	80.25	80.25	80.25	80.25	-
375	17	87.5	87.5	87.5	87.5	87.5	-
350	17	87.5	87.5	87.5	87.5	87.5	-
400	17	87.5	87.5	87.5	87.5	87.5	-
High Efficiency							
120	17	46	53	53	-	-	-
130	17	46	53	53	-	-	-
140	17	46	53	53	-	-	-
155	17	48	76	76	-	-	-
170	17	48	76	76	-	-	-
185	17	39	69	64	64	-	-
200	17	39	69	64	64	-	-
250	17	76	90	90	75	-	-
275	17	80.25	80.25	80.25	80.25	80.25	-
300	17	87.5	87.5	87.5	87.5	87.5	-
350	17	87.5	87.5	87.5	87.5	87.5	-
375	17	84.85	84.85	84.85	84.85	92.75	78
400	17	84.85	84.85	84.85	84.85	92.75	78

Seismic Spring Isolator Selection
Table 39. Seismic spring isolator selections (MSSH-1E-xxxx)

Size (tons)	Location													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Standard Efficiency														
140	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-	-	-
155	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-	-	-
170	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-	-	-
185	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	-	-	-	-	-	-
200	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	-	-	-	-	-	-
225	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-
250	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	-	-	-	-
275	2990N	2990N	2990N	2990N	2575N	2575N	2575N	2575N	2575N	2575N	-	-	-	-
300	2990N	2990N	2990N	2990N	2575N	2575N	2575N	2575N	2000	2000	2000	2000	-	-
350	2990N	2990N	2990N	2990N	2575N	2575N	2575N	2575N	2575N	2575N	2000	2000	-	-
400	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	-	-
450	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N
500	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N
High Efficiency														
140	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-	-	-
155	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-	-	-
170	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-	-	-
185	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-
200	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-
225	2575N	2575N	2575N	2575N	2575N	2575N	2000	2000	2000	2000	-	-	-	-
250	2575N	2575N	2575N	2575N	2575N	2575N	2000	2000	2000	2000	-	-	-	-
275	2990N	2990N	2990N	2990N	2575N	2575N	2575N	2575N	2000	2000	2000	2000	-	-
300	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	-	-
350	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	-	-
400	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N
Extra Efficiency														
140	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-	-	-
155	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-
170	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	-	-	-	-
185	2575N	2575N	2575N	2575N	2575N	2575N	2000	2000	2000	2000	-	-	-	-
200	2575N	2575N	2575N	2575N	2575N	2575N	2000	2000	2000	2000	-	-	-	-
250	2990N	2990N	2990N	2990N	2575N	2575N	2575N	2575N	2000	2000	2000	2000	-	-
275	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	2575N	-	-
300	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	-	-
350	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N	2990N



Installation - Mechanical

Point Weights (Units with Seismic Rating)

Table 40. Point weights (lbs) - seismically rated units

Size (tons)	Isolator Location													
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
Aluminum Coils - Standard Efficiency														
140	1465	1515	1445	1494	1422	1471	1393	1441	-	-	-	-	-	-
155	1472	1522	1452	1501	1429	1478	1400	1448	-	-	-	-	-	-
170	1534	1523	1452	1502	1429	1478	1406	1455	-	-	-	-	-	-
185	1740	1757	1821	1720	1642	1663	1595	1607	-	-	-	-	-	-
200	1758	1820	1728	1786	1684	1741	1639	1697	-	-	-	-	-	-
225	1597	1650	1578	1632	1546	1598	1515	1569	1484	1547	-	-	-	-
250	1616	1681	1598	1663	1568	1598	1538	1603	1510	1575	-	-	-	-
275	2360	2250	2251	2140	2122	2011	1993	1882	1885	1774	-	-	-	-
300	2387	2287	2220	2120	2008	1909	1772	1673	1607	1508	1442	1343	-	-
350	2357	2254	2224	2122	2058	1954	1871	1768	1741	1638	1611	1507	-	-
400	2322	2410	2280	2368	2239	2327	2197	2286	2156	2245	2115	2203	-	-
450	2143	2223	2111	2191	2079	2159	2015	2095	1951	2031	1918	1999	1887	1967
500	1738	1821	1814	1896	1937	2019	2050	2132	2163	2245	2276	2358	2389	2471
Aluminum Coils - High Efficiency														
140	1471	1522	1451	1501	1428	1478	1405	1455	-	-	-	-	-	-
155	1667	1730	1643	1689	1580	1636	1538	1582	-	-	-	-	-	-
170	1740	1735	1643	1703	1591	1658	1538	1606	-	-	-	-	-	-
185	1490	1599	1475	1586	1450	1571	1426	1539	1402	1470	-	-	-	-
200	1572	1630	1553	1616	1518	1571	1488	1539	1458	1512	-	-	-	-
225	1701	1846	1683	1828	1652	1796	1627	1771	1592	1737	-	-	-	-
250	1701	1846	1683	1828	1652	1796	1627	1772	1592	1737	-	-	-	-
275	2293	2193	2153	2054	1976	1877	1780	1680	1642	1543	1504	1406	-	-
300	2308	2204	2181	2077	2055	1950	1927	1824	1801	1697	1674	1571	-	-
350	2218	2302	2179	2263	2139	2223	2100	2184	2060	2144	2021	2105	-	-
400	2043	2125	2043	2124	2043	2123	2041	2122	2039	2121	2038	2120	2037	2119
Aluminum Coils - Extra Efficiency														
140	1736	1731	1640	1699	1587	1654	1535	1603	-	-	-	-	-	-
155	1491	1601	1477	1587	1451	1572	1427	1541	1403	1471	-	-	-	-
170	1569	1627	1551	1613	1516	1568	1486	1537	1456	1510	-	-	-	-
185	1701	1846	1683	1828	1651	1796	1627	1772	1592	1737	-	-	-	-
200	1697	1850	1679	1831	1648	1800	1623	1776	1589	1741	-	-	-	-
250	2292	2194	2153	2054	1976	1877	1779	1681	1642	1543	1504	1405	-	-
275	2307	2203	2181	2077	2055	1951	1928	1824	1801	1697	1674	1570	-	-
300	2218	2302	2178	2262	2139	2223	2099	2184	2059	2145	2021	2105	-	-
350	2044	2125	2043	2124	2042	2124	2041	2122	2039	2120	2038	2119	2037	2118

Drainage

Provide large capacity drain for use during shutdown or repair. Evaporator is provided with drain connection. All local and national codes apply. Vent on top of evaporator waterbox prevents vacuum by allowing air into evaporator for complete drainage.

Evaporator Water Piping

RTAC units are available with 2- or 3-pass evaporator configurations.

Figure 20. Evaporator pass configurations - 2 compressor units

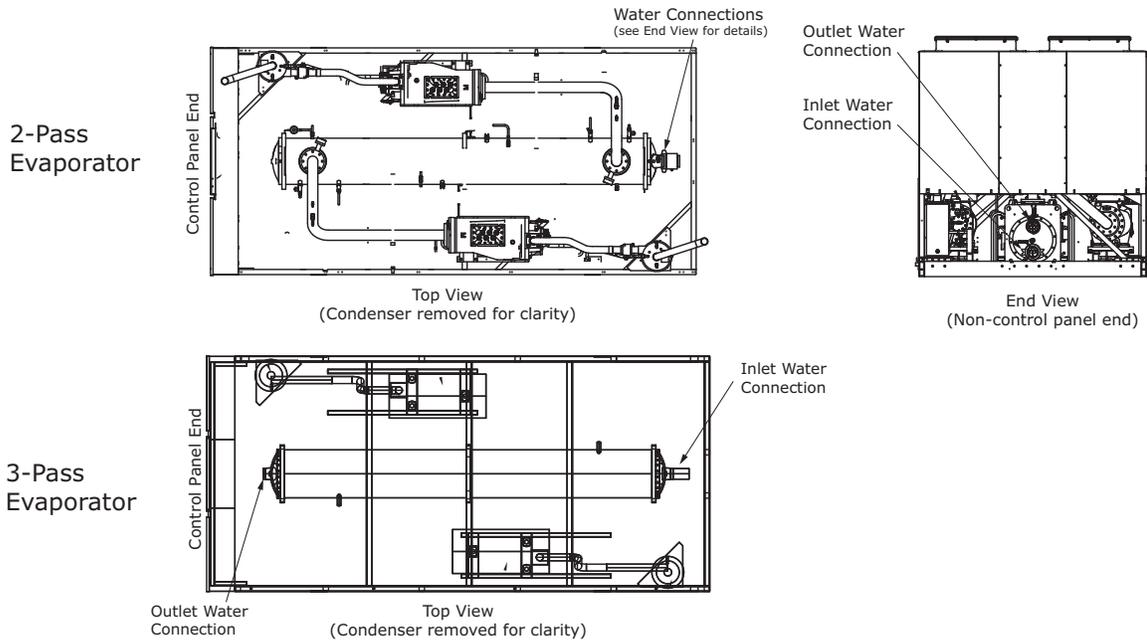
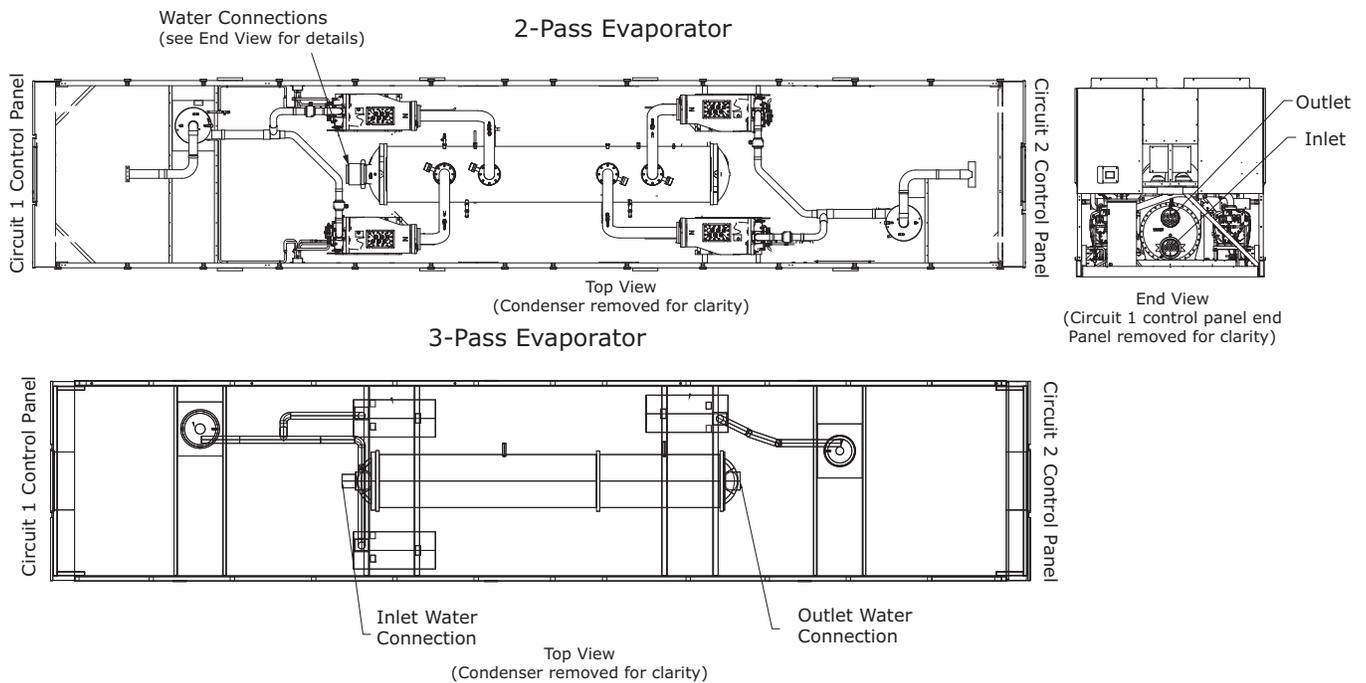


Figure 21. Evaporator pass configurations - 3 or 4 compressor units





Installation - Mechanical

Thoroughly flush all water piping to the unit before making the final piping connections to the unit.

Components and layout will vary slightly, depending on the location of connections and the water source.

NOTICE:

Evaporator Damage!

The chilled water connections to the evaporator are to be "victaulic" type connections. Do not attempt to weld these connections, as the heat generated from welding can cause microscopic and macroscopic fractures on the cast iron waterboxes that can lead to premature failure of the waterbox. To prevent damage to chilled water components, do not allow evaporator pressure (maximum working pressure) to exceed 150 psig (10.5 bar).

Provide shutoff valves in gauge lines to isolate them from system when not in use. Use rubber vibration eliminators to prevent vibration transmission through water lines. If desired, install thermometers in lines to monitor entering and leaving water temperatures. Install a balancing valve in leaving water line to control water flow balance. Install shutoff valves on both entering and leaving water lines so evaporator can be isolated for service.

NOTICE:

Evaporator Damage!

To prevent evaporator damage, pipe strainers must be installed in the water supplies to protect components from water born debris. Trane is not responsible for equipment-only-damage caused by water born debris.

"Piping components" include all devices and controls used to provide proper water system operation and unit operating safety. These components and their general locations are given below.

Entering Chilled Water Piping

- Air vents (to bleed air from system).
- Water pressure gauges with shutoff valves.
- Vibration eliminators.
- Shutoff (isolation) valves. Thermometers (if desired).
- Clean-out tees.
- Pipe strainer.

Leaving Chilled Water Piping

- Air vents (to bleed air from system).
- Water pressure gauges with shutoff valves.
- Vibration eliminators.
- Shutoff (isolation) valves.
- Thermometers.
- Clean-out tees.
- Balancing valve.

Evaporator Drain

A 1/2" drain connection is located under outlet end of evaporator waterbox for drainage during unit servicing. A shutoff valve must be installed on drain line.

Evaporator Flow Switch

The flow switch is factory-installed and programmed based on the operating conditions submitted with the order. The leaving evaporator temperature, fluid type and fluid concentration affect the selected flow switch. If the operating conditions on the job site change, the flow switch may need to be replaced.

The sensor head includes 3 LEDs, two yellow and one green. Wait 15 seconds after power is applied to the sensor before evaluating LEDs for flow status. When wired correctly and flow is established, only the green LED should be lit. Following are the LED indicators:

- Green ON, both yellow OFF — Flow
- Green and outside yellow ON — No Flow
- Center yellow ON continuously — Miswire

Factory installed jumper wire W3 must be removed if using auxiliary contacts and/or additional proof of flow. See schematics in RTAC-SVE01*-EN for more details.

NOTICE:

Equipment Damage!

Incorrect wiring of auxiliary contacts could result in equipment damage.

Note: Use caution when connecting auxiliary contacts. Terminals 1TB6-3 and 1TB6-5 are to be used for field connections. Inadvertent use of 1TB6-5 and 1TB6-4 will result in a FALSE FLOW indication.

If using auxiliary flow sensing, both yellow LEDs come on initially when flow is stopped. Center yellow LED will turn off after approximately 7 seconds. LED indicators are otherwise same as indicated above.

NOTICE:

Proper Water Treatment!

The use of untreated or improperly treated water in this equipment could result in scaling, erosion, corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

Important: If using an acidic commercial flushing solution, construct a temporary bypass around the unit to prevent damage to internal components of the evaporator.

Dirt, scale, products of corrosion and other foreign material will adversely affect heat transfer between the water and system components. Foreign matter in chilled water system can also increase pressure drop and reduce water flow. Proper water treatment must be determined locally, depending on system and local water characteristics.

Neither salt nor brackish water is recommended. Use of either will lead to a shortened life to an indeterminable degree. The Trane Company encourages the service of a reputable water treatment specialist, familiar with local water conditions, to assist in this determination and in establishment of a proper water treatment program.

Using untreated or improperly treated water in these units may result in inefficient operation and possible tube damage. Consult a qualified water treatment specialist to determine whether treatment is needed.

Indexing Flow Switch

To properly index flow switch, the following requirements must be met:

- Dot must be at a position no greater than 90° off Index.
- Torque must be between 22 ft-lb min and 74 ft-lb max.
- A minimum distance of 5x pipe diameter must be maintained between flow switch and any bends, valves, changes in cross sections, etc.

Figure 22. Proper flow switch indexing

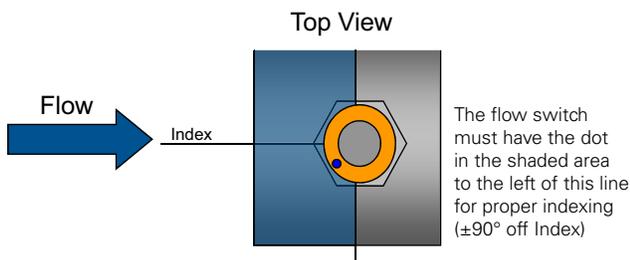


Figure 23. Evaporator water pressure drop— 2-pass evaporator — 120-250 ton

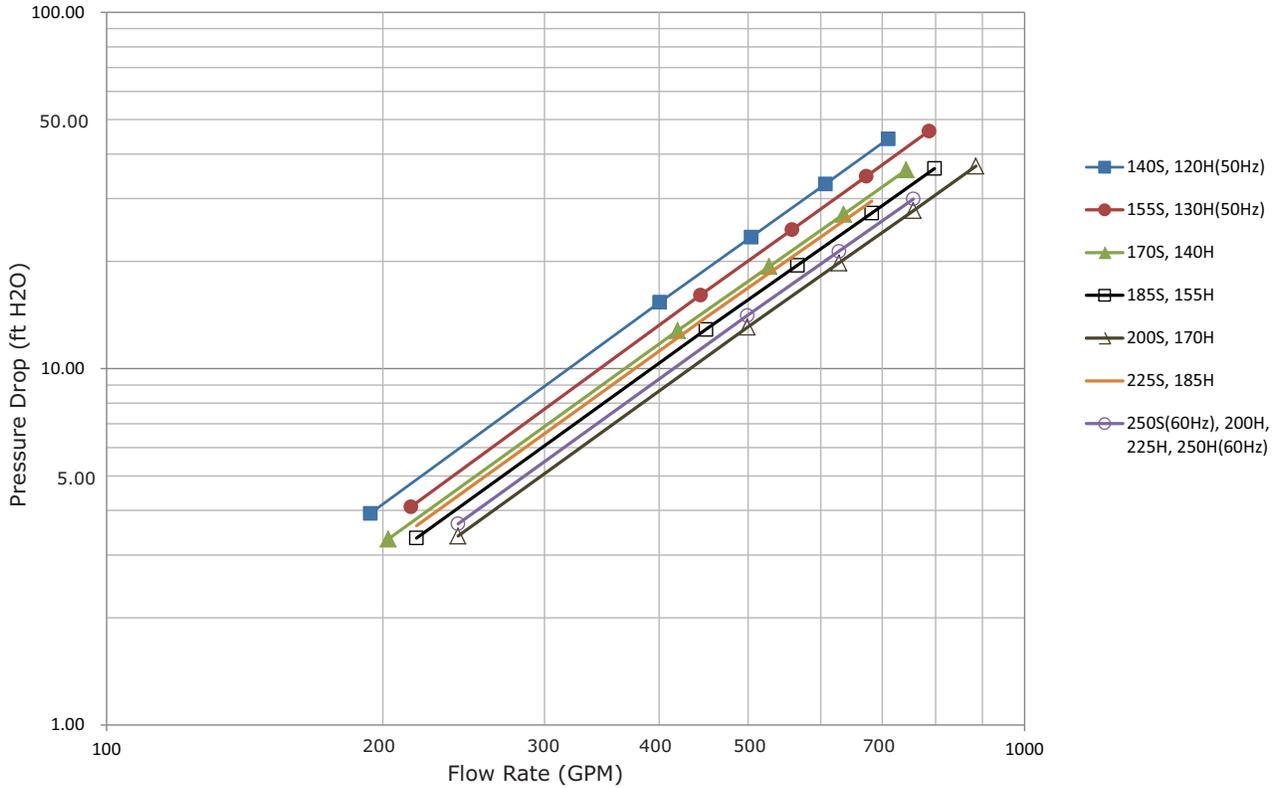


Figure 24. Evaporator water pressure drop — 2-pass evaporator — 250-500 ton

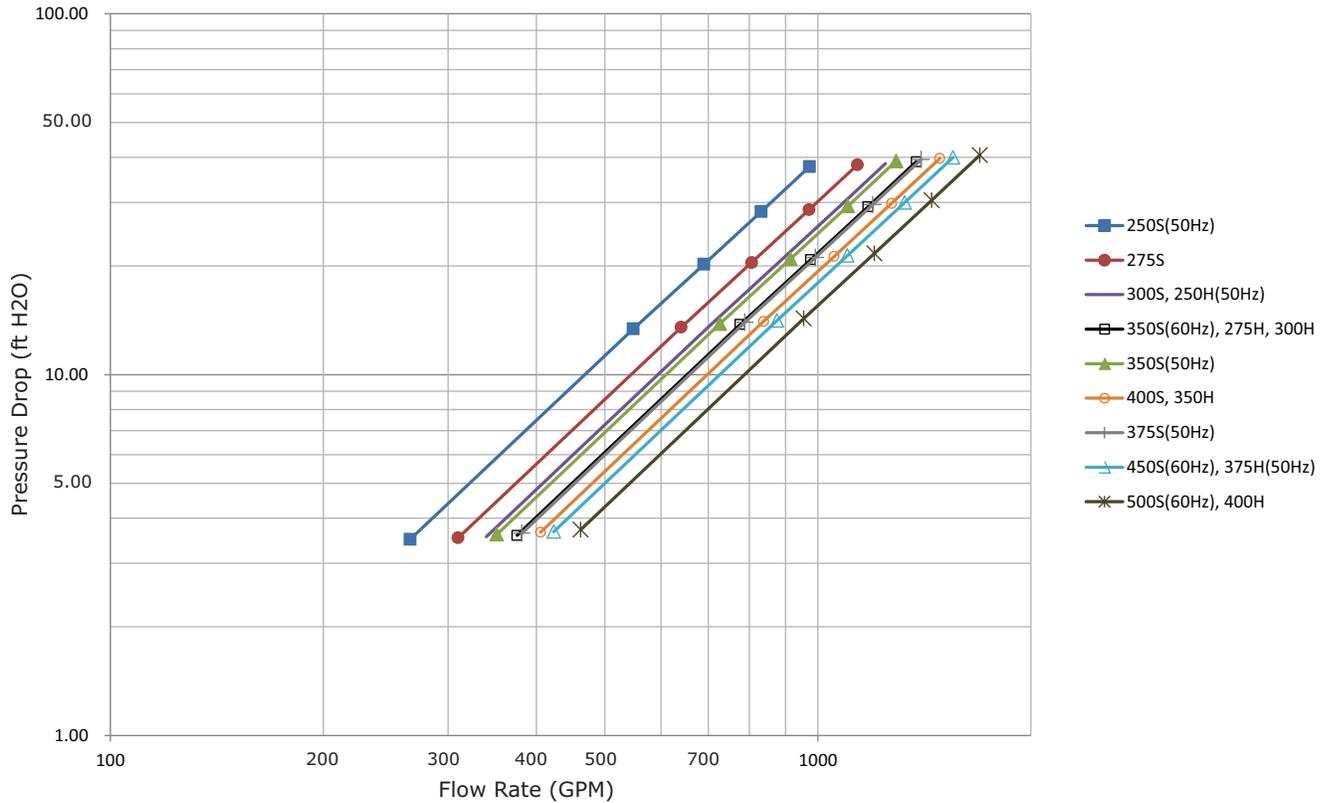


Figure 25. Evaporator water pressure drop – 3-pass evaporator – 140-250T

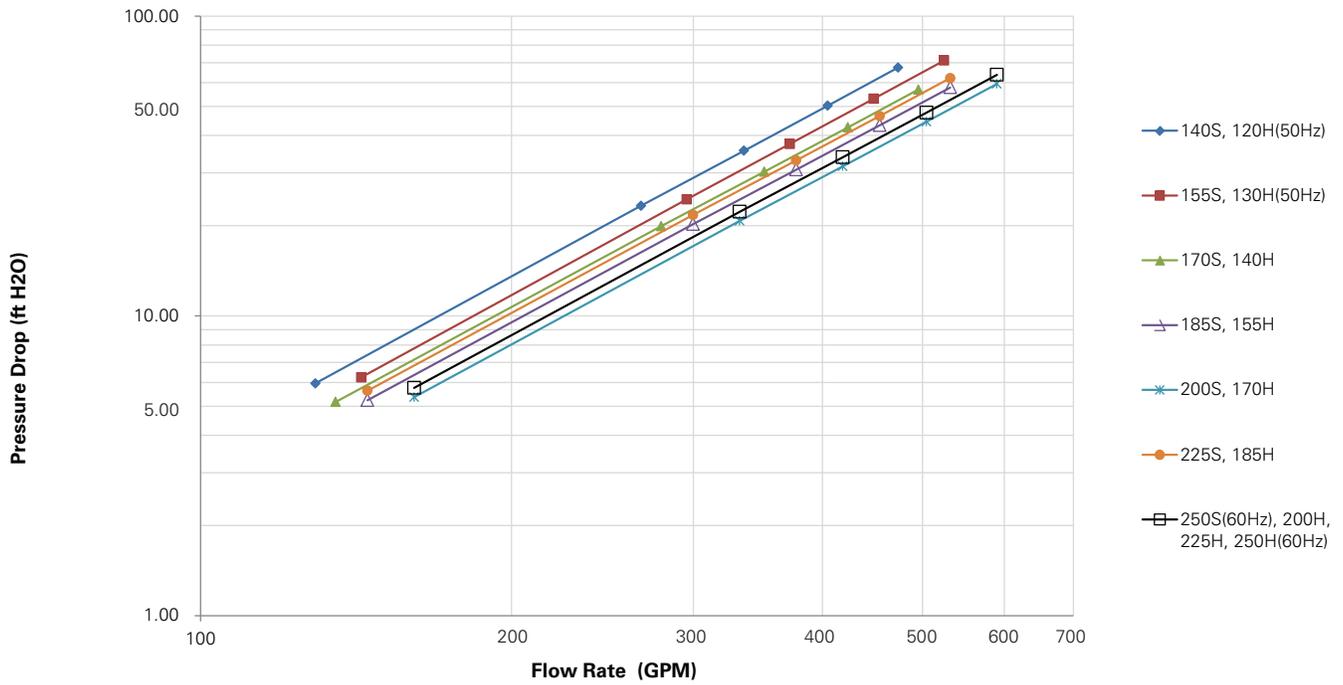
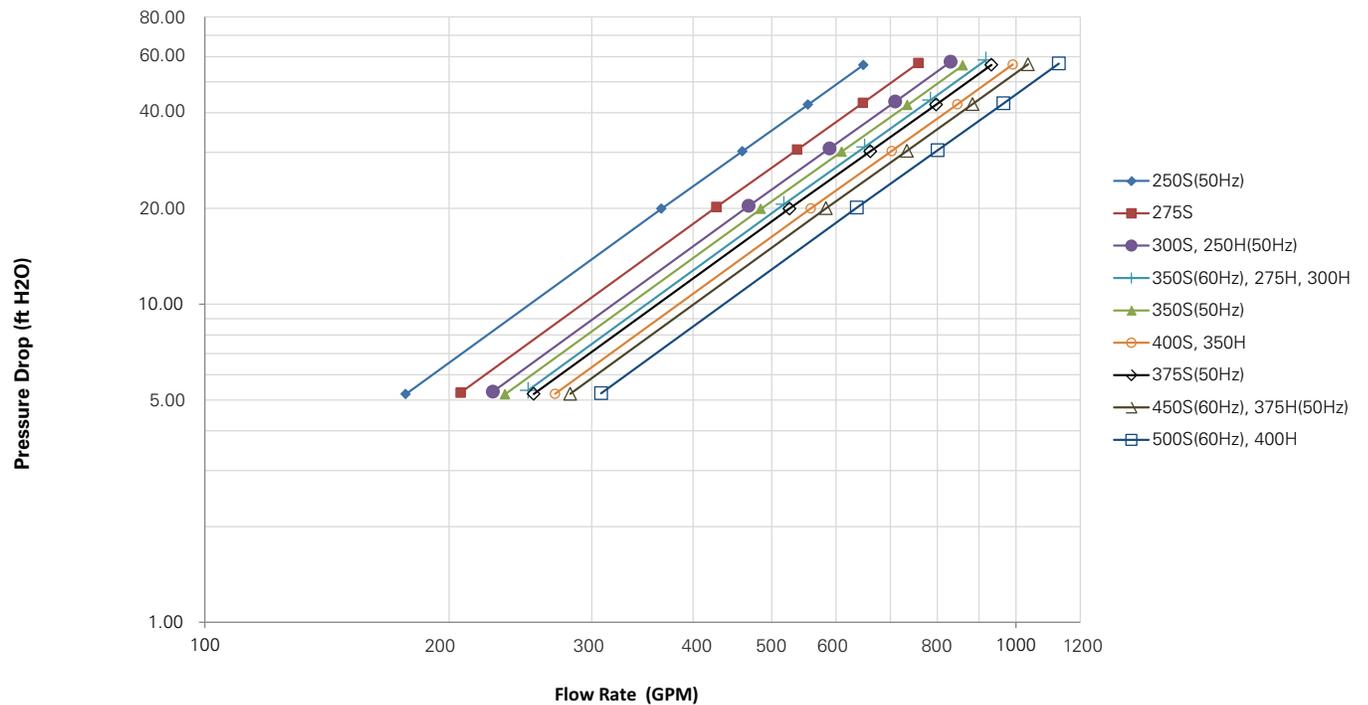
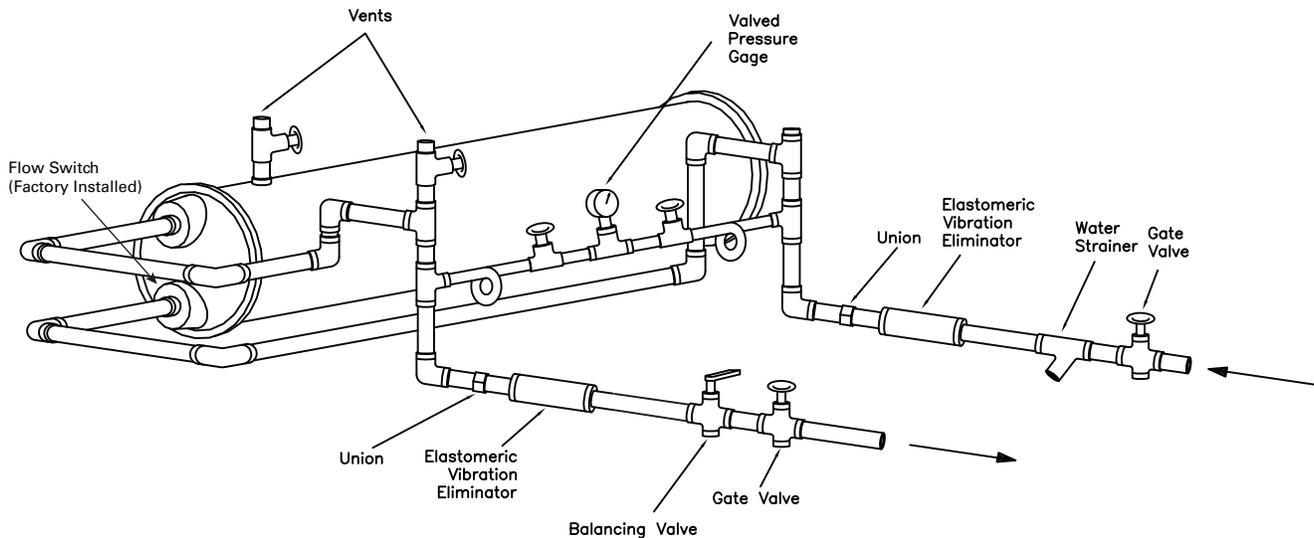


Figure 26. Evaporator water pressure drop – 3-pass evaporator – 250-500T



Water Pressure Gauges

Figure 27. Suggested piping for typical RTAC evaporator



Install field-supplied pressure components as shown in [Figure 27, p. 52](#). Locate pressure gauges or taps in a straight run of pipe; avoid placement near elbows, etc. Be sure to install the gauges at the same elevation on each shell if the shells have opposite-end water connections.

Note: Once the unit is installed at a site, one vertical or one diagonal unit support can be permanently removed if it creates an obstruction for water piping.

To read manifolded pressure gauges, open one valve and close the other (depending upon the reading desired). This eliminates errors resulting from differently calibrated gauges installed at unmatched elevations.

Water Pressure Relief Valves

NOTICE:

Evaporator Damage!

To prevent shell damage, install pressure relief valves in the evaporator water system.

Install a water pressure relief valve in the evaporator inlet piping between the evaporator and the inlet shutoff valve, as shown in [Figure 27, p. 52](#). Water vessels with close-coupled shutoff valves have a high potential for hydrostatic pressure buildup on a water temperature increase. Refer to applicable codes for relief valve installation guidelines.

Freeze Avoidance

One or more of the ambient freeze avoidance methods in [Table 41](#) must be used to protect the RTAC chiller from ambient freeze damage.

Note: A secondary set of pump interlock is **strongly recommended**, but not required.

Table 41. RTAC freeze avoidance methods

Method	Protects to ambient temperature	Notes
Water Pump Control AND Heaters	Down to -20°F	<ul style="list-style-type: none"> • Heaters alone will provide low ambient protection down to -20°F (-29°C), but will NOT protect the evaporator from freezing as a result of charge migration. Therefore, it is required that water pump control be used in conjunction with heaters. • Heaters are factory-installed on the evaporator and water piping and will protect them from freezing • Install heat tape on all water piping, pumps, and other components that may be damaged if exposed to freezing temperatures. Heat tape must be designed for low ambient temperature applications. Heat tape selection should be based on the lowest expected ambient temperature. • CH530 controller can start the pump when freezing conditions are detected. For this option the pump must be controlled by the RTAC unit and this function must be validated. • Water circuit valves need to stay open at all times. • Water pump control and heater combination will protect the evaporator down to any ambient temperature provided power is available to the pump and the CH530 controller. This option will NOT protect the evaporator in the event of a power failure to the chiller unless backup power is supplied to the necessary components. • When no chiller operation is possible and the pump is already off, CH530 pump control for freeze protection will command the pump to turn: <ul style="list-style-type: none"> ON if liquid level > -0.83" AND evap sat temp < LWTC for 30°F-sec (17°C-sec) OFF again if evaporator saturated temperature > LWTC OR liquid level < -0.83" for 30 minutes. ON if entering OR leaving water temperature < LWTC for 30°F-sec (17°C-sec) OFF again if water temperature > LWTC for 30 min (where LWTC is leaving water temperature cutout)
Freeze Inhibitor	Varies. See "Low Evaporator Refrigerant Cutout, Glycol Recommendations," p. 54	<ul style="list-style-type: none"> • Freeze protection can be accomplished by adding sufficient glycol to protect against freezing below the lowest ambient expected. • Use of glycol type antifreeze reduces the cooling capacity of the unit and must be considered in the design of the system specifications.
Drain Water Circuit	Below -20°F	<ul style="list-style-type: none"> • Shut off the power supply to the unit and to all heaters. • Purge the water circuit. • Blow out the evaporator to ensure no liquid is left in the evaporator.

NOTICE:

Evaporator Damage!

If insufficient concentration or no glycol is used, the evaporator water flow must be controlled by the CH530 AND heaters must be used to avoid catastrophic damage to the evaporator due to freezing. It is the responsibility of the installing contractor and/or the customer to ensure that a pump will start when called upon by the chiller controls.

Even with water pump control, a power loss of as little as 15 minutes under freezing conditions can damage the evaporator. Only the proper addition of freeze inhibitor or complete drainage of the water circuit can ensure no evaporator damage in the event of a power failure. See [Table 42, p. 54](#) for correct concentration of glycol.



Low Evaporator Refrigerant Cutout, Glycol Recommendations

1. Solution freeze point is 4 deg F below operating point saturation temperature.
2. LRTC is 4 deg F below freeze point.

Procedure

1. Is operating condition contained within [Table 42, p. 54](#)? If no, see "Specials," p. 54.
2. For leaving fluid temperatures greater than 40 deg F, use settings for 40 deg F.
3. Select operating conditions from [Table 42](#).
4. Read off recommended % glycol.
5. Go to [Table 43, p. 55](#) using the % glycol determined above.

Important: Additional glycol beyond the recommendations will adversely effect unit performance. Unit efficiency and saturated evaporator temperature will be reduced. For some operating conditions this effect can be significant.

6. If additional glycol is used, then use the actual % glycol to establish the low refrigerant cutout setpoint.
7. The minimum low refrigerant cutout setpoint allowed is -5 deg F. The minimum is established by the solubility limits of the oil in the refrigerant.

Specials

Any of the following conditions are considered special applications that must be calculated by engineering:

1. Freeze inhibitor other than ethylene glycol, propylene glycol, calcium chloride or methanol.
2. Fluid delta T outside the range 4 to 16 deg F.
3. Unit configuration other than Standard, Standard with extra pass, and Premium.
4. % Glycol greater than maximum in column in [Table 43](#).

Special should all be calculated by engineering. The purpose of calculating is to make sure that design saturation temperature is greater than 3 deg F. Additionally, the calculation must verify that the fluid freeze point is a minimum of 4 deg. F lower that the design saturation temperature. The low evaporator temperature cutout will be 4 deg F below the freeze point or -5 deg F, whichever is greater.

Important: When using glycol, Techview Setpoint View setting for "Freeze Inhibitor Present" must be set to "Yes" to prevent nuisance high approach diagnostic.

Table 42. Glycol recommendations

DT		Ethylene Glycol						
		4	6	8	10	12	14	16
°F	°C	15	-14	-13	-12	-11	-10	-9
Leaving Water Temperature °F (°C)	38 (3)	--	5	5	5	5	6	--
	34 (1)	--	11	11	11	12	--	--
	30 (-1)	--	15	16	17	18	--	--
	28 (-2)	--	18	18	19	--	--	--
	26 (-3)	--	20	21	22	--	--	--
	24 (-4)	--	22	23	26	--	--	--
	22 (-6)	--	24	26	--	--	--	--
	20 (-7)	--	26	30	--	--	--	--
	18 (-8)	--	29	--	--	--	--	--
	16 (-9)	--	31	--	--	--	--	--
	14 (-10)	30	--	--	--	--	--	--
12 (-11)	32	--	--	--	--	--	--	
10.4 (-12)	34	--	--	--	--	--	--	
DT		Propylene Glycol						
		4	6	8	10	12	14	16
°F	°C	-15	-14	-13	-12	-11	-10	-9
Leaving Water Temperature °F (°C)	38 (3)	--	6	6	7	7	8	--
	34 (1)	--	13	13	15	17	--	--
	30 (-1)	--	19	21	--	--	--	--
	28 (-2)	--	22	--	--	--	--	--
	26 (-3)	--	25	--	--	--	--	--
	24 (-4)	--	--	--	--	--	--	--
	22 (-6)	--	--	--	--	--	--	--
	20 (-7)	--	--	--	--	--	--	--
	18 (-8)	--	--	--	--	--	--	--
	16 (-9)	--	--	--	--	--	--	--
	14 (-10)	--	--	--	--	--	--	--
12 (-11)	--	--	--	--	--	--	--	
10.4 (-12)	--	--	--	--	--	--	--	

Notes:

1. These tables represent the MINIMUM RECOMMENDED glycol percentages for each operating condition
2. Operation is not recommended at certain operating conditions as some chillers may not satisfy maximum or minimum velocity requirements or minimum performance requirements. Contact Trane Sales Representative for more information regarding the operating limits of a particular chiller.

Table 43. Recommended low evaporator refrigerant cutout and percent glycol

% Glycol	Low Refrig. Temp Cutout		Solution Freeze Point	
	°F	°C	°F	°C
Ethylene				
0	28.0	-2.2	32	0
5	25.0	-3.9	29	-1.7
10	21.5	-5.8	25.5	-3.6
15	17.5	-8.1	21.5	-5.8
20	12.8	-10.7	16.8	-8.4
25	7.4	-13.7	11.4	-11.4
30	1.1	-17.2	5.1	-15.0
35	-5.0	-20.6	-2.3	-19.1
40	-5.0	-20.6	-10.8	-23.8
45	-5.0	-20.6	-20.7	-29.3
50	-5.0	-20.6	-32.1	-35.6
54	-5.0	-20.6	-42.3	-41.3
Propylene Glycol				
0	28.0	-2.2	32.0	0
5	25.3	-3.7	29.3	-1.5
10	22.4	-5.3	26.4	-3.1
15	19.1	-7.2	23.1	-4.9
20	15.3	-9.3	19.3	-7.1
25	10.8	-11.8	14.8	-9.6
30	5.3	-14.8	9.3	-12.6
35	-1.3	-19.5	2.7	-16.3
40	-5.0	-20.6	-5.2	-20.7
45	-5.0	-20.6	-14.6	-25.9
50	-5.0	-20.6	-25.8	-32.1
54	-5.0	-20.6	-36.1	-37.8

Chilled Water Temperature Cutout should be set to 5°F below the lowest allowable Chilled Water Set Point bases on the %Glycol.



Installation - Mechanical

Remote Evaporator Option

The **RTAC 140-250 ton** outdoor unit with the Remote Evaporator option is shipped as two pieces: the outdoor unit (condensing) and the evaporator. Short suction line connections are provided with the outdoor condensing unit. The remote evaporator is shipped complete, with factory-mounted electronic expansion valves, water temperature sensors, suction pressure transducers, liquid level control sensors, evaporator flow switch, all factory wired to a ribbon cable. Solenoid valves and drain valves are wired to a relay board in the terminal box. The installing contractor is required to provide and install the following:

- 2-wire, twisted shielded communication line between the remote evaporator terminal box and the Condensing Unit's control panel
- 4-wire connection from evaporator terminal box to condensing unit control panel for flow switch wiring (see [Figure 32, p. 64](#))
- 115 VAC single phase power supply to the remote evaporator terminal box
- 2 liquid lines
- 2 suction lines
- Suction accumulator as specified

Note: A unit ordered as a remote evaporator must also be ordered with either the wide or low ambient option. The fan inverters are necessary for proper control.

System Configuration and Interconnecting Refrigerant Piping

The system may be configured in any of the four arrangements shown in [Figure 28, p. 57](#). The configurations and their associated elevations, along with the total distance between the remote evaporator and the compressor/condenser section, play a critical role in determining suction and liquid line sizes. This will also affect field refrigerant and oil charges. Consequently, there are physical limits which must not be violated if the system is to operate as designed. Please note the following requirements for field installation:

1. The remote evaporator **MUST** be matched with its respective outdoor condensing unit.
2. The circuit number on the outdoor condensing unit must match the circuit number on the evaporator, i.e. circuit #1 on the outdoor condensing unit must be connected with circuit # 1 on the remote evaporator and likewise for circuit #2. RTAC Circuit Capacities are shown in General Data Tables.

NOTICE:

Equipment Damage!

If the circuits are crossed, serious equipment damage could occur.

3. Piping between the evaporator and outdoor unit can not exceed 200 actual feet and/or an equivalent length of 300 feet.

Note: The latter includes the equivalent length of all associated field installed fittings, valves, accessories and straight lengths of interconnecting piping.

4. Horizontal portions of suction lines must be downward sloping toward the compressor at least 1/2 inch for each 10 feet run. This promotes the movement of oil in the direction of gas flow.
5. Suction lines must be insulated.
6. The line sizes defined are to be used only for 40-60 F leaving water temperature and/or full load ice-making applications.
7. [Figure 28, p. 57](#), drawing 1 depicts an installation where the remote evaporator elevation is the same as that of the outdoor condensing unit. The suction and liquid lines are horizontal or down flowing only.

The suction and liquid lines can be put under ground or in a trench. The temperature of the suction lines must never exceed the temperature of the compressor. The line can be below the compressors a maximum of 15 ft.

8. [Figure 28, p. 57](#), drawing 2 shows a variation to drawing 1. The remote evaporator and outdoor condensing unit are at the same elevation but interconnecting piping may be installed up to 15 feet above the base elevation. Refer to [Table 46, p. 60](#) to determine the required length of the suction accumulator line. A full size suction accumulator is required at the evaporator and 50% of the value is required at the condensing unit.
9. A refrigerant drain valve is installed at the bottom of the evaporator for freeze protection. This drain valve is a normally open, pilot operated valve which remains closed unless there is a potential freezing situation detected via low evap temperatures or low water temperatures or a power failure. If the drain valve is opened the installed suction accumulator must be capable of holding the entire evaporator charge. Refer to [Table 46, p. 60](#) for sizing.
10. For installations where the remote evaporator is at a lower elevation than the outdoor condensing unit as shown in [Figure 28, p. 57](#), drawing 3, the elevation difference is not to exceed 100 feet. An inverted liquid

Installation - Mechanical Remote Evaporator Option

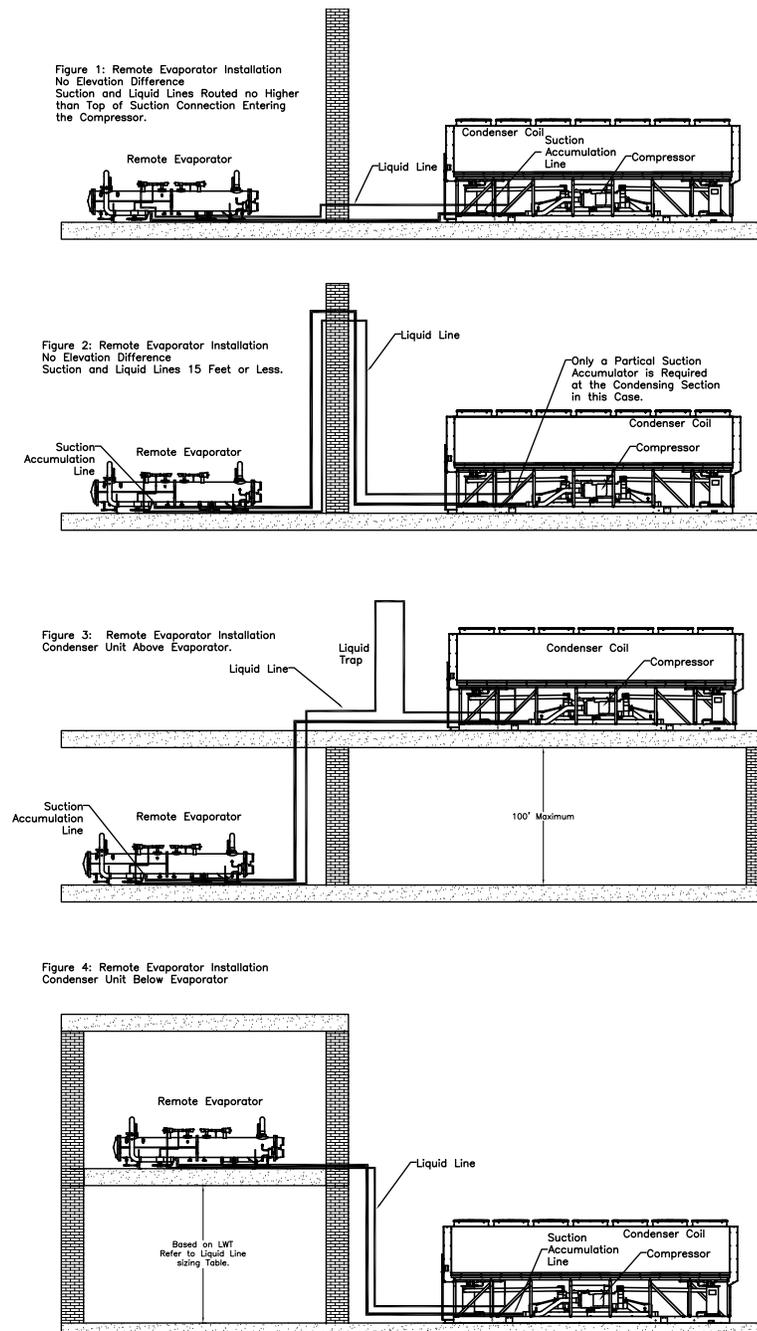
line trap at the condensing unit is required to prevent unwanted free cooling. The apex of the liquid line trap should be at a height above the condenser coils. A suction accumulator must be installed at the evaporator. Refer to [Table 46, p. 60](#) for sizing.

- When the elevation of the remote evaporator exceeds that of the outdoor condensing unit as shown in [Figure 28, p. 57, drawing 4](#), the elevation difference is determined by [Table 44, p. 59](#). The suction accumulator line must be installed according to [Table 46, p. 60](#). It is very important, for proper control

and operation of the chiller, that the elevation requirements given in [Table 44, p. 59](#) are **not** exceeded. It should also be noted that in this configuration the suction accumulator is installed at the condensing section.

- Note:** The height is limited by the available subcooling.
- Compressor & oil separator heaters must be on at least 24 hours prior to compressor start.

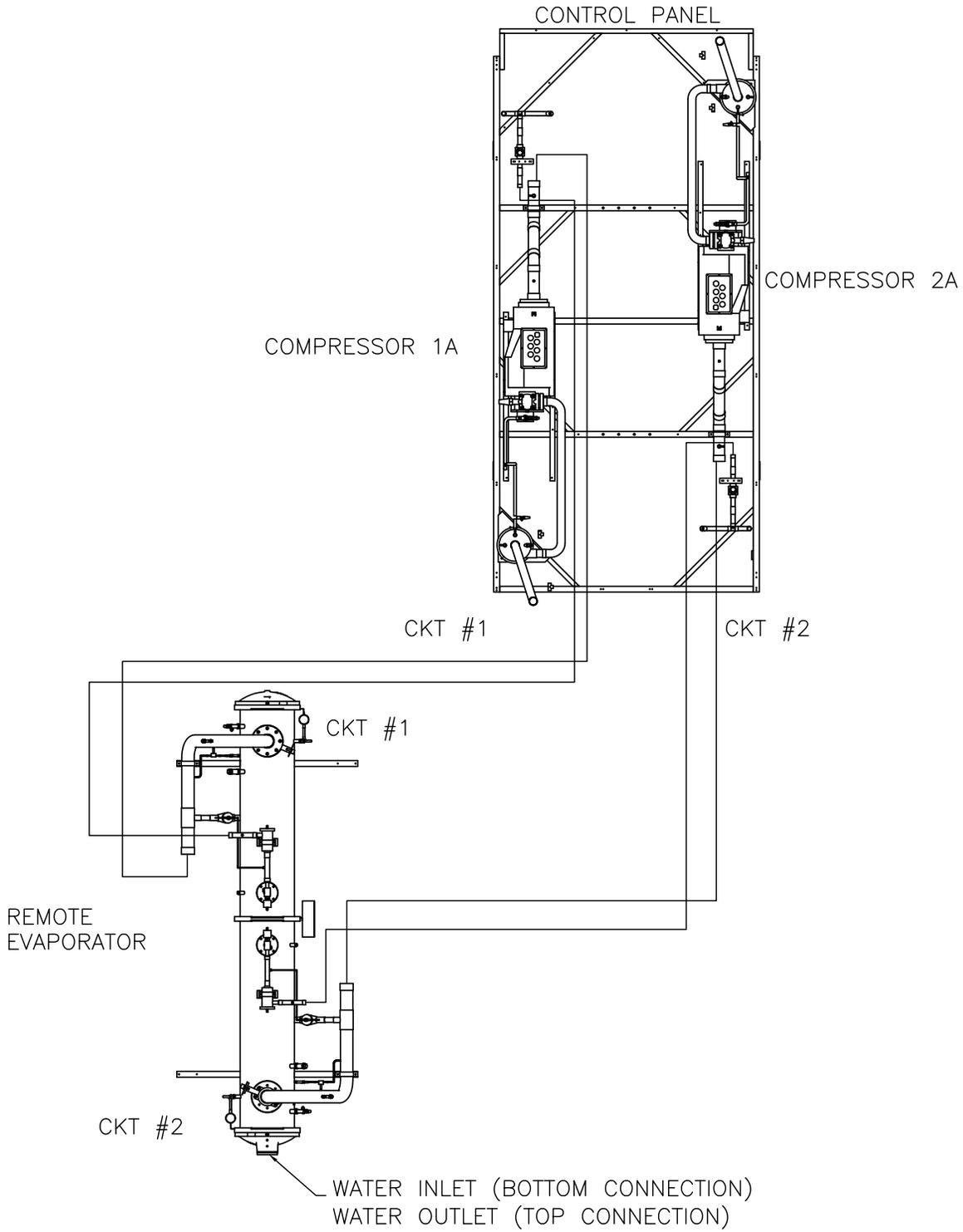
Figure 28. Remote evaporator installations





Installation - Mechanical Remote Evaporator Option

Figure 29. Circuit identification



Installation - Mechanical Remote Evaporator Option

Table 44. Liquid line sizing^(a) - 140-250T remote evaporator

Leaving water 40-50°F	Height (ft)								Leaving water 50-60°F	Height (ft)									
	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35		0	1-5	6-10	11-15	16-20	21-25	26-30			
70-ton circuit																			
Total Equivalent Length (ft)	25	1.375	1.375	1.375	1.375	1.375	1.375	1.375	n/a	Total Equivalent Length (ft)	25	1.375	1.375	1.375	1.375	1.375	1.375	1.375	2.125
	50	1.375	1.375	1.375	1.375	1.375	1.375	1.375	n/a		50	1.375	1.375	1.375	1.375	1.375	1.625	2.125	
	75	1.375	1.375	1.375	1.375	1.375	1.375	1.625	n/a		75	1.375	1.375	1.375	1.375	1.375	1.625	n/a	
	100	1.375	1.375	1.375	1.375	1.375	1.375	1.625	n/a		100	1.375	1.375	1.375	1.375	1.625	2.125	n/a	
	125	1.375	1.375	1.375	1.375	1.375	1.625	1.625	n/a		125	1.375	1.375	1.375	1.625	1.625	2.125	n/a	
	150	1.375	1.375	1.375	1.375	1.375	1.625	n/a	n/a		150	1.375	1.375	1.375	1.625	1.625	2.125	n/a	
	175	1.375	1.375	1.375	1.375	1.625	1.625	n/a	n/a		175	1.375	1.375	1.625	1.625	1.625	2.125	n/a	
	200	1.375	1.375	1.375	1.375	1.625	1.625	n/a	n/a		200	1.375	1.625	1.625	1.625	2.125	2.125	n/a	
	225	1.375	1.375	1.375	1.625	1.625	1.625	n/a	n/a		225	1.375	1.625	1.625	1.625	2.125	2.125	n/a	
	250	1.375	1.375	1.375	1.625	1.625	n/a	n/a	n/a		250	1.625	1.625	1.625	1.625	2.125	2.125	n/a	
	275	1.375	1.375	1.625	1.625	1.625	n/a	n/a	n/a		275	1.625	1.625	1.625	2.125	2.125	2.125	n/a	
	300	1.375	1.375	1.625	1.625	1.625	n/a	n/a	n/a		300	1.625	1.625	1.625	2.125	2.125	2.125	n/a	
85-ton circuit																			
Total Equivalent Length (ft)	25	1.375	1.375	1.375	1.375	1.375	2.125	n/a	Total Equivalent Length (ft)	25	1.375	1.375	1.375	1.375	2.125	n/a	n/a		
	50	1.375	1.375	1.375	1.375	1.375	1.625	n/a		n/a	50	1.375	1.375	1.375	1.625	2.125	n/a	n/a	
	75	1.375	1.375	1.375	1.375	1.375	1.625	n/a		n/a	75	1.375	1.375	1.625	1.625	n/a	n/a	n/a	
	100	1.375	1.375	1.375	1.375	1.625	1.625	n/a		n/a	100	1.375	1.625	1.625	2.125	n/a	n/a	n/a	
	125	1.375	1.375	1.375	1.625	1.625	2.125	n/a		n/a	125	1.375	1.625	1.625	2.125	n/a	n/a	n/a	
	150	1.375	1.375	1.375	1.625	1.625	2.125	n/a		n/a	150	1.625	1.625	1.625	2.125	n/a	n/a	n/a	
	175	1.375	1.375	1.625	1.625	1.625	2.125	n/a		n/a	175	1.625	1.625	2.125	2.125	n/a	n/a	n/a	
	200	1.375	1.625	1.625	1.625	2.125	2.125	n/a		n/a	200	1.625	1.625	2.125	2.125	n/a	n/a	n/a	
	225	1.375	1.625	1.625	1.625	2.125	2.125	n/a		n/a	225	1.625	2.125	2.125	2.125	n/a	n/a	n/a	
	250	1.625	1.625	1.625	1.625	2.125	2.125	n/a		n/a	250	1.625	2.125	2.125	2.125	n/a	n/a	n/a	
	275	1.625	1.625	1.625	1.625	2.125	2.125	n/a		n/a	275	1.625	2.125	2.125	2.125	n/a	n/a	n/a	
	300	1.625	1.625	1.625	2.125	2.125	2.125	n/a		n/a	300	2.125	2.125	2.125	2.125	n/a	n/a	n/a	
100-ton circuit																			
Total Equivalent Length (ft)	25	1.625	1.625	1.625	1.625	1.625	1.625	1.625	Total Equivalent Length (ft)	25	1.625	1.625	1.625	1.625	1.625	1.625	1.625		
	50	1.625	1.625	1.625	1.625	1.625	1.625	1.625		50	1.625	1.625	1.625	1.625	1.625	1.625	1.625		
	75	1.625	1.625	1.625	1.625	1.625	1.625	1.625		75	1.625	1.625	1.625	1.625	1.625	1.625	2.125		
	100	1.625	1.625	1.625	1.625	1.625	1.625	2.125		100	1.625	1.625	1.625	1.625	1.625	1.625	2.125		
	125	1.625	1.625	1.625	1.625	1.625	1.625	2.125		125	1.625	1.625	1.625	1.625	1.625	2.125	2.125		
	150	1.625	1.625	1.625	1.625	1.625	1.625	2.125		2.125	150	1.625	1.625	1.625	1.625	1.625	2.125	2.125	
	175	1.625	1.625	1.625	1.625	1.625	1.625	2.125		2.125	175	1.625	1.625	1.625	1.625	2.125	2.125	2.125	
	200	1.625	1.625	1.625	1.625	1.625	2.125	2.125		2.125	200	1.625	1.625	1.625	2.125	2.125	2.125	2.125	
	225	1.625	1.625	1.625	1.625	1.625	2.125	2.125		2.125	225	1.625	1.625	1.625	2.125	2.125	2.125	2.125	
	250	1.625	1.625	1.625	1.625	1.625	2.125	2.125		2.125	250	1.625	1.625	2.125	2.125	2.125	2.125	2.625	
	275	1.625	1.625	1.625	1.625	2.125	2.125	2.125		2.125	275	1.625	1.625	2.125	2.125	2.125	2.125	2.625	
	300	1.625	1.625	1.625	1.625	2.125	2.125	2.125		n/a	300	1.625	2.125	2.125	2.125	2.125	2.125	2.625	
120-ton circuit																			
Total Equivalent Length (ft)	25	1.625	1.625	1.625	1.625	1.625	1.625	2.125	Total Equivalent Length (ft)	25	1.625	1.625	1.625	1.625	1.625	1.625	1.625		
	50	1.625	1.625	1.625	1.625	1.625	1.625	2.125		50	1.625	1.625	1.625	1.625	1.625	1.625	1.625		
	75	1.625	1.625	1.625	1.625	1.625	1.625	2.125		2.625	75	1.625	1.625	1.625	1.625	1.625	1.625	2.125	
	100	1.625	1.625	1.625	1.625	1.625	1.625	2.125		2.625	100	1.625	1.625	1.625	1.625	1.625	1.625	2.125	
	125	1.625	1.625	1.625	1.625	1.625	2.125	2.125		2.625	125	1.625	1.625	1.625	1.625	1.625	2.125	2.125	
	150	1.625	1.625	1.625	1.625	1.625	2.125	2.125		2.625	150	1.625	1.625	1.625	1.625	1.625	2.125	2.125	
	175	1.625	1.625	1.625	1.625	2.125	2.125	2.125		2.625	175	1.625	1.625	1.625	1.625	2.125	2.125	2.125	
	200	1.625	1.625	1.625	1.625	2.125	2.125	2.125		2.625	200	1.625	1.625	1.625	2.125	2.125	2.125	2.125	
	225	1.625	1.625	1.625	2.125	2.125	2.125	2.125		n/a	225	1.625	1.625	1.625	2.125	2.125	2.125	2.125	
	250	1.625	1.625	1.625	2.125	2.125	2.125	2.125		2.625	250	1.625	1.625	2.125	2.125	2.125	2.125	2.625	
	275	1.625	1.625	2.125	2.125	2.125	2.125	2.625		n/a	275	1.625	1.625	2.125	2.125	2.125	2.125	2.625	
	300	1.625	2.125	2.125	2.125	2.125	2.125	2.625		n/a	300	1.625	2.125	2.125	2.125	2.125	2.125	2.625	

(a) Typical type L copper O.D.



Installation - Mechanical Remote Evaporator Option

Line Sizing

To determine the appropriate outside diameter for field installed liquid and suction lines, it is first necessary to establish the equivalent length of pipe for each line. It is also necessary to know the capacity (tons) of each circuit. Circuit capacities for each RTAC unit are listed in [Table 1, p. 10](#) through [Table 10, p. 19](#).

Table 45. Equivalent lengths of non-ferrous valves and fittings (feet)

Line Size Inches OD	Globe Valve	Short Angle Valve	Short Radius ELL	Long Radius ELL
1-1/8	87	29	2.7	1.9
1-3/8	102	33	3.2	2.2
1-5/8	115	34	3.8	2.6
2-1/8	141	39	5.2	3.4
2-5/8	159	44	6.5	4.2
3-1/8	185	53	8	5.1
3-5/8	216	66	10	6.3
4-1/8	248	76	12	7.3

Liquid Line Sizing Steps

The steps to compute liquid line size are as follows:

1. Compute the actual length of field installed piping.
2. Multiply the length from step # 1 by 1.5 to estimate the equivalent length.

Table 46. Required length of field installed suction line accumulator (ft)

Actual Feet of field installed liquid line	70 Ton Circuit ^(a)			85 Ton Circuit			100 Ton Circuit			120 Ton Circuit		
	O.D. of Field Installed Liquid Line											
	1 3/8"	1 5/8"	2 1/8"	1 3/8"	1 5/8"	2 1/8"	1 5/8"	2 1/8"	2 5/8"	1 5/8"	2 1/8"	2 5/8"
	Length of 3 5/8" Suction Accumulator			Length of 3 5/8" Suction Accumulator			Length of 4 1/8" Suction Accumulator			Length of 4 1/8" Suction Accumulator		
10	43	44	45	52	52	53	43	44	46	52	53	54
20	45	46	49	53	54	57	45	47	50	53	55	58
30	46	48	52	54	56	60	46	49	53	55	58	62
40	48	50	55	56	58	63	48	52	57	56	60	66
50	49	52	59	57	60	67	49	55	61	58	63	70
60	51	54	62	59	62	70	51	57	65	59	66	74
70	52	56	65	60	64	73	53	60	69	61	68	78
80	53	58	69	62	66	77	54	62	73	62	71	81
90	55	60	72	63	68	80	56	65	77	64	73	85
100	56	62	75	64	70	83	57	68	81	66	76	89
110	58	64	79	66	72	87	59	70	85	67	79	93
120	59	66	82	67	74	90	60	73	89	69	81	97
130	61	68	85	69	76	93	62	75	93	70	84	101
140	62	70	89	70	78	97	63	78	97	72	86	105
150	64	72	92	72	80	100	65	81	101	73	89	109
160	65	74	95	73	82	103	67	83	105	75	92	113
170	66	76	99	75	84	107	68	86	108	76	94	117
180	68	78	102	76	86	110	70	88	112	78	97	121
190	69	79	105	77	88	113	71	91	116	80	99	125
200	71	81	109	79	90	117	73	94	120	81	102	129

(a) Circuit 2 of 155 ton premium unit requires an additional 10 feet of suction accumulator length.

3. See [Table 44, p. 59](#) to determine outside diameter corresponding to equivalent length computed in step 2 for height and leaving water temperature of interest.

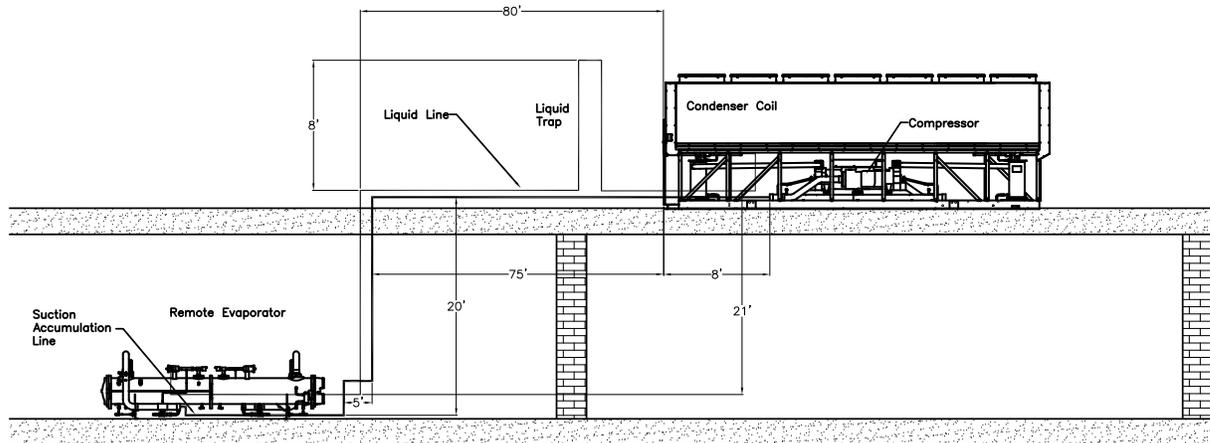
Note: If condenser is at same elevation or above evap, use 0 ft. column.

4. With the outside diameter found in step # 3, use [Table 45, p. 60](#) to determine the equivalent lengths of each fitting in the field installed piping.
5. Add equivalent lengths of all field installed elbows and valves.
6. Add the length found in step # 5 to the actual length from step # 1. This is your new equivalent line length.
7. Using [Table 44, p. 59](#) again, find the outside diameter that corresponds to the new equivalent line length from step # 6. If it is the same as step #3, this is the final equivalent length. Otherwise, proceed to the next step.
8. Using [Table 45, p. 60](#) and the new outside diameter found in step # 7, find the equivalent line length of each valve and fitting, and sum them.
9. Add the length found in step # 8 to the actual length from step # 1. This is the new equivalent line length.
10. With the equivalent line length found in step # 9, use [Table 44, p. 59](#) to select the proper outside diameter for the liquid lines. If the same as in step #7, this is your final equivalent line length. Otherwise, repeat step #7.

Note: Location and quantity of suction accumulator is dependent upon the unit configuration.

Example Liquid Line Sizing

Figure 30. Liquid line sizing example



For this example, refer to [Table 44, p. 59](#), [Table 45, p. 60](#) and [Figure 30, p. 61](#). Assume a 70 ton circuit and a leaving water temperature of 49 degrees F.

1. From [Figure 30, p. 61](#), the actual length of field installed piping is:
 $80 + 8 + 8 + 21 = 117$ feet
2. Estimate equivalent line length:
 $117 \text{ feet} \times 1.5 = 175$ feet
3. From [Table 44, p. 59](#) for a 70 ton circuit, for 175 equivalent feet the OD is 1.375 inches.

Note: Use the 0 ft. column since the condenser is above the evap

4. In [Figure 30, p. 61](#), there are six long-radius elbows. From [Table 45, p. 60](#), for 1.375 inch elbows, the equivalent feet is:
 $6 \text{ elbows} \times 2.2 \text{ feet} = 13.2$ feet
5. Adding equivalent feet from step #4 to step #1 gives:
 $13.2 \text{ feet} + 117 \text{ feet} = 130.2$ feet
6. From [Table 44, p. 59](#), for a 70 ton circuit, for 125 equivalent feet (nearest to 130.2), the O.D. is 1- 3/8 inches.

Liquid Line size = 1-3/8 inches

Suction Line Sizing Steps

Table 47. Suction line sizes

Vertical/Upflow and Horizontal/Downflow Suction Lines O.D. (Type L Copper)				
LWT (F)	70 ton circuit	85ton circuit	100 ton circuit	120 ton circuit
40 - 60	3 5/8"	3 5/8"	4 1/8"	4 1/8"

The steps to compute suction line size are as follows:

1. Break the suction line into it's Vertical/Upflow and Horizontal/Downflow components.
2. From [Table 47, p. 61](#), select the appropriate Vertical/Upflow suction line outside diameter according to the circuit tonnage. This is the diameter of the upflow suction line and any fittings in the upflow line.
3. From [Table 47](#), select the appropriate Horizontal/Downflow suction line outside diameter according to the circuit tonnage. This is the diameter of the upflow suction line and any fittings in the upflow line.

Note: The diameters of the upflow, and horizontal or downflow portions of the suction line may differ depending on the application.

Example Suction Line Sizing

For this example, refer to [Table 47](#) and [Figure 30, p. 61](#) assume a 70 ton circuit and a leaving water temperature of 49 degrees F.

1. From [Table 47](#) the vertical/upflow suction line is: 3 5/8" O.D.
2. From [Table 47](#), the horizontal/downflow line is: 3 5/8" O.D.

Note: In this example, the horizontal line is pitched downward in the direction of flow.

Suction Accumulator Sizing

Use [Table 46, p. 60](#) to calculate length and size of the required suction accumulator(s).

Example of Suction Accumulator Line Sizing

Use [Figure 30, p. 61](#) and the same assumptions from the liquid line sizing example to calculate the suction accumulator line size and length.

In this case the accumulator is installed at the evaporator.



Installation - Mechanical Remote Evaporator Option

1. Use the 70 ton circuit column.
2. From the liquid line sizing example, use a field installed liquid line of:
1.375 (1 3/8") inches
3. The actual feet of liquid line installed is: 117 feet
4. The size of the suction accumulator is: 3 5/8 inches
5. The length of the suction line accumulator is: 59 feet

Piping Installation Procedures

⚠ WARNING

Hazard of Explosion and Deadly Gases!

Never solder, braze or weld on refrigerant lines or any unit components that are above atmospheric pressure or where refrigerant may be present. Always remove refrigerant by following the guidelines established by the EPA Federal Clean Air Act or other state or local codes as appropriate. After refrigerant removal, use dry nitrogen to bring system back to atmospheric pressure before opening system for repairs. Mixtures of refrigerants and air under pressure may become combustible in the presence of an ignition source leading to an explosion. Excessive heat from soldering, brazing or welding with refrigerant vapors present can form highly toxic gases and extremely corrosive acids. Failure to follow all proper safe refrigerant handling practices could result in death or serious injury.

NOTICE:

Equipment Damage!

Do not use a saw to remove end caps, as this may allow copper chips to contaminate the system. Use a tubing cutter or heat to remove the end caps.

The outdoor unit and the evaporator are shipped with a 25 psig holding pressure of dry nitrogen. Do not relieve this pressure until field installation of the refrigerant piping is to be accomplished. This will require the removal of the temporary pipe caps.

Note: Use Type L refrigerant-grade copper tubing only.

The refrigerant lines must be isolated to prevent line vibration from being transferred to the building. Do not secure the lines rigidly to the building at any point.

All horizontal suction lines should be pitched downward, in the direction of flow, at a slope of 1/2 inch per 10 feet of run.

Important: Field installed liquid line service valves are recommended for installation. Liquid line service valves are not provided by the factory.

Note: Although packaged unit condensers and evaporators are sized to hold complete refrigerant charge, units with a remote evaporator may not have the same capability, due to additional piping requirements.

Refrigerant Sensors

All necessary refrigerant devices, transducers and solenoids are factory installed and wired to the evaporator terminal box.

Refrigerant Pressure Relief Valve Venting

⚠ WARNING

Confined Space Hazards!

Do not work in confined spaces where refrigerant or other hazardous, toxic or flammable gas may be leaking. Refrigerant or other gases could displace available oxygen to breathe, causing possible asphyxiation or other serious health risks. Some gases may be flammable and or explosive. If a leak in such spaces is detected, evacuate the area immediately and contact the proper rescue or response authority. Failure to take appropriate precautions or to react properly to such potential hazards could result in death or serious injury.

Vent pipe size must conform to the ANSI/ASHRAE Standard 15 for vent pipe sizing. All federal, state, and local codes take precedence over any suggestions stated in this manual.

All relief valve venting is the responsibility of the installing contractor.

All RTAC remote evaporator units use evaporator pressure relief valves (see Figure 31, p. 63) that must be vented to the outside of the building.

Relief valve connection sizes and locations are shown in the unit submittals. Refer to local codes for relief valve vent line sizing information.

NOTICE:

Equipment Damage!

Do not exceed vent piping code specifications. Failure to comply with specifications could result in capacity reduction, unit damage and/or relief valve damage.

Relief valve discharge setpoints and capacities rates are given in Table 48, p. 63. Once the relief valve has opened, it will re-close when pressure is reduced to a safe level.

Once opened, relief valves may have a tendency to leak and must be replaced.

Pressure relief valve discharge capacities will vary with shell diameter and length and also compressor displacement. Discharge venting capacity should be calculated as required by ASHRAE Standard 15-94. Do not adjust relief valve setting in the field.

Table 48. Pressure Relief Valve Data

Unit Sizes	Valve Location	Discharge Setpoint (psi)	Qty	Rated Capacity per Valve (lba/min.)	Field Connection Pipe Size (NPT)	Factory Shell Side Connection (in)
120H - 250S 60Hz/200H/170XE	Evap	200	2	17.3	5/8 MFL	7/8 - 14 UNF-2A
250S 50Hz/225H/185XE - 500S	Evap	200	2	28.9	3/4 NPTFI	7/8 - 14 UNF-2A
All	Oil Sep	350	2	6.3	3/8 MFL	1/4-18 NPTFE

Leak Test and Evacuation

After installation of refrigerant piping, thoroughly test the system for leaks. Pressure test system at pressures required by local codes.

⚠ WARNING

Hazard of Explosion!

Use only dry nitrogen with a pressure regulator for pressurizing unit. Do not use acetylene, oxygen or compressed air or mixtures containing them for pressure testing. Do not use mixtures of a hydrogen containing refrigerant and air above atmospheric pressure for pressure testing as they may become flammable and could result in an explosion. Refrigerant, when used as a trace gas should only be mixed with dry nitrogen for pressurizing units. Failure to follow these recommendations could result in death or serious injury or equipment or property-only damage.

For field evacuation, use a rotary-type vacuum pump capable of pulling a vacuum of 500 microns or less. Follow the pump manufacturer's instructions for proper use of the pump. The line used to connect the pump to the system should be copper and be the largest diameter that can be practically used. A larger line size with minimum flow resistance can significantly reduce evacuation time.

Use the ports on the suction service valves and the liquid line shutoff valves for access to the system for evacuation. Ensure that the suction service valve, the liquid line shutoff valve, the oil line shutoff valve and any field installed valves are open in the proper position before evacuating.

Insulate entire suction line and suction accumulator line. Where line is exposed, wrap with weatherproof tape and seal with weatherproof compound.

Figure 31. Remote evaporator

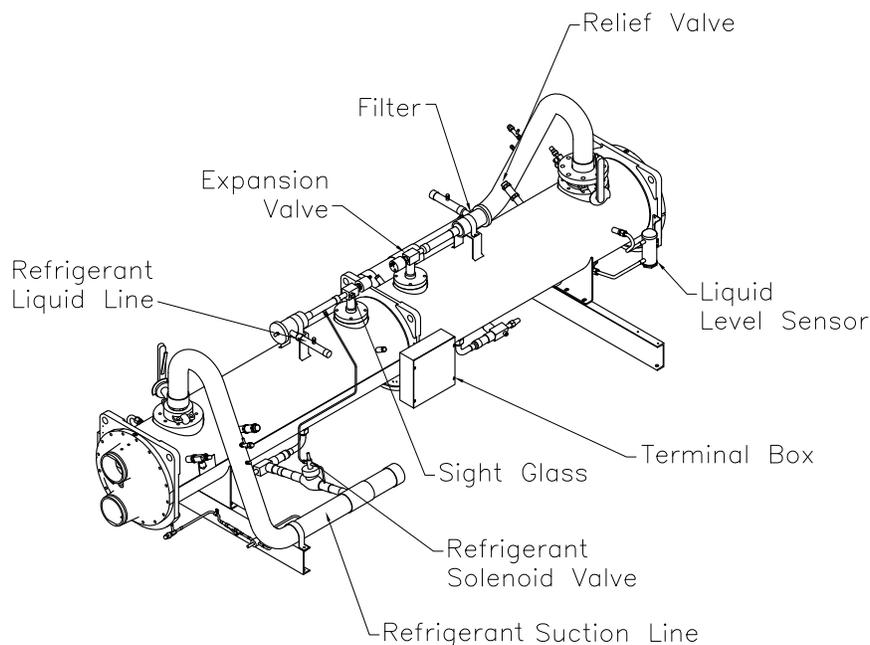
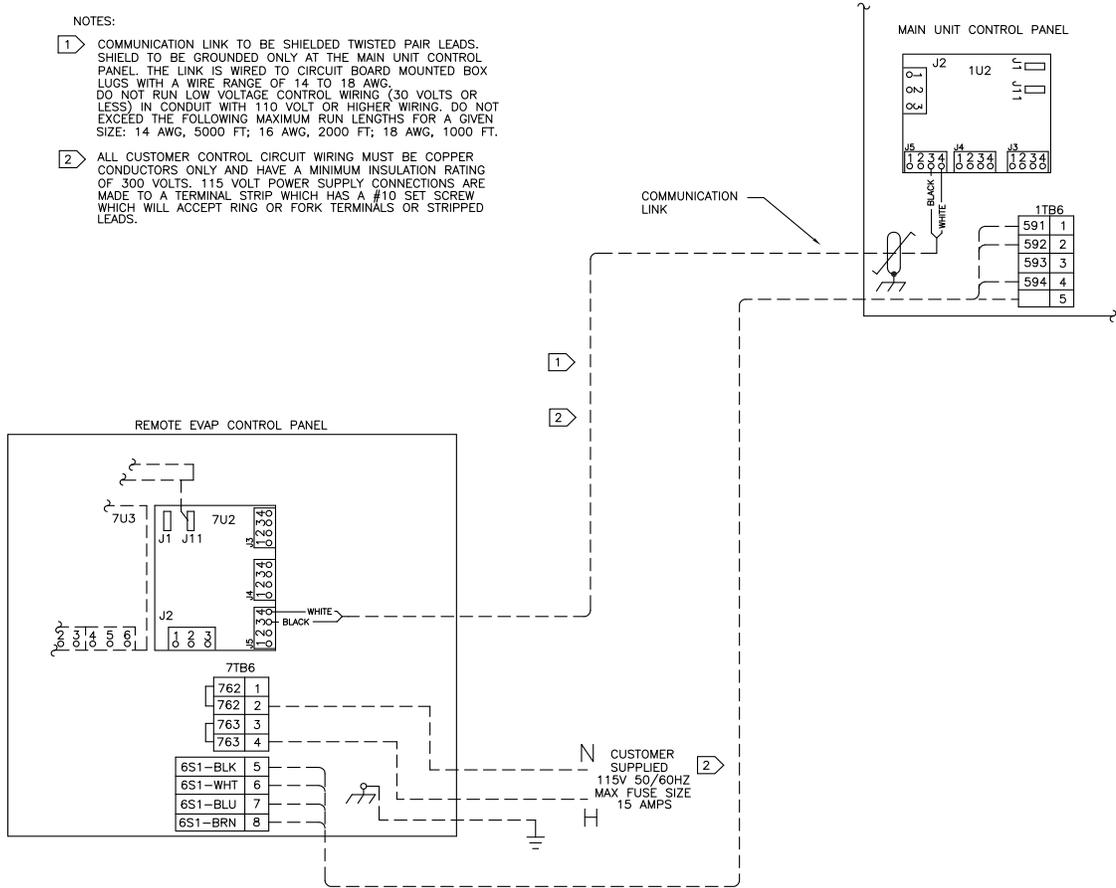


Figure 32. Field wiring between remote evaporator and condensing unit



Refrigerant and Additional Oil Charge

Refrigerant Charge Determination

The approximate amount of refrigerant charge required by the system must be determined by referring to [Table 49](#) and must be verified by running the system and checking subcooling.

Table 49. Field installed piping charge

Pipe O.D. (in)	Suction Line lbs of R134a per 100ft	Liquid Line lbs of R134a per 100ft
1-3/8	N/A	62.4
1-5/8	N/A	88.3
2-1/8	N/A	153.6
2-5/8	N/A	236.9
3-1/8	5.0	N/A
3-5/8	6.8	N/A
4-1/8	8.8	N/A

1. To determine the appropriate charge, first refer to the [Table 1, p. 10](#) through [Table 10, p. 19](#) in section "General Data," p. 9 to establish the required charge

without the field-installed piping.

2. Next, determine the charge required for the field-installed piping by referring to [Table 49, p. 64](#).
3. Sum the values of step 1 and step 2 to determine the circuit charge.

Note: The amounts of refrigerant listed in [Table 49, p. 64](#) are per 100 feet of pipe. Requirements will be in direct proportion to the actual length of piping.

Oil Charge Determination

The unit is factory charged with the amount of oil required by the system, without the field-installed piping. The amount of the additional oil required is dependent upon the amount of refrigerant that is added to the system for the field installed piping.

Use the following formula to calculate the amount of oil to be added:

$$\text{Pints of Oil} = [\text{lbs of R-134a added for field-installed piping}] / 100$$



Installation - Electrical

General Recommendations

As you review this manual, keep in mind that:

- All field-installed wiring must conform to National Electric Code (NEC) guidelines, and any applicable state and local codes. Be sure to satisfy proper equipment grounding requirements per NEC.
- Compressor motor and unit electrical data (including minimum circuit ampacities, motor kW, voltage utilization range, rated load amps) is listed on the chiller nameplate.
- All field-installed wiring must be checked for proper terminations, and for possible shorts or grounds.

Note: Always refer to wiring diagrams shipped with chiller or unit submittal for specific electrical schematic and connection information.

⚠ WARNING

Proper Field Wiring and Grounding Required!

All field wiring **MUST** be performed by qualified personnel. Improperly installed and grounded field wiring poses **FIRE** and **ELECTROCUTION** hazards. To avoid these hazards, you **MUST** follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

⚠ WARNING

Hazardous Voltage!

Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

NOTICE:

Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors could result in equipment damage.

Important: To prevent control malfunctions, do not run low voltage wiring (<30 V) in conduit with conductors carrying more than 30 volts.



Installer-Supplied Components

Customer wiring interface connections are shown in the electrical schematics and connection diagrams that are shipped with the unit. The installer must provide the following components if not ordered with the unit:

- Power supply wiring (in conduit) for all field-wired connections.
- All control (interconnecting) wiring (in conduit) for field supplied devices.
- Fused-disconnect switches or circuit breakers.
- Power factor correction capacitors. (optional)

Power Supply Wiring

All power supply wiring must be sized and selected accordingly by the project engineer in accordance with NECTable 310-16.

⚠ WARNING

Proper Field Wiring and Grounding Required!

All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state electrical codes. Failure to follow code could result in death or serious injury.

⚠ WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer’s literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06A-EN

All wiring must comply with local codes and the National Electrical Code. The installing (or electrical) contractor must provide and install the system interconnecting wiring, as well as the power supply wiring. It must be properly sized and equipped with the appropriate fused disconnect switches.

The type and installation location(s) of the fused disconnects must comply with all applicable codes.

NOTICE:

Use Copper Conductors Only!

Unit terminals are not designed to accept other types of conductors. Failure to use copper conductors could result in equipment damage.

Cut holes into the sides of the control panel for the appropriately-sized power wiring conduits. The wiring is passed through these conduits and connected to the terminal blocks, optional unit-mounted disconnects, or HACR type breakers. Refer to [Figure 33, p. 67](#).

To provide proper phasing of 3-phase input, make connections as shown in field wiring diagrams and as stated on the WARNING label in the starter panel. For additional information on proper phasing, refer to “Unit Voltage Phasing.” Proper equipment ground must be provided to each ground connection in the panel (one for each customer-supplied conductor per phase).

All 115 volt field-provided connections (either control or power) are made through knockouts on the lower left side of the panel, as shown on [Figure 33](#). Additional grounds may be required for each 115 volt power supply to the unit. Green lugs are provided for 115V customer wiring.

Single Point Power on Dual Panel Units (Optional)

Units which require two control panels and with single point power option selected, are built with a power connection junction box located in the center of the unit as shown in [Figure 34, p. 67](#). Customer will connect to terminal blocks inside this panel.

Figure 33. Control panel

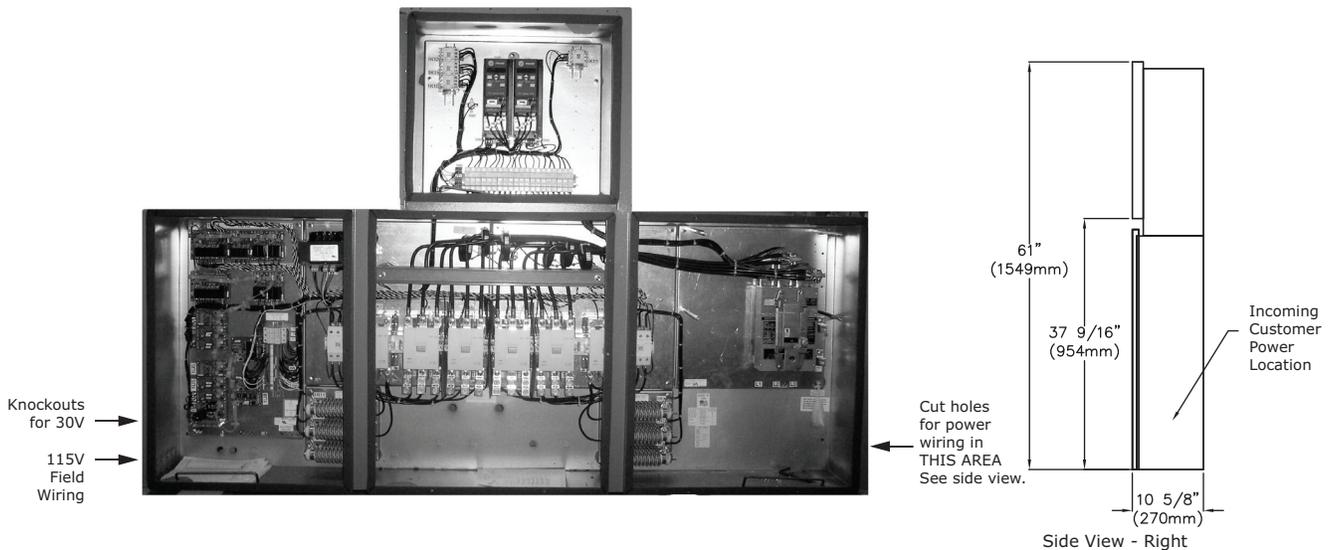
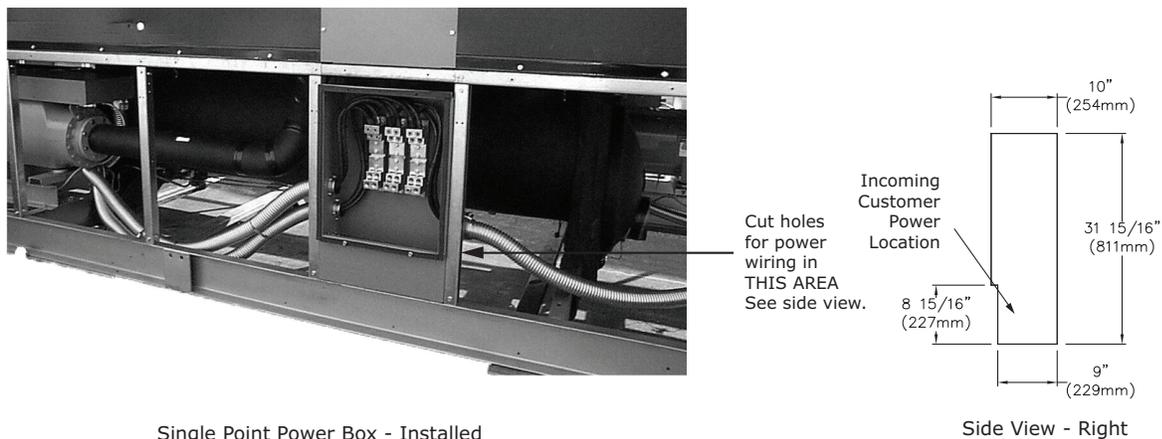


Figure 34. Single point power box - optional on dual panel units



Single Point Power Box - Installed

Control Power Supply

The unit is equipped with a control power transformer; it is not necessary to provide additional control power voltage to the unit.

All units are factory-connected for appropriate labeled voltages except for the 400V/50Hz units which need the control power transformer (1T1) reconnected as noted below.

Important: *As shipped, a normal 400 volt unit control power transformer is wired on the 400 volt tap (H3). Reconnect the appropriate transformer wire lead 126A to the tap (H2) for 380V/50Hz power supply or lead 126A to the tap H4 for the 415V/50 Hz power supply. It is also necessary to adjust the "unit voltage" setting using TechView (Configuration-Custom Tab).*

Heater Power Supply and Convenience Outlet (Packaged Units Only)

The evaporator shell is insulated from ambient air and protected from freezing temperatures by two thermostatically-controlled immersion heaters and two strip heaters. Whenever the water temperature drops to approximately 37°F (2.8°C), the thermostat energizes the heaters. The heaters will provide protection from ambient temperatures down to -20°F (-29°C).

It is required to provide an independent power source (115V 60Hz-20 amp, 220V 50Hz-15 amp), with a fused-disconnect. The heaters are factory-wired back to the unit control panel.

NOTICE:

Equipment Damage!

Control panel main processor does not check for loss of power to the heat tape nor does it verify thermostat operation. A qualified technician must verify power to the heat tape and confirm operation of the heat tape thermostat to avoid catastrophic damage to the evaporator.

A convenience outlet is also optional, which shares the same power supply as the heaters on 140-250 ton units. Be aware that when the heater is operating, the convenience outlet amperage draw will be reduced accordingly.

Note: *The convenience outlet is optional. The heaters are required.*

Interconnecting Wiring

Chilled Water Pump Control

An evaporator water pump output relay closes when the chiller is given a signal to go into the Auto mode of operation from any source. The contact is opened to turn off the pump in the event of most machine level diagnostics to prevent the build up of pump heat.

NOTICE:

Equipment Damage!

If insufficient concentration or no glycol is used, the evaporator water pumps must be controlled by the CH530 to avoid severe damage to the evaporator due to freezing. A power loss of 15 minutes during freezing can damage the evaporator. It is the responsibility of the installing contractor and/or the customer to ensure that a pump will start when called upon by the chiller controls.

Please consult [Table 42, p. 54](#) for correct concentration of glycol.

The warranty will be void, in case of freezing due to the lack of use of either of these protections.

The relay output from 1U10 is required to operate the Evaporator Water Pump (EWP) contactor. Contacts should be compatible with 115/240 VAC control circuit. The EWP relay operates in different modes depending on CH530 or Tracer commands, if available, or service pumpdown (See maintenance section). Normally, the EWP relay follows the AUTO mode of the chiller. Whenever the chiller has no diagnostics and is in the AUTO mode, regardless of where the auto command is coming from, the normally open relay is energized. When the chiller exits the AUTO mode, the relay is timed open for an adjustable (using TechView) 0 to 30 minutes. The non-AUTO modes in which the pump is stopped, include Reset (88), Stop (00), External Stop (100), Remote Display Stop (600), Stopped by Tracer (300),

Low Ambient Run Inhibit (200), and Ice Building complete (101).

Regardless of whether the chiller is allowed to control the pump on a full-time basis, if the MP calls for a pump to start and water does not flow, the evaporator may be damaged catastrophically. It is the responsibility of the installing contractor and/or the customer to ensure that a pump will start when called upon by the chiller controls.

Table 50. Pump Relay Operation

Chiller Mode	Relay Operation
Auto	Instant close
Ice Building	Instant close
Tracer Override	Close
Stop	Timed Open
Ice Complete	Instant Open
Diagnostics	Instant Open

Note: *Exceptions are listed below.*

When going from Stop to Auto, the EWP relay is energized immediately. If evaporator water flow is not established in 20 minutes (for normal transition) or 4 minutes, 15 seconds (for pump commanded ON due to an override safety), the CH530 de-energizes the EWP relay and generates a non-latching diagnostic. If flow returns (e.g. someone else is controlling the pump), the diagnostic is cleared, the EWP is re-energized, and normal control resumed.

If evaporator water flow is lost once it had been established, the EWP relay remains energized and a non-latching diagnostic is generated. If flow returns, the diagnostic is cleared and the chiller returns to normal operation.

In general, when there is either a non-latching or latching diagnostic, the EWP relay is turned off as though there was a zero time delay. Exceptions (see above table) whereby the relay continues to be energized occur with:

A Low Chilled Water Temp. diagnostic (non-latching) (unless also accompanied by an Evap Leaving Water Temperature Sensor Diagnostic)

or

A starter contactor interrupt failure diagnostic, in which a compressor continues to draw current even after commanded to have shutdown

or

A Loss of Evaporator Water Flow diagnostic (non-latching) and the unit is in the AUTO mode, after initially having proven evaporator water flow.

Alarm and Status Relay Outputs (Programmable Relays)

A programmable relay concept provides for enunciation of certain events or states of the chiller, selected from a list of

likely needs, while only using four physical output relays, as shown in the field wiring diagram. The four relays are provided (generally with a Quad Relay Output LLID) as part of the Alarm Relay Output Option. The relay's contacts are isolated Form C (SPDT), suitable for use with 120 VAC circuits drawing up to 2.8 amps inductive, 7.2 amps resistive, or 1/3 HP and for 240 VAC circuits drawing up to 0.5 amp resistive.

The list of events/states that can be assigned to the programmable relays can be found in Table 51. The relay will be energized when the event/state occurs.

Table 51. Alarm and Status Relay Output Configuration Table

	Description
Alarm - Latching	This output is true whenever there is any active diagnostic that requires a manual reset to clear, that affects either the Chiller, the Circuit, or any of the Compressors on a circuit. This classification does not include informational diagnostics.
Alarm - Auto Reset	This output is true whenever there is any active diagnostic that could automatically clear, that affects either the Chiller, the Circuit, or any of the Compressors on a circuit. This classification does not include informational diagnostics.
Alarm	This output is true whenever there is any diagnostic affecting any component, whether latching or automatically clearing. This classification does not include informational diagnostics
Alarm Ckt 1	This output is true whenever there is any diagnostic effecting Refrigerant Circuit 1, whether latching or automatically clearing, including diagnostics affecting the entire chiller. This classification does not include informational diagnostics.
Alarm Ckt 2	This output is true whenever there is any diagnostic affecting Refrigerant Circuit 2 whether latching or automatically clearing, including diagnostics effecting the entire chiller. This classification does not include informational diagnostics.
Chiller Limit Mode (with a 20 minute filter)	This output is true whenever the chiller has been running in one of the Unloading types of limit modes (Condenser, Evaporator, Current Limit or Phase Imbalance Limit) continuously for the last 20 minutes.
Circuit 1 Running	This output is true whenever any compressors are running (or commanded to be running) on Refrigerant Circuit 1, and false when no compressors are commanded to be running on that circuit.
Circuit 2 Running	This output is true whenever any compressors are running (or commanded to be running) on Refrigerant Circuit 2, and false when no compressors are commanded to be running on that circuit.
Chiller Running	This output is true whenever any compressors are running (or commanded to be running) on the chiller and false when no compressors are commanded to be running on the chiller.

Table 51. Alarm and Status Relay Output Configuration Table (continued)

	Description
Maximum Capacity (software 18.0 or later)	This output is true whenever the chiller has reached maximum capacity or had reached its maximum capacity and since that time has not fallen below 70% average current relative to the rated ARI current for the chiller. The output is false when the chiller falls below 70% average current and, since that time, had not reestablished maximum capacity.

Relay Assignments Using TechView

CH530 ServiceTool (TechView) is used to install the Alarm and Status Relay Option package and assign any of the above list of events or status to each of the four relays provided with the option. The relays to be programmed are referred to by the relay's terminal numbers on the LLID board 1U12.

The default assignments for the four available relays of the RTAC Alarm and Status Package Option are:

Table 52. Default assignments

Relay	
Relay 1 Terminals J2 -12,11,10:	Alarm
Relay 2 Terminals J2 - 9,8,7:	Chiller Running
Relay 3 Terminals J2-6,5,4:	Maximum Capacity
Relay 4 Terminals J2-3,2,1:	Chiller Limit

If any of the Alarm/Status relays are used, provide electrical power, 115 VAC with fused-disconnect to the panel and wire through the appropriate relays (terminals on 1U12 (EUR=A4-5)). Provide wiring (switched hot, neutral, and ground connections) to the remote annunciation devices. Do not use power from the chiller's control panel transformer to power these remote devices. Refer to the field diagrams which are shipped with the unit.

Low Voltage Wiring

The remote devices described below require low voltage wiring. All wiring to and from these remote input devices to the Control Panel must be made with shielded, twisted pair conductors. Be sure to ground the shielding only at the panel.

Important: *To prevent control malfunctions, do not run low voltage wiring (<30 V) in conduit with conductors carrying more than 30 volts.*

Emergency Stop

CH530 provides auxiliary control for a customer specified/ installed latching trip out. When this customer-furnished remote contact 5K14 is provided, the chiller will run normally when the contact is closed. When the contact opens, the unit will trip on a manually resettable



Installation - Electrical

diagnostic. This condition requires manual reset at the chiller switch on the front of the control panel.

Connect low voltage leads to terminal strip locations on 1U4. Refer to the field diagrams that are shipped with the unit.

Silver or gold-plated contacts are recommended. These customer-furnished contacts must be compatible with 24 VDC, 12 mA resistive load.

External Auto/Stop

If the unit requires the external Auto/Stop function, the installer must provide leads from the remote contacts 5K15 to the proper terminals of the LLID 1U4 on the control panel.

The chiller will run normally when the contacts are closed. When either contact opens, the compressor(s), if operating, will go to the RUN:UNLOAD operating mode and cycle off. Unit operation will be inhibited. Closure of the contacts will permit the unit to return to normal operation.

Field-supplied contacts for all low voltage connections must be compatible with dry circuit 24 VDC for a 12 mA resistive load. Refer to the field diagrams that are shipped with the unit.

External Circuit Lockout – Circuit #1 and #2

CH530 provides auxiliary control of a customer specified or installed contact closure, for individual operation of either Circuit #1 or #2. If the contact is closed, the refrigerant circuit will not operate 5K16 and 5K17.

Upon contact opening, the refrigerant circuit will run normally. This feature is used to restrict total chiller operation, e.g. during emergency generator operations.

Connections to 1U5 are shown in the field diagrams that are shipped with the unit.

These customer-supplied contact closures must be compatible with 24 VDC, 12 mA resistive load. Silver or gold plated contacts are recommended.

Ice Building Option

CH530 provides auxiliary control for a customer specified/ installed contact closure for ice building if so configured and enabled. This output is known as the Ice Building Status Relay. The normally open contact will be closed when ice building is in progress and open when ice building has been normally terminated either through Ice Termination setpoint being reached or removal of the Ice Building command. This output is for use with the ice storage system equipment or controls (provided by others) to signal the system changes required as the chiller mode changes from “ice building” to “ice complete”. When contact 5K18 is provided, the chiller will run normally when the contact is open.

CH530 will accept either an isolated contact closure (External Ice Building command) or a Remote

Communicated input (Tracer) to initiate and command the Ice Building mode.

CH530 also provides a “Front Panel Ice Termination Setpoint”, settable through TechView, and adjustable from 20 to 31°F (-6.7 to -0.5°C) in at least 1°F (1°C) increments.

Note: *When in the Ice Building mode, and the evaporator entering water temperature drops below the ice termination setpoint, the chiller terminates the Ice Building mode and changes to the Ice Building Complete Mode.*

NOTICE:

Equipment Damage!

Freeze inhibitor must be adequate for the leaving water temperature. Failure to do so will result in damage to system components.

Techview must also be used to enable or disable Ice Machine Control. This setting does not prevent the Tracer from commanding Ice Building mode.

Upon contact closure, the CH530 will initiate an ice building mode, in which the unit runs fully loaded at all times. Ice building shall be terminated either by opening the contact or based on the entering evaporator water temperature. CH530 will not permit the ice building mode to be reentered until the unit has been switched out of ice building mode (open 5K18 contacts) and then switched back into ice building mode (close 5K18 contacts.)

In ice building, all limits (freeze avoidance, evaporator, condenser, current) will be ignored. All safeties will be enforced.

If, while in ice building mode, the unit gets down to the freeze stat setting (water or refrigerant), the unit will shut down on a manually resettable diagnostic, just as in normal operation.

Connect leads from 5K18 to the proper terminals of 1U7. Refer to the field diagrams which are shipped with the unit.

Silver or gold-plated contacts are recommended. These customer furnished contacts must be compatible with 24 VDC, 12 mA resistive load.

External Chilled Water Setpoint (ECWS) Option

The CH530 provides inputs that accept either 4-20 mA or 2-10 VDC signals to set the external chilled water setpoint (ECWS). This is not a reset function. The input defines the set point. This input is primarily used with generic BAS (building automation systems). The chilled water setpoint set via the DynaView or through digital communication with Tracer (Comm3). The arbitration of the various chilled water setpoint sources is described in the flow charts at the end of the section.

The chilled water setpoint may be changed from a remote location by sending either a 2-10VDC or 4-20 mA signal to the 1U6, terminals 5 and 6 LLID. 2-10 VDC and 4-20 mA

each correspond to a 10 to 65°F (-12 to 18°C) external chilled water setpoint.

The following equations apply:

	Voltage Signal	Current Signal
As generated from external source	$VDC=0.1455*(ECWS)+0.5454$	$mA=0.2909*(ECWS)+1.0909$
As processed by CH530	$ECWS=6.875*(VDC)-3.75$	$ECWS=3.4375*(mA)-3.75$

If the ECWS input develops an open or short, the LLID will report either a very high or very low value back to the main processor. This will generate an informational diagnostic and the unit will default to using the Front Panel (DynaView) Chilled Water Setpoint.

TechView ServiceTool is used to set the input signal type from the factory default of 2-10 VDC to that of 4-20 mA. TechView is also used to install or remove the External Chilled Water Setpoint option as well as a means to enable and disable ECWS.

External Current Limit Setpoint (ECLS) Option

Similar to the above, the CH530 also provides for an optional External Current Limit Setpoint that will accept either a 2-10 VDC (default) or a 4-20 mA signal. The Current Limit Setting can also be set via the DynaView or through digital communication with Tracer (Comm 3). The arbitration of the various sources of current limit is described in the flow charts at the end of this section. The External Current Limit Setpoint may be changed from a remote location by hooking up the analog input signal to the 1 U6 LLID terminals 2 and 3. Refer to the following paragraph on Analog Input Signal Wiring Details. The following equations apply for ECLS:

	Voltage Signal	Current Signal
As generated from external source	$VDC+0.133*(\%)-6.0$	$mA=0.266*(\%)-12.0$
As processed by UCM	$\%=7.5*(VDC)+45.0$	$\%=3.75*(mA)+45.0$

If the ECLS input develops an open or short, the LLID will report either a very high or very low value back to the main processor. This will generate an informational diagnostic and the unit will default to using the Front Panel (DynaView) Current Limit Setpoint.

The TechView ServiceTool must be used to set the input signal type from the factory default of 2-10 VDC to that of 4-20 mA current. TechView must be also be used to install or remove the External Current Limit Setpoint Option for field installation, or can be used to enable or disable the feature (if installed).

ECLS and ECWS Analog Input Signal Wiring Details:

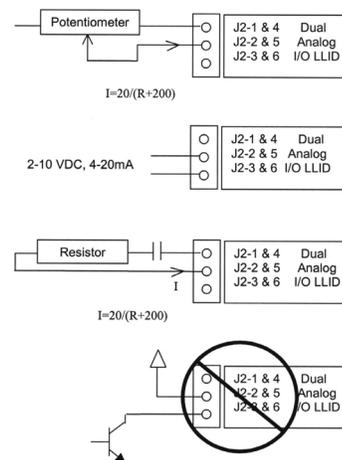
Both the ECWS and ECLS can be connected and setup as either a 2-10 VDC (factory default), 4-20 mA, or resistance input (also a form of 4-20mA) as indicated below.

Depending on the type to be used, the TechView Service Tool must be used to configure the LLID and the MP for the proper input type that is being used. This is accomplished by a setting change on the Custom Tab of the Configuration View within TechView.

Important: For proper unit operation, BOTH ECLS and ECWS settings MUST be the same (2-10 VDC or 4-20mA), even if only one input is to be used.

The J2-3 and J2-6 terminal is chassis grounded and terminal J2- 1 and J2-4 can be used to source 12 VDC. The ECLS uses terminals J2-2 and J2-3. ECWS uses terminals J2-5 and J2-6. Both inputs are only compatible with high-side current sources.

Figure 35. Wiring examples for ECLS and ECWS



Chilled Water Reset (CWR)

CH530 resets chilled water temperature set point based on either return water temperature, or outdoor air temperature. Return Reset and Outdoor Reset are standard. The following shall be selectable:

- One of three Reset Types: None, Return Water Temperature Reset, Outdoor Air Temperature Reset, or Constant Return Water Temperature Reset.
- Reset Ratio Set Points.
For outdoor air temperature reset there shall be both positive and negative reset ratio's.
- Start Reset Set Points.
- Maximum Reset Set Points.

The equations for each type of reset are as follows:

Return

$$CWS' = CWS + \text{RATIO} (\text{START RESET} - (TWE - TWL))$$

$$\text{and } CWS' > \text{ or } = CWS$$

$$\text{and } CWS' - CWS < \text{ or } = \text{Maximum Reset}$$

Outdoor

$$CWS' = CWS + \text{RATIO} * (\text{START RESET} - \text{TOD})$$

$$\text{and } CWS' > \text{ or } = CWS$$



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and $CWS' - CWS < \text{or} = \text{Maximum Reset}$

where

CWS' is the new chilled water set point or the "reset CWS "

CWS is the active chilled water set point before any reset has occurred, e.g. normally Front Panel, Tracer, or ECWS

RESET RATIO is a user adjustable gain

START RESET is a user adjustable reference

TOD is the outdoor temperature

TWE is entering evap. water temperature

TWL is leaving evap. water temperature

MAXIMUM RESET is a user adjustable limit providing the maximum amount of reset. For all types of reset, $CWS' - CWS < \text{or} = \text{Maximum Reset}$.

Reset Type	Range		Increment			Factory Default
	Reset Ratio	Start Reset	Max Reset	IP Units	SI Units	
Return	10 to 120%	4 to 30 F (2.2 to 16.7 C)	0 to 20 F (0.0 to 11.1 C)	1%	1%	50%
Outdoor	80 to -80%	50 to 130 F (10 to 54.4 C)	0 to 20 F (0.0 to 11.1 C)	1%	1%	10%

In addition to Return and Outdoor Reset, the MP provides a menu item for the operator to select a Constant Return Reset. Constant Return Reset will reset the leaving water temperature set point so as to provide a constant entering water temperature. The Constant Return Reset equation is the same as the Return Reset equation except on selection of Constant Return Reset, the MP will automatically set Ratio, Start Reset, and Maximum Reset to the following.

RATIO = 100%

START RESET = Design Delta Temp.

MAXIMUM RESET = Design Delta Temp.

The equation for Constant Return is then as follows:

$CWS' = CWS + 100\% (\text{Design Delta Temp.} - (TWE - TWL))$
and $CWS' > \text{or} = CWS$

and $CWS' - CWS < \text{or} = \text{Maximum Reset}$

When any type of CWR is enabled, the MP will step the Active CWS toward the desired CWS' (based on the above equations and setup parameters) at a rate of 1 degree F every 5 minutes until the Active CWS equals the desired CWS' . This applies when the chiller is running.

When the chiller is not running, CWS is reset immediately (within one minute) for Return Reset and at a rate of 1 degree F every 5 minutes for Outdoor Reset. The chiller will start at the Differential to Start value above a fully reset CWS or CWS' for both Return and Outdoor Reset.

Communications Interface Options

Tracer Communications Interface Option

This option allows the Tracer CH530 controller to exchange information (e.g. operating setpoints and Auto/Standby commands) with a higher-level control device, such as a Tracer Summit or a multiple-machine controller. A shielded, twisted pair connection establishes the bi-directional communications link between the Tracer CH530 and the building automation system.

Important: To prevent control malfunctions, do not run low voltage wiring (<30 V) in conduit with conductors carrying more than 30 volts.

Field wiring for the communication link must meet the following requirements:

- All wiring must be in accordance with the NEC and local codes.
- Communication link wiring must be shielded, twisted pair wiring (Belden 8760 or equivalent). See the table below for wire size selection:

Table 53. Wire Size

Wire Size	Maximum Length of Communication Wire
14 AWG (2.5 mm ²)	5,000 FT (1525 m)
16 AWG (1.5 mm ²)	2,000 FT (610 m)
18 AWG (1.0 mm ²)	1,000 FT (305 m)

- The communication link cannot pass between buildings.
- All units on the communication link can be connected in a "daisy chain" configuration.

LonTalk™ Interface (LCI-C)

CH530 provides an optional LonTalk Communication Interface (LCI-C) between the chiller and a Building Automation System (BAS). An LCI-C LLID shall be used to provide "gateway" functionality between a LonTalk compatible device and the Chiller. The inputs/outputs include both mandatory and optional network variables as established by the LonMark® Functional Chiller Profile 8040.

Note: For more information, see ACC-SVN25*-EN.

BACnet™ Interface (BCI-C)

Optional BACnet Communication Interface for Chillers (BCI-C) is comprised of a Tracer UC400 controller with interface software. It is a non-programmable communications module that allows units to communicate on a BACnet communications network.

Note: For more information, see BAS-SVP05*-EN.



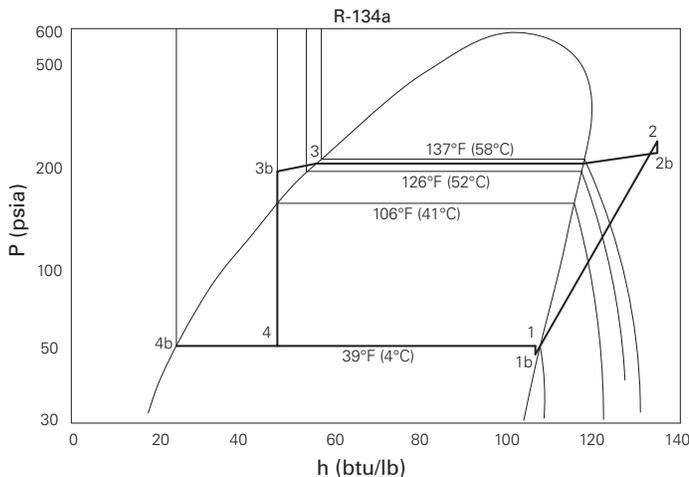
Operating Principles

This section contains an overview of the operation and maintenance of RTAC units equipped with CH530 control systems. It describes the overall operating principles of the RTAC design.

Refrigeration Cycle

The refrigeration cycle of the RTAC chiller is similar to that of the RTAA air cooled water chiller. The exception is that the evaporating and condensing temperatures have been increased to allow for optimization of the chiller and reduced foot print. The refrigeration cycle is represented in the pressure enthalpy diagram in Figure 36. Key state points are indicated on the figure. The cycle for the full load AHRI design point is represented in the plot.

Figure 36. Pressure enthalpy (P-h) diagram - RTAC



The RTAC chiller uses a shell and tube evaporator design with refrigerant evaporating on the shell side and water flowing inside tubes having enhanced surfaces (states 4 to 1). The suction lines and bolt pads are designed to minimize pressure drop (states 1 to 1b). The compressor is a twin-rotor helical rotary compressor designed similarly to the compressors offered in other Trane Screw Compressor Based Chillers (states 1b to 2). The discharge lines include a highly efficient oil separation system that virtually removes all oil from the refrigerant stream going to the heat exchangers (states 2 to 2b). De-superheating, condensing and sub-cooling is accomplished in a fin and tube air cooled heat exchanger where refrigerant is condensed in the tube (states 2b to 3b). Refrigerant flow through the system is balanced by an electronic expansion valve (states 3b to 4).

Refrigerant R-134a

The RTAC chiller uses environmentally friendly R134a. Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle

refrigerants must be certified. The Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

R-134a is a medium pressure refrigerant. It may not be used in any condition that would cause the chiller to operate in a vacuum without a purge system. RTAC is not equipped with a purge system. Therefore, the RTAC chiller may not be operated in a condition that would result in a saturated condition in the chiller of -15°F (-26°C) or lower.

R-134a requires the use of specific POE oils as designated on the unit nameplate.

Important: Use only R-134a and Trane Oil 00048 in RTAC chillers.

Compressor

The compressor is a semi-hermetic, direct-drive rotary type compressor. Each compressor has only four moving parts: two rotors that provide compression and male and female load-control valves. The male rotor is attached to the motor and the female rotor is driven by the male rotor. The rotors and motor are supported by bearings.

The helical rotary compressor is a positive displacement device. Refrigerant vapor from evaporator is drawn into the suction opening of the compressor (state 1b), through a suction strainer screen across the motor (which provides motor cooling) and into the intake of the compressor rotors. The gas is then compressed and discharged through a check valve and into the discharge line (state 2).

There is no physical contact between the rotors and the compressor housing. The rotors contact each other at the point where the driving action between the male and female rotors occurs. Oil is injected into the rotors of the compressor, coating the rotors and the compressor housing interior. Although this oil does provide rotor lubrication, its primary purpose is to seal the clearance spaces between the rotors and compressor housing. A positive seal between these internal parts enhances compressor efficiency by limiting leakage between the high pressure and low pressure cavities.

Capacity control is accomplished by means of a female step load-control valve and a male control valve. The female step valve is the first stage of loading after the compressor starts and the last stage of unloading before the compressor shuts down. The male control valve is positioned by a piston cylinder along the length of the male rotor. Compressor capacity is dictated by the position of the loading valve relative to the rotors. When the valve slides toward the discharge end of the rotors compressor capacity is reduced.



Condenser and Subcooler

Condenser and subcooler are similar to the condenser used in RTAA chillers. The heat exchanger consists of 3/8" tubes that contain refrigerant, large fins that are in the air flow and fans that draw air through fins. Heat is transferred from the refrigerant through the tubes and fins to the air.

High pressure gas from the compressor enters the tubes of the condenser through a distribution header (state 2b). As refrigerant flows through the tubes, the heat of compression and cooling load are rejected to the air. In this process the refrigerant is de-superheated, condensed (states 2b to 3) and finally subcooled (states 3 to 3b) to a temperature slightly above the ambient air temperature. The subcooled liquid refrigerant is collected in the leaving header where it is transferred to the liquid line (state 3b).

Controls algorithm always runs as many fans as possible without reducing differential pressure (discharge minus suction) below setpoint, 60 psid (4.2 bar). If a warm enough ambient is sensed, all fans will run. If ambient is cooler, some fans are shut off to maintain pressure differential. Fan staging depends on chiller load, evaporator pressure, condenser effectiveness, ambient temperature, and numbers and sizes of fans installed on circuit.

Algorithm pre-starts fans (based on ambient and water temperatures) when a circuit starts the compressor. (For rare conditions such as during some pull-downs, a steady fan state would either violate the 60 psid (4.2 bar) setpoint or cause a high pressure cut-out; in those conditions a fan will cycle on and off.)

For up to two minutes after chiller start-up, the setpoint is 35 psi (2.45 bar) difference, and then before the controls adjust gradually over half a minute up to 60 psi (4.2 bar).

Expansion Valve

Pressure drop occurs in an electronic expansion valve. The unit controller (CH530) uses the valve to regulate the flow through the liquid line to match the flow produced by the compressor. The valve has a variable orifice that is modulated by a stepper motor.

High pressure, subcooled liquid refrigerant enters the expansion valve from the liquid line. As refrigerant passes through the valve the pressure is dropped substantially, which results in vaporization of some of the refrigerant. The heat of vaporization is supplied by the two phase mixture resulting in low temperature low pressure refrigerant which is supplied to the evaporator (state 4) to provide cooling.

Evaporator

The evaporator is composed of a liquid-vapor distributor and falling film evaporator.

A liquid-vapor refrigerant mixture enters the distributor (state 4). The mixture is distributed over the length of the evaporator tubes (state 4b). Liquid is evenly distributed

over the length of the evaporator tubes by the two-phase distribution system. A portion of the liquid boils as it falls by gravity from tube to tube, wetting all the tubes of the evaporator. To ensure that the tubes at the bottom of the evaporator do not experience "dry out," a liquid pool is maintained in the bottom few inches of the bundle. Tubes located in the bottom of the evaporator will evaporate the liquid refrigerant by boiling (pool boiling).

Heat is transferred from the water or glycol inside the tubes to the liquid refrigerant as the film of refrigerant evaporates on the surface of the tube. Thin film heat transfer requires a smaller temperature difference for a given amount of heat transfer than nucleate boiling, which is the heat transfer process used in flooded evaporators. Hence, efficiency is enhanced by the use of falling film evaporation. Additionally, the evaporator requires less refrigerant than a comparable flooded evaporator and the evaporator boils the entire refrigerant supply at constant pressure. Refrigerant vapor exits the evaporator through the suction line (state 1).

Oil System

Screw compressors require large quantities of oil for lubricating and sealing the rotors and lubricating the bearings. This oil is mixed with refrigerant at the discharge of the compressor. To enhance the performance of the heat exchanger surfaces an oil separation system is placed into the discharge line. The oil separator is located between the compressor and the condenser. It separates oil using highly efficient centrifugal force. Approximately 99.5% of the oil is removed from the refrigerant in the separator.

Oil that is removed from the refrigerant falls by gravity into the oil sump. This oil is directed back to the compressor through the oil lines. Internal to the compressor is a high efficiency filter to clean the oil before it is delivered to the rotors and bearings. Once oil is injected into the compressor rotors it mixes with the refrigerant again and is delivered back to the discharge line.

Oil that gets past the oil separators flows through the condenser, subcooler and expansion valve into the evaporator. This oil is collected in the pool of refrigerant that is maintained in the bottom of the evaporator. A small amount of oil and refrigerant from this pool (state 4b) is returned through a line that is connected to the compressor down stream of the motor. This oil and refrigerant mixes with the refrigerant vapor that was drawn out of the evaporator, prior to injection into the compressor rotors.



Controls Interface

Overview

RTAC units utilize the Tracer™ CH530 chiller control system which consists of several elements:

- The main processor collects data, status, and diagnostic information and communicates commands to the starter module and the LLID (for Low Level Intelligent Device) bus. The main processor has an integral display (DynaView™).
- Higher level modules (e.g. starter) exist only as necessary to support system level control and communications. The starter module provides control of the starter when starting, running, and stopping the chiller motor. It also processes its own diagnostics and provides motor and compressor protection.
- Low level intelligent device (LLID) bus. The main processor communicates to each input and output device (e.g. temperature and pressure sensors, low voltage binary inputs, analog input/output) all connected to a four-wire bus, rather than the conventional control architecture of signal wires for each device.
- The communication interface to a building automation system (BAS).
- A service tool to provide all service/maintenance capabilities.

Main processor and service tool (™) software is downloadable from www.Trane.com. The process is discussed in section "TechView," p. 83.

DynaView provides bus management. It has the task of restarting the link, or filling in for what it sees as "missing" devices when normal communications has been degraded. Use of TechView may be required.

The CH530 uses the IPC3 protocol based on RS485 signal technology and communicating at 19.2 Kbaud to allow 3 rounds of data per second on a 64-device network. A typical four-compressor RTAC will have around 50 devices.

Most diagnostics are handled by the DynaView. If a temperature or pressure is reported out of range by a LLID, the DynaView processes this information and calls out the diagnostic. The individual LLIDs are not responsible for any diagnostic functions. The only exception to this is the Starter module.

Note: *It is imperative that the CH530 Service Tool (TechView) be used to facilitate the replacement of any LLID or reconfigure any chiller component. TechView is discussed later in this section.*

Controls Interface

Each chiller is equipped with a DynaView interface. The DynaView has the capability to display information to the operator including the ability to adjust settings. Multiple screens are available and text is presented in multiple

languages as factory-ordered or can be easily downloaded from www.trane.com.

TechView can be connected to either the DynaView module and provides further data, adjustment capabilities, diagnostics information using downloadable software.

DynaView Display

DynaView™ display interface is made of weatherproof and durable plastic for use as a stand-alone device on the outside of the unit or mounted nearby. See Figure 37.

The DynaView uses a 1/4 VGA display with a resistive touch screen and an LED backlight. The display area is approximately 4 inches wide by 3 inches high (102mm x 60mm).

Figure 37. DynaView



Key Functions

In this touch screen application, key functions are determined completely by software and change depending upon the subject matter currently being displayed. The basic touch screen functions are outlined below.

Radio Buttons

Radio buttons show one menu choice among two or more alternatives, all visible. (It is the AUTO button in Figure 37.) The radio button model mimics the buttons used on old-fashioned radios to select stations. When one is pressed, the one that was previously pressed "pops out" and the new station is selected. In the DynaView model the possible selections are each associated with a button. The selected button is darkened, presented in reverse video to indicate it is the selected choice. The full range of possible choices as well as the current choice is always in view.

Spin Value Buttons

Spin values are used to allow a variable setpoint to be changed, such as leaving water setpoint. The value increases or decreases by touching the increment (+) or decrement (-) arrows.

Action Buttons

Action buttons appear temporarily and provide the user with a choice such as **Enter** or **Cancel**.

Hot Links

Hot links are used to navigate from one view to another view.

File Folder Tabs

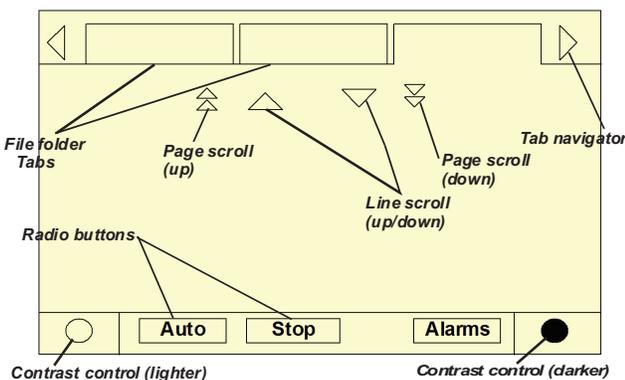
File folder tabs are used to select a screen of data. Just like tabs in a file folder, these serve to title the folder/screen selected, as well as provide navigation to other screens. In DynaView, the tabs are in one row across the top of the display. The folder tabs are separated from the rest of the display by a horizontal line. Vertical lines separate the tabs from each other. The folder that is selected has no horizontal line under its tab, thereby making it look like a part of the current folder (as would an open folder in a file cabinet). The user selects a screen of information by touching the appropriate tab.

Display Screens

Note: Screens shown in this chapter are representative samples only, and may not exactly match the values, selections found on your particular unit.

Basic Screen Format

The basic screen format appears as



The file folder tabs across the top of the screen are used to select the various display screens.

Scroll arrows are added if more file tabs (choices) are available. When the tabs are at the left most position, the left navigator will not show and only navigation to the right will be possible. Likewise when the right most screen is selected, only left navigation will be possible.

The main body of the screen is used for description text, data, setpoints, or keys (touch sensitive areas). The Chiller Mode is displayed here.

The double up arrows cause a page-by-page scroll either up or down. The single arrow causes a line by line scroll to occur. At the end of the page, the appropriate scroll bar will disappear.

A double arrow pointing to the right indicates more information is available about the specific item on that same line. Pressing it will bring you to a subscreen that will present the information or allow changes to settings.

The bottom of the screen (Fixed Display) is present in all screens and contains the following functions. The **left circular area** is used to reduce the contrast/viewing angle of the display. The **right circular area** is used to increase the contrast/viewing angle of the display. The contrast may require re-adjustment at ambient temperatures significantly different from those present at last adjustment.

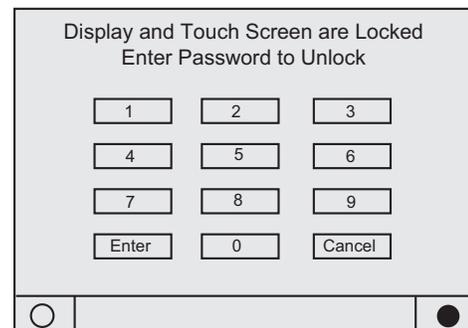
The other functions are critical to machine operation. The AUTO and STOP keys are used to enable or disable the chiller. The key selected is in black (reverse video). The chiller will stop when the STOP key is touched and after completing the Run Unload mode.

Touching the AUTO key will enable the chiller for active cooling if no diagnostic is present. (A separate action must be taken to clear active diagnostics.)

The AUTO and STOP keys, take precedence over the Enter and Cancel keys. (While a setting is being changed, AUTO and STOP keys are recognized even if Enter or Cancel has not been pressed.)

The ALARMS button appears only when an alarm is present, and blinks (by alternating between normal and reverse video) to draw attention to a diagnostic condition. Pressing the ALARMS button takes you to the corresponding tab for additional information.

Front Panel Lockout Feature



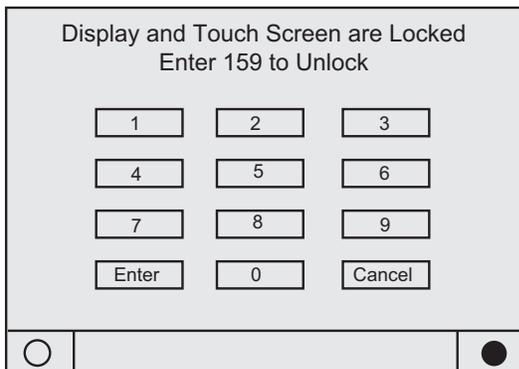
Note: The DynaView display and Touch Screen Lock screen is shown below. This screen is used if the Display and touch screen and lock feature is enabled. Thirty minutes after the last keystroke, this screen is displayed and the Display and Touch Screen is locked out until the sequence "159 <ENTER>" is pressed.

Until the proper password is entered, there will be no access to the DynaView screens including all reports, setpoints, and Auto/Stop/Alarms/Interlocks.

The password "159" is not programmable from either DynaView or TechView.

Front Panel Display During Cold Ambients

If the Display and Touch Screen Lock feature is disabled, the following screen is automatically displayed if the DynaView Temperature is below freezing and has been 30 minutes after the last keystroke.



Note: This feature is provided to avoid unintended actuations of the keypad, which can occur due to ice build-up on the DynaView's exterior surfaces. Also be aware that at extremes of temperatures, the LCD display screen will change its contrast from the optimal adjustment made at more normal temperatures. It can appear washed out or blacked out. Simply pressing the lower right contrast

control on the screen will return the display to readable condition.

Note: All screens shown in this section are typical. Some screens show all display options available, only one of which may appear on a line.

Modes Screen

The Mode Screen is only found on software revisions 18 and later. This screen provides a display for the top level operating mode for each of the components and sub-components of the chiller (i.e. Chiller, Circuits, and Compressors) that exist on the Chiller as it is configured. The modes are displayed as text only without the hex codes.

In software revisions 17.0 and earlier, the top level mode and the sub mode for each component was displayed on the respective component tab on the first two lines. The mode display of the first three lines of the Compressor and Chiller Screen tabs is eliminated with the addition of the Mode Screen

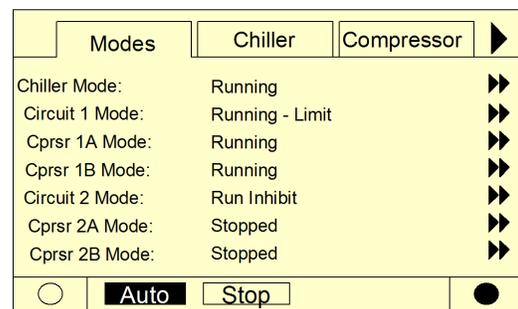


Table 54. Chiller modes

Chiller Modes	Description
Top Level Mode	
Sub-modes	
Stopped	The chiller is not running and cannot run without intervention. Further information is provided by the sub-mode:
Local Stop	Chiller is stopped by DynaView Stop button command- cannot be remotely overridden.
Panic Stop	Chiller is stopped by the DynaView Panic Stop (by pressing Stop button twice in succession) - previous shutdown was manually commanded to shutdown immediately without a run-unload or pumpdown cycle - cannot be remotely overridden.
Diagnostic Shutdown - Manual Reset	The chiller is stopped by a diagnostic that requires manual intervention to reset.
Other sub-modes are possible in conjunction with at least one of the above modes - See items below for their descriptions:	
Diagnostic Shutdown - Auto Reset	
Start Inhibited by Low Cond Temp	
Start Inhibited by Low Ambient Temp	
Start Inhibited by External Source	
Start Inhibited by BAS	
Waiting for BAS Communications	
Ice Building to Normal Transition	
Ice Building is Complete	
Run Inhibit	The chiller is currently being inhibited from starting (and running), but may be allowed to start if the inhibiting or diagnostic condition is cleared. Further information is provided by the sub-mode:
Diagnostic Shutdown - Auto Reset	The entire chiller is stopped by a diagnostic that may automatically clear.



Controls Interface

Table 54. Chiller modes (continued)

Chiller Modes	Description
Top Level Mode	
Sub-modes	
Start Inhibited by Low Cond Temp	The chiller is inhibited from starting by Low Condenser Temperature- Inhibit is active below either 25°F (can be disabled with proper freeze protection) or 0°F (limit set by design, cannot be disabled). As an exception, this will not stop a chiller already running.
Start Inhibited by Low Ambient Temp	The chiller is inhibited from starting (and running) by an outdoor air ambient temperature lower than a specified temperature - per user adjustable settings and can be disabled.
Start Inhibited by External Source	The chiller is inhibited from starting (and running) by the "external stop" hardwired input.
Start Inhibited by BAS	The chiller is inhibited from starting (and running) by command from a Building Automation System via the digital communication link (com 3 or com 5).
Waiting for BAS Communications	This is a transient mode - 15-min. max, and is only possible if the chiller is in the Auto - Remote command mode. After a power up reset, it is necessary to wait for valid communication from a Building Automation System (Tracer) to know whether to run or stay inhibited. Either valid communication will be received from the Building Automation System (e.g. Tracer), or a communication diagnostic ultimately will result. In the latter case the chiller will revert to Local control.
Ice Building to Normal Transition	The chiller is inhibited from running for a brief period of time if it is commanded from active ice building mode into normal cooling mode via the ice building hardwired input or Tracer. This allows time for the external system load to "switchover" from an ice bank to the chilled water loop, and provides for a controlled pull down of the loop's warmer temperature. This mode is not seen if the ice making is automatically terminated on return brine temperature per the mode below.
Ice Building is Complete	The chiller is inhibited from running as the Ice Building process has been normally terminated on the return brine temperature. The chiller will not start unless the ice building command (hardwired input or Building Automation System command) is removed or cycled.
Auto	The chiller is not currently running but can be expected to start at any moment given that the proper conditions and interlocks are satisfied. Further information is provided by the sub-mode:
Waiting For Evap Water Flow	The chiller will wait up to 4 minutes in this mode for evaporator water flow to be established per the flow switch hardwired input.
Waiting for Need to Cool	The chiller will wait indefinitely in this mode, for an evaporator leaving water temperature higher than the Chilled Water Setpoint plus the Differential to Start.
Starting	The chiller is going through the necessary steps to allow the lead circuit and lead compressor to start.
No Sub Modes	
Running	At least one circuit and one compressor on the chiller are currently running. Further information is provided by the sub-mode:
Unit is Building Ice	The chiller is running in the Ice Building Mode, and either at or moving towards full capacity available. Ice mode is terminated either with the removal of the ice mode command or with the return brine temperature falling below the Ice Termination Setpoint.
Running - Limited	At least one circuit and one compressor on the chiller are currently running, but the operation of the chiller as a whole is being actively limited by the controls.
Capacity Limited by High Evap Water Temp	This mode will occur if both the OA temperature is above 40°F and the Evap Leaving Water Temperature is above 75°F as is often the case in a high temperature pull-down. While in this mode, no compressors will be allowed to load past their minimum load capacity step, but it will not inhibit compressor staging. This mode is necessary to prevent nuisance trips due to Compressor Overcurrent or High Pressure Cutout. Reasonable pull-down rates can still be expected despite this limit.

Table 55. Circuit modes

Circuit Modes	Description
Top Level Mode	
Sub-modes	
Stopped	The given circuit is not running and cannot run without intervention. Further information is provided by the sub-mode:
Front Panel Lockout	The circuit is manually locked out by the circuit lockout setting - the nonvolatile lockout setting is accessible through either the DynaView or TechView.
Diagnostic Shutdown - Manual Reset	The circuit has been shutdown on a latching diagnostic.
Other sub-modes are possible in conjunction with at least one of the above modes - See items below for their descriptions: Diagnostic Shutdown - Auto Reset Start Inhibited by External Source Start Inhibited by BAS	
Run Inhibit	The given circuit is currently being inhibited from starting (and running), but may be allowed to start if the inhibiting or diagnostic condition is cleared. Further information is provided by the sub-mode:
Diagnostic Shutdown - Auto Reset	The circuit has been shutdown on a diagnostic that may clear automatically.
Start Inhibited by External Source	The circuit is inhibited from starting (and running) by its "external circuit lockout" hardwired input.
Start Inhibited by BAS	The circuit is inhibited from starting (and running) by command from a Building Automation System via the digital communication link (com 3 or com 5).
Auto	The given circuit is not currently running but can be expected to start at any moment given that the proper conditions and interlocks are satisfied.
No Sub Modes	
Starting	The given circuit is going through the necessary steps to allow the lead compressor on that circuit to start.
No Sub Modes	
Running	At least one compressor on the given circuit is currently running. Further information is provided by the sub-mode:
Establishing Min. Cap - Low Diff pressure	Circuit is experiencing low system differential pressure and is being force loaded, regardless of Chilled Water Temperature Control, to develop pressure sooner.
Running - Limited	At least one compressor on the given circuit is currently running, but the capacity of the circuit is being actively limited by the controls. Further information is provided by the sub-mode:
Capacity Limited by High Cond Press	Circuit is experiencing condenser pressures at or near the condenser limit setting. Compressors on circuit will be unloaded to prevent exceeding limits.
Capacity Limited by Low Evap Rfqt Temp	The circuit is experiencing saturated evaporator temperatures at or near the Low Refrigerant Temperature Cutout setting. Compressors on the circuit will be unloaded to prevent tripping.
Capacity Limited by Low Liquid Level	The circuit is experiencing low refrigerant liquid levels and the EXV is at or near full open. The compressors on the circuit will be unloaded to prevent tripping.
Shutting Down	The given circuit is still running but shutdown is imminent. The circuit is going through either a compressor run-unload mode or a circuit operational pumpdown to dry out the evaporator (cold OA ambient only). Shutdown is necessary due to one (or more) of the following sub-modes:
Operational Pumpdown	The circuit is in the process shutting down by performing an operational pumpdown just prior to stopping the last running compressor. The EXV is commanded closed. Pumpdown will terminate when both the liquid level and the evap pressure
Front Panel Lockout	The circuit has been manually locked out by the circuit lockout setting and is in the process of shutting down - the nonvolatile lockout setting is accessible through either the DynaView or TechView.
Diagnostic Shutdown - Manual Reset	The circuit is in the process of shutdown due to a latching diagnostic.
Diagnostic Shutdown - Auto Reset	The circuit is in the process of shutdown due to a diagnostic that may automatically clear.
Start Inhibited by External Source	The circuit is in the process of shutdown due to a command from the external circuit lockout hardwired input.
Start Inhibited by BAS	The circuit is in the process of shutdown due to a command from the Building Automation System (e.g. Tracer)



Controls Interface

Table 55. Circuit modes (continued)

Circuit Modes	Description
Top Level Mode	
Sub-modes	
Service Override	The given circuit is in a Service Override mode
Service Pumpdown	The circuit is running with fan control, via a manual command to perform a Service Pumpdown. Its respective EXV is being held wide open, but the manual liquid line service valve should be closed.

Table 56. Compressor modes

Compressor Modes	Description
Top Level Mode	
Sub-modes	
Stopped	The given compressor is not running and cannot run without intervention. Further information is provided by the sub-mode:
Diagnostic Shutdown - Manual Reset	The compressor has been shutdown on a latching diagnostic.
Service Tool Lockout	The compressor has been shutdown due to a command from the TechView Service Tool to be "locked out" and inoperative. This setting is nonvolatile and operation can only be restored by using TechView to "unlock" it.
Other sub-modes are possible in conjunction with at least one of the above modes - See items below for their descriptions:	
Diagnostic Shutdown - Auto Reset	
Restart Inhibit	
Run Inhibit	The given compressor is currently being inhibited from starting (and running*), but may be allowed to start if the inhibiting or diagnostic condition is cleared. Further information is provided by the sub-mode:
Diagnostic Shutdown - Auto Reset	The compressor has been shutdown on a diagnostic that may clear automatically.
Restart Inhibit	The compressor is currently unable to start due to its restart inhibit timer. A given compressor is not allowed to start until 5 minutes has expired since its last start.
Auto	The given compressor is not currently running but can be expected to start at any moment given that the proper conditions occur.
No Sub Modes	
Starting	The given compressor is going through the necessary steps to allow it to start. (This mode is short and transitory)
No Sub Modes	
Running	The given compressor is currently running. Further information is provided by the sub-mode:
Establishing Min. Capacity - High Oil Temp	The compressor is running and is being forced loaded to its step load point, without regard to the leaving water temperature control, to prevent tripping on high oil temperature.
Running - Limited	The given compressor is currently running, but its capacity is being actively limited by the controls. Further information is provided by the sub-mode:
Capacity Limited by High Current	The compressor is running and its capacity is being limited by high currents. The current limit setting is 120% RLA (to avoid overcurrent trips) or lower as set by the compressor's "share" of the active current limit (demand limit) setting for the entire chiller.
Capacity Limited by Phase Unbalance	The compressor is running and its capacity is being limited by excessive phase current unbalance.
Shutting Down	The given compressor is still running but shutdown is imminent. The compressor is going through either a run-unload mode or is the active compressor in the operational pumpdown cycle for its circuit. Shutdown is either normal (no sub-mode displayed) or due the following sub-modes:
Diagnostic Shutdown - Manual Reset	The compressor is in the process of shutdown due to a latching diagnostic.
Diagnostic Shutdown - Auto Reset	The compressor is in the process of shutdown due to a diagnostic that may clear automatically.
Service Tool Lockout	The compressor is in the process of shutdown due to a command from the TechView Service Tool to be "locked out" and inoperative. This setting is nonvolatile and operation can only be restored by using TechView to "unlock" it.

Chiller Screen

The chiller screen is a summary of the chiller activity.

Modes	Chiller	Compressor
Evap Leaving Water Temperature:	44.0 F	
Evap Entering Water Temperature:	54.0 F	
Active Chilled Water Setpoint:	44.0 F	▶▶
Active Current Limit Setpoint:	100 %	▶▶
Outdoor Air Temperature:	72.0 F	
Software Version:	18.0	
<input type="radio"/>	Auto	Stop <input type="radio"/>

Table 57. Chiller screen

Description	Resolution	Units
Evap Leaving Water Temperature	X.X	F / C
Evap Entering Water Temperature	X.X	F / C
Active Chilled Water Setpoint	X.X	F / C
Active Current Limit Setpoint	X	% RLA
Out Door Temperature	X.X	F / C
Software Type	RTA	Text
Software Version	X.XX	Text

Compressor Screen

The compressor screen displays information for the one, two, three, or four compressors in the format shown. The top line of radio buttons allows you to select the compressor of interest. The next three lines show the compressor operating mode. The compressor radio buttons and the compressor operating mode lines don't change as you scroll down in the menu.

The top screen has no upward scroll keys. The single arrow down scrolls the screen one line at a time. As soon as the display is one line away from the top, the upward pointing arrow appears.

The last screen has a single arrow to scroll upward one line at a time. When in the last position, the single down arrow disappears.

Each compressor has its own screen depending on which radio key is pressed. When toggling between compressor screens, say to compare starts and run time, the same lines can be seen without additional key strokes. For example, toggling from the bottom of the compressor 1A menu accesses the top of the compressor 2A menu.

Modes	Chiller	Compressor
▼	1A	1B 2A 2B
Amps L1 L2 L3:	55.0	56.2 54.3
% RLA:	86.0	88.4 84.3
Unit Volts:	460	
Oil Temperature:	95.0	F
Intermediate Oil Pressure:	102.9	psig
Suction Pressure:	32.6	psig
<input type="radio"/>	Auto	Stop <input type="radio"/>

Table 58. Compressor screen

Description	Resolution	Units
Amps L1 L2 L3	XXX	Amps
% RLA L1 L2 L3	X.X	% RLA
Unit Volts	XXX	Volts
Oil Temperature	X.X	F / C
Intermediate Oil Pressure	X.X	Pressure
Suction Pressure	X.X	Pressure
Starts/ Run Hours	X, XX:XX	hr:min

Refrigerant Screen

The refrigerant screen displays those aspects of the chiller related to the refrigerant circuits.

Chiller	Compressor	Rfgt.
		Ckt 1 Ckt 2
Cond Rfgt Pressure:	185.0	185.0 psig
Sat Cond Rfgt Temp:	125.0	125.0 F
Evap Rfgt Pressure:	30.0	30.0 psig
Sat Evap Rfgt Temp:	34.0	34.0 F
Evap Approach Temp:	4.0	4.0 F
Rfgt Liquid Level:	0.1	-0.1 in
<input type="radio"/>	Auto	Stop <input type="radio"/>

Table 59. Refrigerant screen

Description	Resolution	Units
Cond Rfgt Pressure Ckt1/Ckt2	X.X	Pressure
Sat Cond Rfgt Temp Ckt1/Ckt2	X.X	F / C
Evap Rfgt Pressure Ckt1/Ckt2	X.X	Pressure
Sat Evap Rfgt Temp Ckt1/Ckt2	X.X	F / C
Evap Approach Temp Ckt1/Ckt2	X.X	F / C
Rfgt Liquid Level Ckt1/Ckt2	X.X	Height

Setpoint Screen

The setpoint screen is a two-part screen. Screen 1 lists all setpoints available to change along with their current value. The operator selects a setpoint to change by touching either the verbal description or setpoint value. Doing this causes the screen to switch to Screen 2.

In Screen 1 the language setpoint will always be the last setpoint in the list. This will facilitate language changes by placing that control in a standard position across all CH.530 product lines.

Screen 2 displays the current value of the chosen setpoint in the upper ½ of the display. It is displayed in a changeable format consistent with its type. Binary setpoints are considered to be simple two state enumeration and will use radio buttons. Analog setpoints are displayed as spin buttons. The lower half of the screen is reserved for help screens.

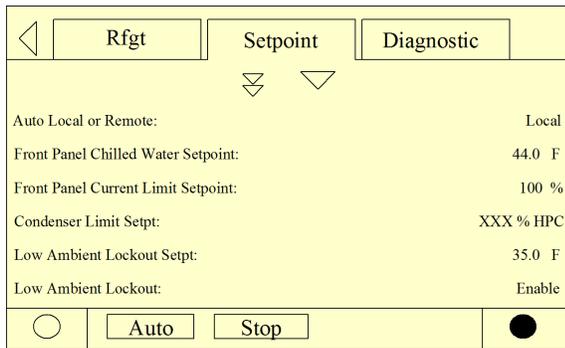


Table 60. Setpoint screen

Description	Resolution or Text	Units
Auto Local or Remote	Remote/Local	Text
Front Panel Chilled Water Setpoint	X.X	F / C

Table 60. Setpoint screen (continued)

Description	Resolution or Text	Units
Front Panel Current Limit Setpoint	XXX	% RLA
Differential to Start	X.X	Temperature
Differential to Stop	X.X	Temperature
Condenser Limit Setpoint	Enable/Disable	Text
Low Ambient Lockout Setpoint	X.X	Temperature
Low Ambient Lockout	Enable/Disable	Text
Ice Build	Enable/Disable	Text
Front Panel Ice Termination Setpoint	X.X	Temperature
Comp 1A Pumpdown	Pumpdown/Abort	Text
Comp 1B Pumpdown	Pumpdown/Abort	Text
Comp 2A Pumpdown	Pumpdown/Abort	Text
Comp 2B Pumpdown	Pumpdown/Abort	Text
EXV Ckt 1 Open	Auto/Open	Text
EXV Ckt 2 Open	Auto/Open	Text
Front Panel Ckt 1 Lockout	Locked Out/Not Locked Out	Text
Front Panel Ckt 2 Lockout	Locked Out/Not Locked Out	Text
Ext Chilled Water Setpoint	X.X	F / C
Ext Current Limit Setpoint	XXX	% RLA
Date Format	mmm dd yyyy, dd mm yyyy	Text
Date		Text
Time Format	12 hr, 24 hr	Text
Time of Day		Text
Keypad/Display Lockout	Enable/Disable	Text
Display Units	SI, English	Text
Pressure Units	Absolute, Gauge	Text
Language Selection	Downloaded from TechView	Text

Table 61 Setpoint options/conditions displayed

Option	Condition(s)	Explanation
Ice Building	Enable/Disable	If feature is installed, operation can be initiated or stopped
Cprsr Pumpdown ¹	Avail	Pumpdown is allowed: only with unit in Stop or when circuit is locked out
	Not Avail	Pumpdown is not allowed because unit is operating or pumpdown has been completed
	Pumpdown	State is displayed while pumpdown is in progress
EXV Ckt Open (For Authorized Service Use Only ²)	Avail	Indicates EXV is closed but can be opened manually since unit is in Stop or circuit is locked out
	Not Avail	EXV is closed but cannot be opened manually since unit is operating
	Open	State is displayed when EXV is open. Unit will not start with EXV manually set open, but will initiate valve closure first.
Ckt Lockout	Locked Out	Circuit is locked out at Front Panel; other circuit may be available to run
	Not Locked Out	Circuit is not locked out and is available to run

Notes:

¹ Pumpdown procedure are discussed in Maintenance section 10.

² Used for liquid level control or to recover from pumpdown

Table 61 Setpoint options/conditions displayed (continued)

Option	Condition(s)	Explanation
Ext. Chilled Water Setpt	Enable/Disable	Allows unit to control setpoint; otherwise another loop controller in line will control, as optionally wired.
Ext. Current Limit Setpt	Enable/Disable	Allows unit to control setpoint; otherwise another loop controller in line will control, as optionally wired.

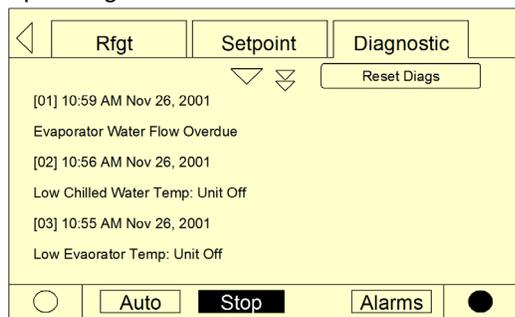
Notes:
¹ Pumpdown procedure are discussed in Maintenance section 10.

² Used for liquid level control or to recover from pumpdown

Diagnostic Screen

The diagnostic screen (shown following) is accessible by either pressing the blinking ALARMS key or by pressing the **Diagnostic** tab on the screen tab selection.

A hex code and a verbal description appears on the display as shown typically above. This is the last active diagnostic. Pressing the "Reset All Active Diagnostics" will reset all active diagnostics regardless of type, machine or refrigerant circuit. Compressor diagnostics, which hold off only one compressor, are treated as circuit diagnostics, consistent with the circuit to which they belong. One circuit not operating will not shut the chiller down. Viewing the "Compressor" screen will indicate whether a circuit is not operating and for what reason.



A complete listing of diagnostics and codes is included in the Diagnostic Section.

Power-Up

On Power-Up, DynaView will cycle through three screens:

- First Screen, Version # of the Boot, full version # displayed.
 - This screen will display for 5 seconds before moving to second screen. Contrast is adjustable from this screen.
- Second Screen, Application or No Application.
 - This screen will display for 5 seconds "A Valid Application Is Present" or "A Valid Application Is Not Present"
- Third Screen, First screen of the Application, the Chiller Tab

Display Formats

Units

Temperature settings are in °F or °C, depending on Display Units settings. Settings can be entered in tenths or whole degrees depending on a menu setting at the TechView.

Dashes ("-----") appearing in a temperature or pressure report, indicates that the value is invalid or not applicable.

Languages

English plus two alternate languages may be installed with DynaView and will reside in the main processor. English will always be available. Alternate languages must be installed using TechView, Software Download View.

TechView



TechView™ is the PC (laptop) based tool used for servicing Tracer CH530. Technicians that make any chiller control modification or service any diagnostic with Tracer CH530 must use a laptop running the software application "TechView." TechView is a Trane application developed to minimize chiller downtime and aid the technicians understanding of chiller operation and service requirements.

Note: Important: Performing any Tracer CH530 service functions should be done only by a properly trained service technician. Please contact your local Trane service agency for assistance with any service requirements.



Controls Interface

TechView software is available via Trane.com.

(<http://www.trane.com/COMMERCIAL/DesignAnalysis/TechView.aspx?i=1435>)

This download site provides a user the TechView installation software and CH530 main processor software that must be loaded onto your PC in order to service a CH530 main processor. The TechView service tool is used to load software into the Tracer CH530 main processor

Minimum PC requirements to install and operate TechView

- Microsoft Windows XP Professional, Windows Vista Business or Windows 7 Enterprise
- Internet Explorer 6.0 or higher
- USB 2.0 or higher
- Pentium II, III or higher processor
- 128Mb RAM minimum for TechView, 1G recommended for total Windows system
- 1024 x 768 resolution of display
- CD-ROM (optional for copying TechView install to CD)
- 56K modem (optional for internet connection)
- 9-pin RS-232 serial connection (optional for connection to DynaView)

Note: TechView was designed for the preceding listed laptop configuration. Any variation will have unknown results. Therefore, support for TechView is limited to only those operating systems that meet the specific configuration listed here. Only computers with a Pentium II class processor or better are supported; Intel Celeron, AMD, or Cyrix processors have not been tested.

TechView is also used to perform any CH530 service or maintenance function. Servicing a CH530 main processor includes:

- Updating main processor software
- Monitoring chiller operation
- Viewing and resetting chiller diagnostics
- Low Level Intelligent Device (LLID) replacement and binding
- Main processor replacement and configuration modifications
- Setpoint modifications
- Service overrides

TechView Software Download, Installation

This information can also be found at <http://www.trane.com/COMMERCIAL/DesignAnalysis/TechView.aspx?i=1435>.

1. Create a folder called "CH530" on your (C:\CH530) on your hard drive. This \CH530 folder is the standard recommended location for the installation file. Storing

the installation file in this location helps you remember where it is stored and makes it easier for technical support personnel to assist you.

2. Click the link for the latest version on the TechView Software Download page. Enter your name, e-mail address and other required information. Click **Submit**.
3. A download link will be sent to the e-mail address provided. Before you click the link please note:
 - Sent link may only be used one time.
 - Internet options must be set correctly to allow download. To verify correct setting:
 - Open Internet Explorer Browser
 - Click **Tools**
 - Select **Internet Options**
 - Select **Security** tab
 - Click on **Internet** zone
 - Click **Custom Level** button
 - Scroll to **Downloads** section
 - Verify/Enable "Automatic prompting for file downloads"
 - Click **OK**
 - Click YES on warning window
 - Click Apply, then OK

Note: If this setting is incorrect, you may or may not receive an error message during download attempt.

4. Click the download link in the e-mail message.
 - If the download window does not open immediately, please look for a yellow highlighted message bar/line near the top of your browser. It may contain a message such as "To help protect your security, Internet Explorer blocked this site from downloading files to your computer. Click here for options..." Click on message line to see options.
 - When dialog box appears, click **Save** and navigate to the CH530 folder created in [Step 1](#). Click OK.
 - If you do not complete the download successfully, you will have to request another download link ([Step 2](#)).
5. Navigate to the CH530 folder created in [Step 1](#). Double-click the installation (.exe) file. The License Agreement dialog box appears.
6. Click **I Agree** after reviewing License Agreement. The **Choose Components** dialog box appears. All components are selected by default. (These are the actual MP versions for all units.) Deselect any components you do not want.

Note: Deselecting components reduces the size of the installed application.

7. Click **Install**. A progress meter dialog box appears. An information file appears when installation is complete.

Note: *Techview requires a current version of JAVA. If you do not have the current release, TechView installation will be interrupted, and you will be provided with information for required JAVA software download. Once you have completed the JAVA installation, return to [Step 5](#) to restart installation.*

Unit View

Unit view is a summary for the system organized by chiller subsystem. This provides an overall view of chiller operating parameters and gives you an “at-a-glance” assessment of chiller operation.

The Control Panel tab displays important operating information for the unit and allows you to change several key operating parameters. The panel is divided into four or more sub-panels (depending on the number of circuits in the unit).

The Operating Mode tab displays the unit, circuit and compressor top level operating modes.

The Hours and Starts tab displays the number a hours (total) a compressor has run and the number of times the compressor has started. This window plays a key role in evaluating maintenance requirements.

Upon successful Local Connect Tech View will display UNIT VIEW, as shown in [Figure 38](#), p. 89.

Compressor Service View

Compressor View provides convenient access to service functions for pumping down circuits and test starting compressors. Various operational lockouts allow operation of rest of chiller while others are awaiting repair. See [Figure 39](#), p. 90.

Status View

Status View displays, in real time, all non-setpoint data organized by subsystem tabs. As data changes on the

Table 62. Setpoints view items

Tab	Text	Min Value	Max Value	Default Value	Unit Type
Chiller	Front Panel Display Units	English, SI		English	Display Units
Chiller	Front Panel Chilled Water Setpoint	10 (-12.22)	65 (18.33)	44 (6.67)	Temp Deg F(C)
Chiller	Front Panel Current Limit Setpoint	60	120	120	Percent
Chiller	Differential to Stop	0.5 (0.2777)	2.5 (1.388)	2.0 (1.111)	Differential Temp Deg F(C)
Chiller	Differential to Start	1.0 (0.555)	30 (16.666)	2 (1.111)	Differential Temp Deg F(C)
Chiller	Leaving Water Temp Cutout	0.0 (-17.78)	36.0 (2.22)	36.0 (2.22)	Temp Deg F(C)
Chiller	Low Refrigerant Temp Cutout	-5.0 (-20.56)	36.0 (2.22)	28.0 (-2.22)	Temp Deg F(C)
Chiller	Front Panel Condenser Limit Setpoint	80	120	90	Percent
Chiller	Low Ambient Lockout Setpoint	-10 (-23.333)	70 (21.111)	25 (-3.89)	Temp Deg F(C)
Chiller	Low Ambient Lockout	Enable, Disable		Enable	Enabled / Disabled

chiller it is automatically updated in Status View. See [Figure 40](#), p. 90.

Setpoint View

Setpoint view displays the active setpoints and allows you to make changes. See [Figure 41](#), p. 90.

Setpoint List

The center displays the scrollable list of setpoint panels.

Setpoint Enumeration Panel

A setpoint numeric panel contains a label with the setpoint description and a pull-down list showing the active value and the other selections. The Default button returns the setpoint to the product's factory setting. The text field is updated when the change is complete.

Setpoint Numeric Panel

A setpoint numeric panel contains a label with the setpoint description, a Default button, a text field with a unit label, and a slider.

The Default button changes the setpoint to the product's factory setting. The text field and slider are updated when the change is complete.

You can change a setpoint with the text field or with the slider. When you click on the entry field, the change setpoint dialog displays to coordinate the setpoint change.

You can change the display units for a setpoint by clicking on the unit label next to the entry field.

Change Setpoint

The change setpoint window allows you to enter a new value for the setpoint into a text field. If the entered value is outside the given range, the background turns red.



Controls Interface

Table 62. Setpoints view items (continued)

Tab	Text	Min Value	Max Value	Default Value	Unit Type
Chiller	Front Panel Ice Termination Setpoint	20 (-6.67)	31 (-0.56)	31 (-0.56)	Temp Deg F(C)
Chiller	External Ice Building Input	Enable, Disable		Disable	Enabled / Disabled
Chiller	Under/Over Voltage Protection	Enable, Disable		Disable	Enabled / Disabled
Chiller	Local Atmospheric Pressure	9.93 (68.5)	16.0 (110.3)	14.7 (101.3)	Absolute Pressure psia(Kpa)
Chiller	Design Delta Temperature	4 (2.22)	30 (16.666)	10 (5.6)	Differential Temp Deg F(C)
Chiller	Reset Type	None, Return, Outdoor, Constant Return		None	RstTyp
Chiller	Return Reset Ratio	10	120	50	Percent
Chiller	Return Start Reset	4.0 (2.22)	30.0 (16.666)	10.0 (5.56)	Differential Temp Deg F(C)
Chiller	Return Maximum Reset	0	20 (11.11)	5.0 (2.78)	Differential Temp Deg F(C)
Chiller	Outdoor Reset Ratio	-80	80	10	Percent
Chiller	Outdoor Start Reset	50 (10)	130 (54.44)	90 (32.22)	Temp Deg F(C)
Chiller	Outdoor Maximum Reset	0	20 (11.11)	5 (2.78)	Differential Temp Deg F(C)
Chiller	External Chilled Water Setpoint	Enable, Disable		Disable	Enabled / Disabled
Chiller	External Current Limit Setpoint	Enable, Disable		Disable	Enabled / Disabled
Chiller	Evaporator Water Pump Off Delay	0	30	1	Minutes
Chiller	Chilled Water Setpoint Filter Settling Time 30		1800	200	Seconds
Chiller	Compressor Staging Deadband	0.4 (0.222)	4.0 (2.222)	0.05 (0.2778)	Differential Temp Deg F(C)

Diagnostics View

See [Figure 42, p. 90](#). This window lists the active and inactive (history) diagnostics. There can be up to 60 diagnostics, both active and historic. For example, if there were 5 active diagnostics, the possible number of historic diagnostics would be 55. You can also reset active diagnostics here, (i.e., transfer active diagnostics to history and allow the chiller to regenerate any active diagnostics).

Resetting the active diagnostics may cause the chiller to resume operation.

The Active and History diagnostics have separate tabs. A button to reset the active diagnostics displays when either tab is selected.

Configuration View

See [Figure 43, p. 91](#). This view displays the active configuration and allows you to make changes.

Configuration View allows you to define the chiller's components, ratings, and configuration settings. These are all values that determine the required installed devices, and how the chiller application is run in the main processor. For example, a user may set an option to be installed with Configuration View, which will require devices to be bound using Binding View. And when the main processor runs the chiller application, the

appropriate steps are taken to monitor required inputs and control necessary outputs.

Any changes made in the Configuration View, on any of the tabs, will modify the chiller configuration when you click on the Load Configuration button (located at the base of the window). The Load Configuration button uploads the new configuration settings into the main processor.

Any changes made to the configuration will change the unit model number and the confirmation code (CRC). If changes are made to the unit configuration the new model number and CRC should be recorded.

Selecting the Undo All button will undo any configuration setting changes made during the present TechView connection and since the last time the Load Configuration button was selected.

Table 63. Configuration View Items

Tab	Item	Default	Description
Feature	Basic Product Line		RTAC - Air Cooled Series R Chiller
			120 Nominal Tons 130 Nominal Tons 140 Nominal Tons 155 Nominal Tons 170 Nominal Tons 185 Nominal Tons 200 Nominal Tons 225 Nominal Tons 250 Nominal Tons 275 Nominal Tons 300 Nominal Tons 350 Nominal Tons 375 Nominal Tons 400 Nominal Tons 450 Nominal Tons 500 Nominal Tons
	Unit Nominal Capacity		
	Unit Voltage		A - 200V/60Hz/3Ph power C - 230V/60Hz/3Ph power J - 380V/60Hz/3Ph power D - 400V/50Hz/3Ph power 4 - 460V/60Hz/3Ph power 5 - 575V/60Hz/3Ph power
	Manufacturing Location		U - Water Chiller Business Unit - Pueblo E - Epinal Business Unit -Charmes
	Design Sequence		XX - Factory/ABU Assigned
	Unit Type		N - Standard Efficiency/Performance H - High Efficiency/Performance A - Extra Efficiency/Performance
	Agency Listing		N - No agency listing U - C/UL listing
	Pressure Vessel Code		A - ASME pressure vessel code C - Canadian code D - Australian code L - Chinese code R - Vietnamese code S - Special
	Evaporator Temperature Range & Application Type		F - Standard Temperature with Freeze Protection R - Rem Evap, Std Temp, No Freeze Protection G - Low Temp, with Freeze Protection
	Evaporator Configuration		N - Standard 2 pass arrangement, insulated P -3 pass arrangement, insulated
	Condenser Temperature Range		N - Standard ambient 25-115°F H - High ambient 25-125°F L - Low ambient 0-115°F W - Wide ambient 0-125°F
	Condenser Fin Material		1 - Standard aluminum slit fins 2 - Copper fins, non-slit fins 4 - Complete Coat aluminum fins
Feature	Condenser Fan/Motor Configuration		T - Standard fans, TEAO motors W - Low Noise fans
			X - Across-the-line Y - Wye-delta closed transition
	Compressor Motor Starter Type		1 -Single point 2 -Dual point (1/ckt)
			T - Terminals only D - Non-fused disconnect switch(es) C - Circuit Breaker(s), HACR-rated
	Power Line Connection Type		
	Unit Operator Interface		D -Dyna-View



Controls Interface

Table 63. Configuration View Items (continued)

Tab	Item	Default	Description
	Remote Interface		N - No remote interface C - Tracer Comm 3 interface B - BACnet communication interface L - Lon Talk Communication interface (LCI)
	Control Input Accessories/Options		N -No remote input R -Remote leaving water temp setpoint C -Remote current limit setpoint B -Remote leaving temp setpoint and remote current limit setpoint
	Control Output Accessories/Options		N -No output options A -Alarm relay C -Icemaking D -Icemaking and alarm relay
	Short Circuit Rating		0 - No short circuit withstand rating 5 -Default short circuit rating 6 - High amp short circuit rating
	Control Panel Accessories		N - No convenience outlet A - 15A 115V convenience outlet (60HZ)
	Refrigerant Service Valves		0 - No suction services valves 1 - Suction service valves
	Compressor Sound Attenuator Option		0 - No sound attenuator 1 - Factory installed sound attenuator
	Appearance Options		N - No appearance options A - Architectural louvered panels C - Half Louvers P - Painted unit L - Painted unit with full louvered panels H - Painted unit with half louvered panels K - Painted unit with access guards W - Painted w/access guards and half louvers
Features	Installation Accessories		N - No installation accessories R - Neoprene Isolators F - Flanged water connection kit G - Neoprene isolators and flange wtr conn kit
	Factory Test		0 - No factory run test
	Control, Label, and Literature Language		E - English G - Chinese
	Special Order		X - Standard catalog configuration S - Unit has special order feature
Custom	Comm 3 ICS address	55	1-64 REM = C
	Status Relay #1 J2-10,11,12	Alarm - Latching	None, Alarm - Latching (Active diagnostic persistence latching), Alarm - Auto reset (Active diagnostic persistence non-latching), Alarm (Active diagnostic persistence latching or non-latching), Alarm Ckt1 (Active diagnostic persistence latching or non-latching), Alarm Ckt2 (Active diagnostic persistence latching or non-latching), Chiller Limit Mode (With 20 minute filter), Circuit 1 Running, Circuit 2 Running, Max Capacity COOP = A, D or X
	Status Relay #2 J2-7,8,9	Chiller Running	
	Status Relay #3 J2-4,5,6	Maximum Capacity	
	Status Relay #4 J2-1,2,3	Chiller Limit Mode	
	Phase Unbalance Trip	30	10-50%
	Phase Unbalance Grace Period	90	30-255 Sec
	Maximum Acceleration Time	3	1-255 Sec
	Starter Feature	All Enabled	Contactors Integrity Test, Phase Reversal Detect, Phase Unbalance Detect
	External Chilled Water Setpoint Detection	2-10 VD	2-10 VDC, 4-20 mA CIOP = C or B
	External Current Limit Water Setpoint Detection	2-10 VDC	2-10 VDC, 4-20 mA CIOP = C or B
	Custom Unit Voltage	400	380,400,415 VOLT = D
Name-plate	<ul style="list-style-type: none"> The Model Number field contains the model number stored in the DynaView. The Confirm Code field contains the confirm code stored in the DynaView. The confirm code is a four-digit hex value that is a mathematical calculation of the model number. This number has one to one correlation to a specific model number and is used to verify that the model number was entered properly. The Serial Number field contains the serial number stored in the DynaView. This model number and confirmation code must be know when the main processor requires replacement. 		

Software View

See [Figure 44, p. 91](#). Software view allows you to verify the version of chiller software currently running and download a new version of chiller software to DynaView.

You can also add up to two available languages to load into the DynaView. Loading an alternate language file allows the DynaView to display its text in the selected alternate language, English will always be available.

Binding View

See [Figure 45, p. 91](#). Binding View allows you to assess the status of the network and all the devices connected as a whole, or the status of individual devices by using status icons and function buttons.

Binding View is essentially a table depicting what devices and options are actually discovered on the network bus (and their communication status) versus what is required to support the configuration defined by the feature codes and categories. Binding View allows you to add, remove, modify, verify, and reassign devices and options in order to match the configuration requirements.

Whenever a device is installed, it must be correctly configured to communicate and function as intended. This process is called binding. Some features of Binding View are intended to serve a second purpose; that is diagnosing problems with communication among the devices.

Replacing or Adding Devices

If a device is communicating but incorrectly configured, it might not be necessary to replace it. If the problem with the device is related to communication, attempt to rebind it, and if the device becomes correctly configured, it will then communicate properly.

If a device that needs to be replaced is still communicating, it should be unbound. Otherwise, it will be necessary to rebuild the CH530 network image for Binding View to discover that it has been removed. An unbound device stops communicating and allows a new device to be bound in its place.

It is good practice to turn the power off while detaching and attaching devices to the CH530 network. Be sure to keep power on the service tool computer. After power is restored to the CH530 network, the reconnect function in Binding View restores communication with the network. If the service tool computer is turned off, you must restart TechView and Binding View.

If a device is not communicating, the binding function displays a window to request manual selection of the device to be bound. Previously-selected devices are deselected when the function starts. When manual selection is confirmed, exactly one device must be selected; if it is the correct type, it is bound. If the desired device cannot be selected or if multiple devices are accidentally selected, you can close the manual selection window by clicking on No and repeat the bind function.

Figure 38. Unit view

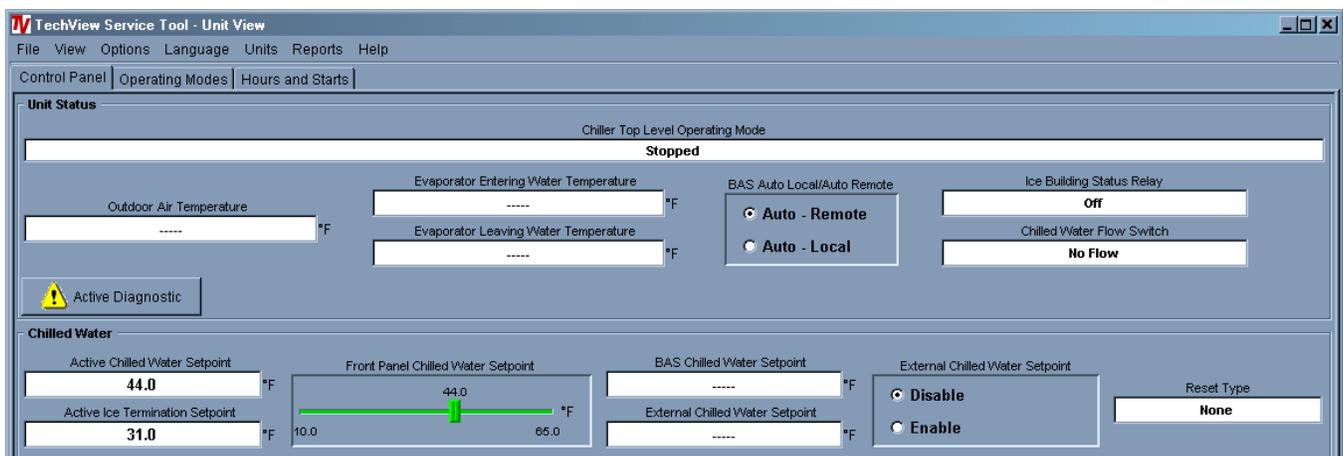


Figure 39. Compressor service view

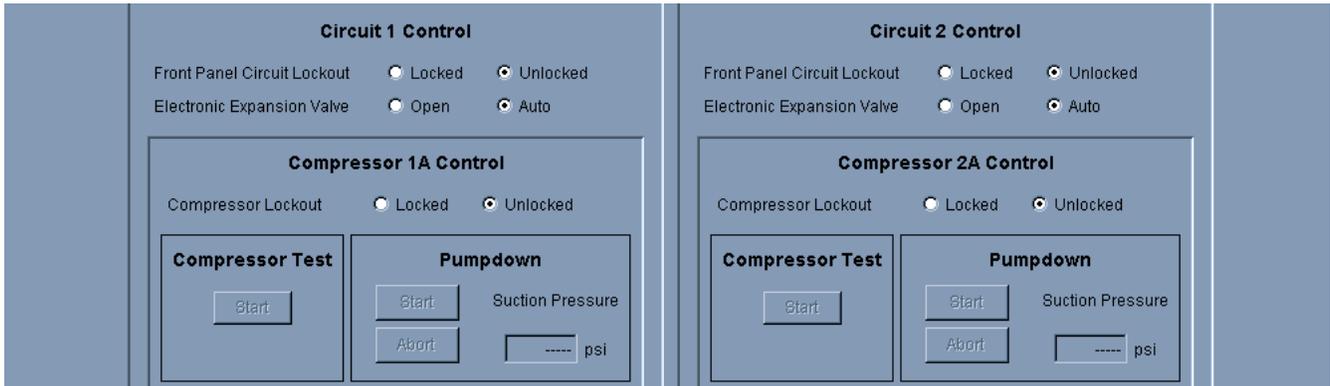


Figure 40. Status view

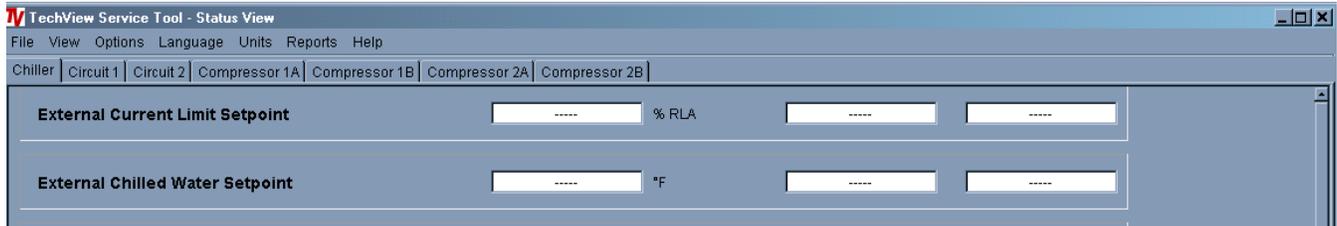


Figure 41. Setpoint view^(a)



(a) Screenshot is representation only. Values shown may not correspond to actual min/max levels in Table 62, p. 85.

Figure 42. Diagnostic view

Date/Time	Description	Target	Severity	Persistence
Feb 14, 1922 11:47 PM	Evaporator Water Flow Overdue	Chiller	Normal Shutdown	Nonlatching
Feb 14, 1922 11:27 PM	Low Chilled Water Temp: Unit Off	Chiller	Warning	Nonlatching
Feb 14, 1922 11:27 PM	Excessive IPC Comm Loss	Chiller	Immediate Shutdown	Latching

Figure 43. Configuration view

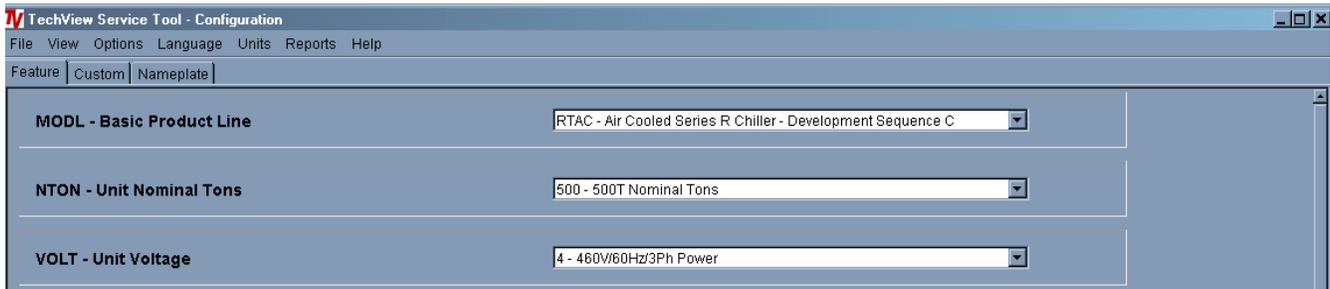


Figure 44. Software view

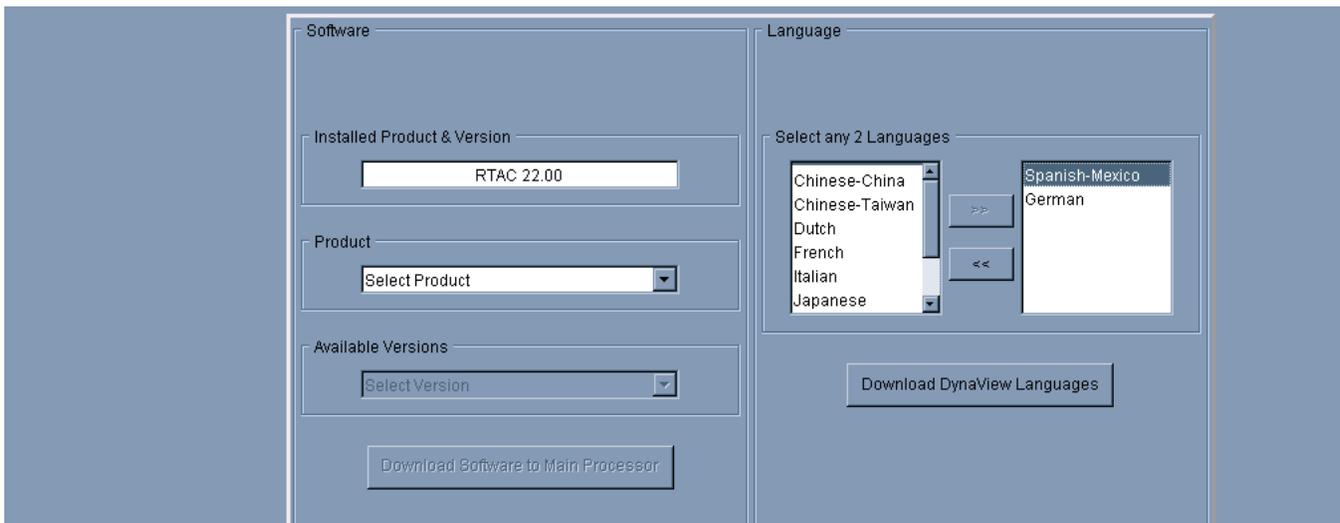
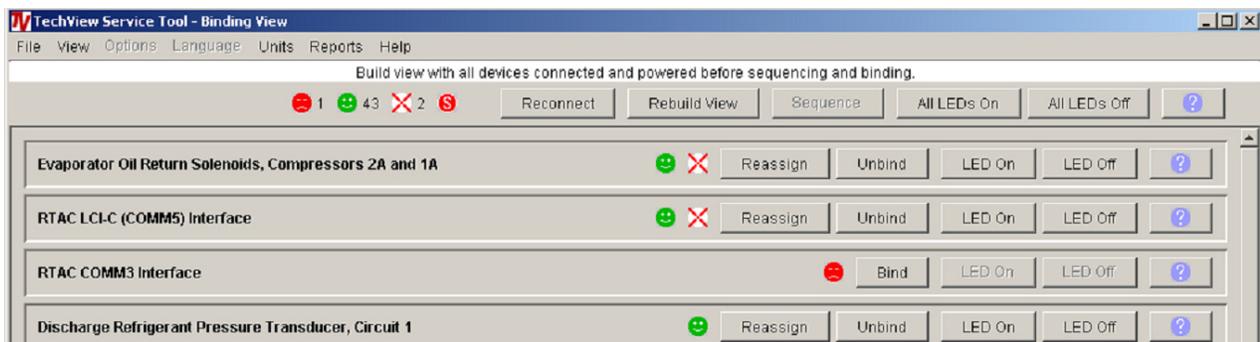


Figure 45. Binding view





Pre-Start Checkout

Upon completion of installation, complete the RTAC Series R® Air-Cooled Chiller Installation Completion Check Sheet and Request for Trane Service checklist in chapter “[Log and Check Sheet](#),” p. 124.

Important: *Start-up must be performed by Trane or an agent of Trane specifically authorized to perform start-up and warranty of Trane products. Contractor shall provide Trane (or an agent of Trane specifically authorized to perform start-up) with notice of the scheduled start-up at least two weeks prior to the scheduled start-up.*



Start-Up and Shutdown

Important: Initial unit commissioning start-up must be performed by Trane or an agent of Trane specifically authorized to perform start-up and warranty of Trane products. Contractor shall provide Trane (or an agent of Trane specifically authorized to perform start-up) with notice of the scheduled start-up at least two weeks prior to the scheduled start-up.

The time line for sequence of operation is shown in Figure 46, p. 96 and Figure 47, p. 98 and depicts the nominal delays and sequences that a chiller would experience during a typical operational cycle. The time line begins with a power up of the main power to the chiller. The sequence assumes a 2 circuit, 2 compressor air-cooled RTAC chiller with no diagnostics or malfunctioning components. External events such as the operator placing the chiller in Auto or Stop, chilled water flow through the evaporator, and application of load to the chilled water loop causing loop water temperature increases are depicted and the chillers responses to those events are shown, with appropriate delays noted. The effects of diagnostics, and other external interlocks other than evaporator water flow proving, are not considered.

Note: Unless the CH530 TechView and building automation system are controlling the chilled water pump, the manual unit start sequence is as follows. Operator actions are noted.

NOTICE:

Compressor Damage!

Ensure that the compressor and oil separator heaters have been operating for a minimum of 24 hours before starting. Failure to do so could result in equipment damage.

Unit Start-Up

If the pre-start checkout, has been completed, the unit is ready to start.

1. Press the STOP key on the CH530.
2. As necessary, adjust the setpoint values in the CH530 menus using TechView.
3. Close the fused-disconnect switch for the chilled water pump. Energize the pump(s) to start water circulation.
4. Check the service valves on the discharge line, suction line, oil line and liquid line for each circuit. These valves must be open (backseated) before starting the compressors.

NOTICE:

Compressor Damage!

Catastrophic damage to the compressor will occur if the oil line shut off valve or the isolation valves are left closed on unit start-up

5. Press the AUTO key. If the chiller control calls for cooling and all safety interlocks are closed, the unit will start. The compressor(s) will load and unload in response to the leaving chilled water temperature.
6. Verify that the chilled water pump runs for at least one minute after the chiller is commanded to stop (for normal chilled water systems).

Once the system has been operating for approximately 30 minutes and has become stabilized, complete the remaining start-up procedures, as follows:

1. Check the evaporator refrigerant pressure and the condenser refrigerant pressure under Refrigerant Report on the CH530 TechView. The pressures are referenced to sea level (14.6960 psia).
2. Check the EXV sight glasses after sufficient time has elapsed to stabilize the chiller. The refrigerant flow past the sight glasses should be clear. Bubbles in the refrigerant indicate either low refrigerant charge or excessive pressure drop in the liquid line or a stuck open expansion valve. A restriction in the line can sometimes be identified by a noticeable temperature differential between the two sides of the restriction. Frost will often form on the line at this point. Proper refrigerant charges are shown in the General Information Section.

Important: A clear sight glass alone does not mean that the system is properly charged. Also check system subcooling, liquid level control and unit operating pressures.

3. Measure the system subcooling.
4. A shortage of refrigerant is indicated if operating pressures are low and subcooling is also low. If the operating pressures, sight glass, superheat and subcooling readings indicate a refrigerant shortage, gas-charge refrigerant into each circuit, as required. With the unit running, add refrigerant vapor by connecting the charging line to the suction service valve and charging through the backseat port until operating conditions become normal.



Start-Up and Shutdown

NOTICE:

Equipment Damage!

If both suction and discharge pressures are low but sub-cooling is normal, a problem other than refrigerant shortage exists. Do not add refrigerant, as this could result in overcharging the circuit.

Use only refrigerants specified on the unit nameplate (HFC 134a) and Trane OIL00048. Failure to do so may cause compressor damage and improper unit operation.

Temporary Shutdown and Restart

To shut the unit down for a short time, use the following procedure:

1. Press the STOP key on the CH530. The compressors will continue to operate and, after an unloading period (which may be followed by pumpdown cycle in outdoor ambients below 50°F), will stop when the compressor contactors de-energize.
2. CH530 pump control will turn off the pump (after a minimum 1 min. delay) when the STOP key is pressed and automatically restart the pump when the unit starts normally.
3. The unit will start normally, provided the following conditions exist:
 - a. The CH530 receives a call for cooling and the differential-to-start is above the setpoint.
 - b. All system operating interlocks and safety circuits are satisfied.

Extended Shutdown Procedure

The following procedure is to be followed if the system is to be taken out of service for an extended period of time, e.g. seasonal shutdown:

1. Test the unit for refrigerant leaks and repair as necessary.
2. Open the electrical disconnect switches for the chilled water pump. Lock the switches in the "OPEN" position.

NOTICE:

Equipment Damage!

To prevent pump damage, lock the chilled water pump disconnects open.

3. Close all chilled water supply valves. Drain the water from the evaporator.
4. With the water drained from evaporator, the "customer provided" power for the 120-volt evaporator heaters (terminated at 1TB4...terminals 1 & 2) must be must disconnect.

These heaters consist of 1 well heater in each evaporator end (or water box), and the heat tape, which

is wrapped around the bundle itself. They are energized by a klixon temperature control mounted on the side of the evaporator, which energizes at or below 37°F. outside air temp. If there is no liquid in the evaporator and the temp drops below 37 degrees, both of the well heaters will burn up because they have no liquid to transfer their heat into.

5. Open the unit main electrical disconnect and unit-mounted disconnect (if installed) and lock on the "OPEN" position. If the optional control power transformer is not installed, open and lock the 115V disconnect.

NOTICE:

Equipment Damage!

If insufficient concentration or no glycol is used, the evaporator water pumps must be controlled by the CH530 to avoid severe damage to the evaporator due to freezing. A power loss of 15 minutes during freezing can damage the evaporator. It is the responsibility of the installing contractor and/or the customer to ensure that a pump will start when called upon by the chiller controls.

Please consult [Table 42, p. 54](#) for correct concentration of glycol.

The warranty will be void, in case of freezing due to the lack of use of either of these protections

NOTICE:

Equipment Damage!

Lock the disconnects in the "OPEN" position to prevent accidental start-up and damage to the system when it has been setup for extended shutdown.

6. At least every three months (quarterly), check the refrigerant pressure in the unit to verify that the refrigerant charge is intact.

Seasonal Unit Start-Up Procedure

1. Close all valves and re-install the drain plugs in the evaporator.
2. Service the auxiliary equipment according to the start-up/maintenance instructions provided by the respective equipment manufacturers.
3. Close the vents in the evaporator chilled water circuits.
4. Open all the valves in the evaporator chilled water circuits.
5. Open all refrigerant valves to verify they are in the open condition.
6. If the evaporator was previously drained, vent and fill the evaporator and chilled water circuit. When all air is removed from the system (including each pass), install the vent plugs in the evaporator water boxes.
7. Check the adjustment and operation of each safety and operating control.
8. Close all disconnect switches.
9. Refer to the sequence for daily unit startup for the remainder of the seasonal startup.

System Restart After Extended Shutdown

Follow the procedures below to restart the unit after extended shutdown:

1. Verify that the liquid line service valves, oil line, compressor discharge service valves and suction service valves are open (backseated).

NOTICE:

Compressor Damage!

Catastrophic damage to the compressor will occur if the oil line shut off valve or the isolation valves are left closed on unit start-up.

2. Check the oil separator oil level (see Maintenance Procedures section).
3. Fill the evaporator water circuit. Vent the system while it is being filled. Open the vent on the top of the evaporator and condenser while filling and close when filling is completed.

NOTICE:

Proper Water Treatment!

The use of untreated or improperly treated water in this equipment could result in scaling, erosion, corrosion, algae or slime. It is recommended that the services of a qualified water treatment specialist be engaged to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

4. Close the fused-disconnect switches that provides power to the chilled water pump.
5. Start the evaporator water pump and, while water is circulating, inspect all piping for leakage. Make any necessary repairs before starting the unit.
6. While the water is circulating, adjust the water flows and check the water pressure drops through the evaporator. Refer to "Water System Flow Rates" and "Water System Pressure Drop".
7. Adjust the flow switch on the evaporator piping for proper operation.
8. Stop the water pump. The unit is now ready for start-up as described in "Start-Up Procedures".

Sequence of Operation

Figure 46. Sequence of operations

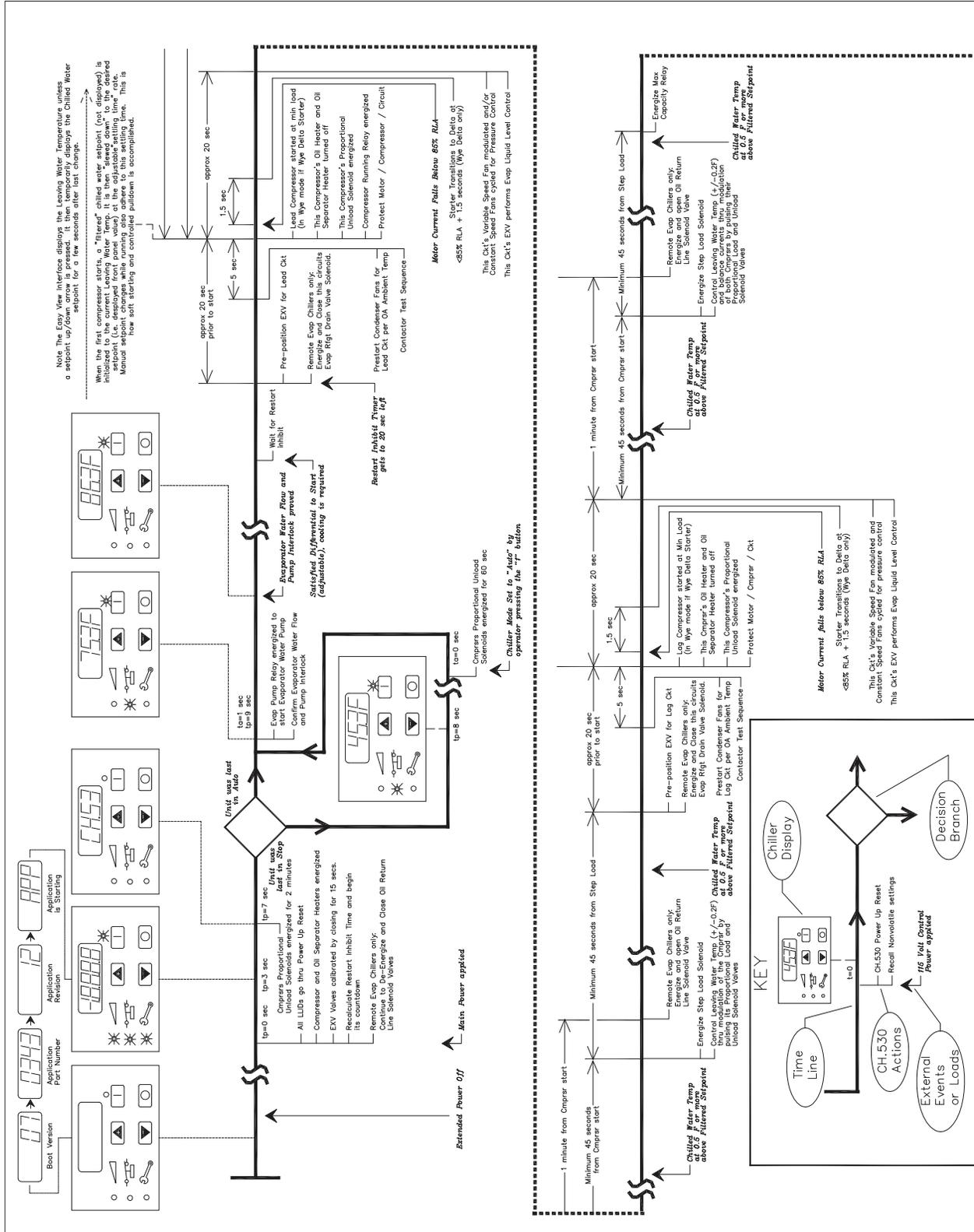
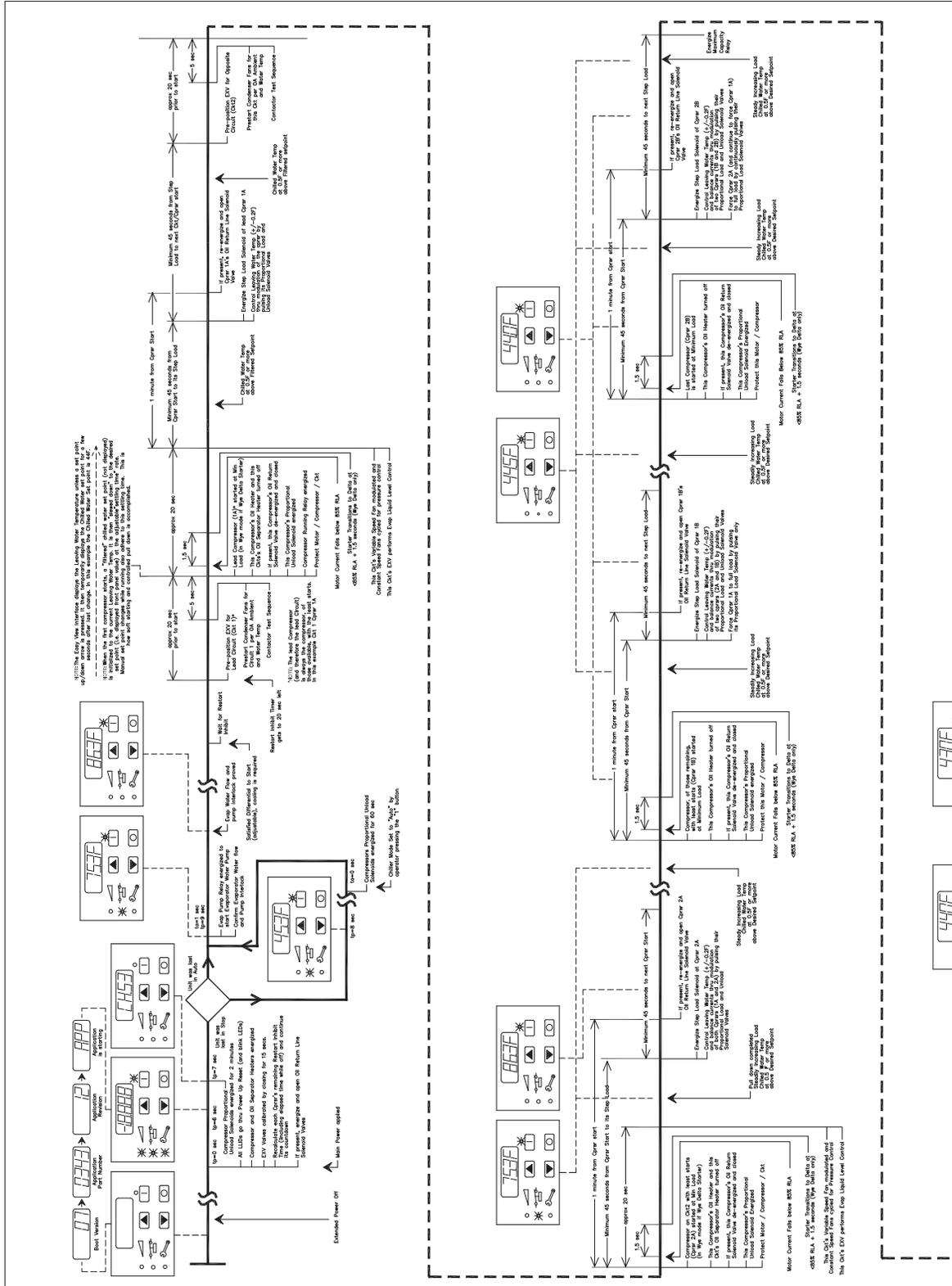


Figure 47. Sequence of operations





Maintenance

Perform all maintenance procedures and inspections at the recommended intervals. This will prolong the life of the chiller and minimize the possibility of costly failures.

Use the "Operator's Log," such as that show in chapter "Log and Check Sheet," p. 124 to record an operating history for unit. The log serves as a valuable diagnostic tool for service personnel. By observing trends in operating conditions, an operator can anticipate and prevent problem situations before they occur. If unit does not operate properly during maintenance inspections, see "Diagnostics," p. 103.

After unit has been operating for approximately 30 minutes and system has stabilized, check the operating conditions and complete procedures below:

Weekly

While unit is running in stable conditions.

1. Check MP pressure for evaporator, condenser and intermediate oil.
2. Observe liquid line sight glass on EXV.
3. If liquid line sight glass has bubbles measure the subcooling entering the EXV. The subcooling should never be less than 4°F under any circumstances.

Important: A clear sightglass alone does not mean that the system is properly charged. Also check the rest of the system operating conditions.

4. Inspect the entire system for unusual conditions and inspect the condenser coils for dirt and debris. If the coils are dirty, refer to coil cleaning.

Monthly

1. Perform all weekly maintenance procedures.
2. Record the system subcooling.
3. Make any repairs necessary.

Annual

1. Perform all weekly and monthly procedures.
2. Check oil sump oil level while unit is off.

Note: Routine changing of oil is not required. Use an oil analysis to determine condition of oil.

3. Have a qualified laboratory perform a compressor oil analysis to determine system moisture content and acid level. This analysis is a valuable diagnostic tool.
4. Contact a qualified service organization to leak test the chiller, to check operating and safety controls, and to inspect electrical components for deficiencies.
5. Inspect all piping components for leakage and damage. Clean out any inline strainers.

6. Clean and repaint any areas that show signs of corrosion.
7. Clean the condenser coils.

⚠ WARNING

Hazardous Voltage w/Capacitors!

Disconnect all electric power, including remote disconnects and discharge all motor start/run capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized. For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharge of capacitors. Verify with an appropriate voltmeter that all capacitors have discharged. Failure to disconnect power and discharge capacitors before servicing could result in death or serious injury.

For additional information regarding the safe discharge of capacitors, see PROD-SVB06A-EN

8. Check and tighten all electrical connections as necessary.

Refrigerant and Oil Charge Management

Proper oil and refrigerant charge is essential for proper unit operation, unit performance, and environmental protection. Only trained and licensed service personnel should service the chiller.

Table 64 lists baseline measurements for RTAC units running at AHRI standard operating conditions. If chiller measurements vary significantly from values listed below, problems may exist with refrigerant and oil charge levels. Contact your local Trane office.

Note: Low temperature applications units will have values that vary from Table 64. Contact your local Trane office for more information.

Table 64. Typical RTAC baselines (AHRI conditions)

Measurement	Baseline
Evaporator Pressure	49.5 psia
Evaporator Approach	3.5°F
EXV Position	45-50%
Evaporator - entering	54°
Evaporator - leaving	44°
Discharge Superheat	26.6°F
Condenser Pressure	226 psia
Subcooling	18-23°F

Lubrication System

The lubrication system has been designed to keep most of the oil lines filled with oil as long as there is a proper oil level in the oil sump.

Oil Sump Level Check

Oil system consists of the following components:

- Compressor
- Oil separator
- Discharge line with service valve
- Oil line from separator to compressor
- Oil line drain (lowest point in system)
- Oil cooler - optional
- Oil temperature sensor
- Oil line shut off valve with flare service connection
- Oil filter (internal to compressor) with flare fitting service connection and schrader valve
- Oil flow control valve (internal to the compressor after the filter)
- Oil return line from evaporator with shut off valve and strainer

Refer to [Table 1, p. 10](#) through [Table 10, p. 19](#) for the standard oil charge for each circuit.

Note: *It is recommended to check the oil level in the sump using a sight glass or a manometer, attached to charging hoses.*

Table 65. Oil charging data

Circuit (Tons)	Approximate sump oil level after running "normal" conditions (in)	Normal quantity of oil in refrigeration system (evaporator/condenser) lb (gal)
70	7	1.1 (0.14)
85	6	1.1 (0.14)
100	7	1.8 (0.23)
120	7	1.8 (0.23)
170	8	3.5 (0.44)
200	8	3.5 (0.44)
240	8	3.5 (0.44)

1. To **measure oil level**, use the oil drain valve on the oil line and a service valve on the discharge line. This measurement can only be made when the circuit is not running.

Note: *The level is measured from the bottom of the separator and 1" must be subtracted for the thickness of the bottom plate.*

2. The initial oil charge should be approximately at the level in the above chart. This is the approximate oil level if all the oil is in the oil lines, filter and oil sump

and the unit is in vacuum so that there is no refrigerant dissolved in the oil.

3. After the unit has run for a while, the oil level in the sump can vary greatly. However, if the unit has run "normal" conditions for a long time the level should resemble the level in the above chart.
 - +1" to - 4" (25 to -101mm) is acceptable

Important: *If levels are outside these ranges, contact your local Trane office.*

Condenser Maintenance

Condenser Coil Cleaning

⚠ WARNING

Hazardous Chemicals!

Coil cleaning agents can be either acidic or highly alkaline and can burn severely if contact with skin occurs. Handle chemical carefully and avoid contact with skin. ALWAYS wear Personal Protective Equipment (PPE) including goggles or face shield, chemical resistant gloves, boots, apron or suit as required. For personal safety refer to the cleaning agent manufacturer's Materials Safety Data Sheet and follow all recommended safe handling practices. Failure to follow all safety instructions could result in death or serious injury.

Clean the condenser coils at least once a year or more frequently if the unit is in a "dirty" environment. A clean condenser coil will help to maintain chiller operating efficiency. Follow the detergent manufacturer's instructions to avoid damaging the condenser coils.

To clean the condenser coils use a soft brush and a sprayer such as a garden pump type or a high-pressure type. A high quality detergent such as Trane Coil Cleaner (Part No. CHM-00255) is recommended.

Note: *If detergent mixture is strongly alkaline (pH value greater than 8.5, an inhibitor must be added).*

Travel Restraint

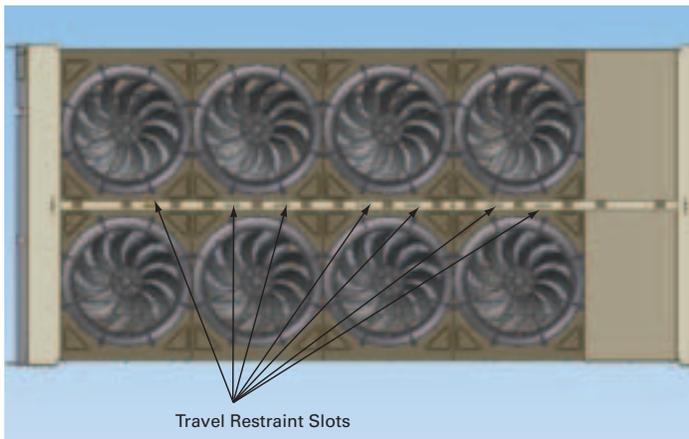
⚠ WARNING

Falling Off Equipment!

This unit is built with fall restraint slots located on unit top that **MUST** be used during servicing. These slots are to be used with fall restraint equipment that will **not** allow an individual to reach the unit edge. However such equipment will **NOT** prevent falling to the ground, for they are **NOT** designed to withstand the force of a falling individual. Failure to use fall restraint slots and equipment could result in individual falling off the unit which could result in death or serious injury.

This unit is built with travel restraint slots located on unit top that must be used during servicing. See [Figure 48](#).

Figure 48. Roof view - travel restraint slots





Diagnostics

Legend to Diagnostics Table

Legacy Hex Code: 3 digit hexadecimal code used on all past products to uniquely identify diagnostics.

Diagnostic Name and Source: Name of Diagnostic and its source. Note that this is the exact text used in the User Interface and/or Service Tool displays.

Affects Target: Defines the “target” or what is affected by the diagnostic. Usually either the entire **Chiller**, or a particular **Circuit or Compressor** is affected by the diagnostic (the same one as the source), but in special cases functions are modified or disabled by the diagnostic. **None** implies that there is no direct affect to the chiller, sub components or functional operation.

Severity: Defines the severity of the above effect. **Immediate** means immediate shutdown of the effected portion, **Normal** means normal or friendly shutdown of the effected portion, **Special Mode** means a special mode of operation (limp along) is invoked, but without shutdown, and **Info** means an Informational Note or Warning is generated.

Persistence: Defines whether or not the diagnostic and its effects are to be manually reset (Latched), or can be either manually or automatically reset (Nonlatched).

Active Modes [Inactive Modes]: States the modes or periods of operation that the diagnostic is active in and, as necessary, those modes or periods that it is specifically not active in as an exception to the active modes. The inactive modes are enclosed in brackets, []. Note that the modes used in this column are internal and not generally announced to any of the formal mode displays

Criteria: Quantitatively defines the criteria used in generating the diagnostic and, if nonlatching, the criteria for auto reset. If more explanation is necessary a hot link to the Functional Specification is used.

Reset Level: Defines the lowest level of manual diagnostic reset command which can clear the diagnostic. The manual diagnostic reset levels in order of priority are: **Local** or **Remote**. For example, a diagnostic that has a reset level of Remote, can be reset by either a remote diagnostic reset command or by a local diagnostic reset command.

Help Text: Provides for a brief description of what kind of problems might cause this diagnostic to occur. Both control system component related problems as well as chiller application related problems are addressed (as can possibly be anticipated). These help messages will be updated with accumulated field experience with the chillers.

Starter Diagnostics

Table 66. Starter diagnostics

Diagnostic Name and Source	Affects			Persistence	Active Modes [Inactive Modes]	Criteria	Reset Level
	Target	Severity					
Motor Current Overload - Compressor 1A	Circuit	Immediate		Latch	Cprsr Energized	Compressor current exceeded overload time vs. trip characteristic. For A/C products Must trip = 140% RLA, Must hold=125%, nominal trip 132.5% in 30 seconds	Local
Motor Current Overload - Compressor 1B	Circuit	Immediate		Latch	Cprsr Energized	Compressor current exceeded overload time vs. trip characteristic. For A/C products Must trip = 140% RLA, Must hold=125%, nominal trip 132.5% in 30 seconds	Local
Motor Current Overload - Compressor 2A	Circuit	Immediate		Latch	Cprsr Energized	Compressor current exceeded overload time vs. trip characteristic. For A/C products Must trip = 140% RLA, Must hold=125%, nominal trip 132.5% in 30 seconds	Local
Motor Current Overload - Compressor 2B	Circuit	Immediate		Latch	Cprsr Energized	Compressor current exceeded overload time vs. trip characteristic. For A/C products Must trip = 140% RLA, Must hold=125%, nominal trip 132.5% in 30 seconds	Local
Over Voltage	Chiller	Normal		NonLatch	Pre-Start and Any Ckt(s) Energzd	Nom. trip: 60 seconds at greater than 112.5%, 2.5%, Auto Reset at 109% or less.	Remote
Phase Loss - Compressor 1A	Cprsr	Immediate		Latch	Start Sequence and Run modes	a) No current was sensed on one or two of the current transformer inputs while running or starting (See Nonlatching Power Loss Diagnostic for all three phases lost while running). Must hold = 20% RLA. Must trip = 5% RLA. Time to trip shall be longer than guaranteed reset on Starter Module at a minimum, 3 seconds maximum. Actual design trip point is 10%. The actual design trip time is 2.64 seconds. b) If Phase reversal protection is enabled and current is not sensed on one or more current transformer inputs. Logic will detect and trip in a maximum of 0.3 second from compressor start.	Local



Diagnostics

Table 66. Starter diagnostics (continued)

Diagnostic Name and Source	Affects Target	Severity	Persistence	Active Modes [Inactive Modes]	Criteria	Reset Level
Phase Loss - Compressor 1B	Cprsr	Immediate	Latch	Start Sequence and Run modes	a) No current was sensed on one or two of the current transformer inputs while running or starting (See Nonlatching Power Loss Diagnostic for all three phases lost while running). Must hold = 20% RLA. Must trip = 5% RLA. Time to trip shall be longer than guaranteed reset on Starter Module at a minimum, 3 seconds maximum. Actual design trip point is 10%. The actual design trip time is 2.64 seconds. b) If Phase reversal protection is enabled and current is not sensed on one or more current transformer inputs. Logic will detect and trip in a maximum of 0.3 second from compressor start	Local
Phase Loss - Compressor 2A	Cprsr	Immediate	Latch	Start Sequence and Run modes	a) No current was sensed on one or two of the current transformer inputs while running or starting (See Nonlatching Power Loss Diagnostic for all three phases lost while running). Must hold = 20% RLA. Must trip = 5% RLA. Time to trip shall be longer than guaranteed reset on Starter Module at a minimum, 3 seconds maximum. Actual design trip point is 10%. The actual design trip time is 2.64 seconds. b) If Phase reversal protection is enabled and current is not sensed on one or more current transformer inputs. Logic will detect and trip in a maximum of 0.3 second from compressor start	Local
Phase Loss - Compressor 2B	Cprsr	Immediate	Latch	Start Sequence and Run modes	a) No current was sensed on one or two of the current transformer inputs while running or starting (See Nonlatching Power Loss Diagnostic for all three phases lost while running). Must hold = 20% RLA. Must trip = 5% RLA. Time to trip shall be longer than guaranteed reset on Starter Module at a minimum, 3 seconds maximum. Actual design trip point is 10%. The actual design trip time is 2.64 seconds. b) If Phase reversal protection is enabled and current is not sensed on one or more current transformer inputs. Logic will detect and trip in a maximum of 0.3 second from compressor start	Local
Phase Reversal - Compressor 1A	Cprsr	Immediate	Latch	Compressor energized to transition command [All Other Times]	A phase reversal was detected on the incoming current. On a compressor startup the phase reversal logic must detect and trip in a maximum of .3 second from compressor start.	Local
Phase Reversal - Compressor 1B	Cprsr	Immediate	Latch	Compressor energized to transition command [All Other Times]	A phase reversal was detected on the incoming current. On a compressor startup the phase reversal logic must detect and trip in a maximum of .3 second from compressor start.	Local
Phase Reversal - Compressor 2A	Cprsr	Immediate	Latch	Compressor energized to transition command [All Other Times]	A phase reversal was detected on the incoming current. On a compressor startup the phase reversal logic must detect and trip in a maximum of .3 second from compressor start.	Local
Phase Reversal - Compressor 2B	Cprsr	Immediate	Latch	Compressor energized to transition command [All Other Times]	A phase reversal was detected on the incoming current. On a compressor startup the phase reversal logic must detect and trip in a maximum of .3 second from compressor start.	Local
Power Loss - Compressor 1A	Cprsr	Immediate	NonLatch	All compressor running modes [all compressor starting and non-running modes]	The compressor had previously established currents while running and then all three phases of current were lost. Design: Less than 10% RLA, trip in 2.64 seconds. This diagnostic will preclude the Phase Loss Diagnostic and the Transition Complete Input Opened Diagnostic from being called out. To prevent this diagnostic from occurring with the intended disconnect of main power, the minimum time to trip must be greater than the guaranteed reset time of the Starter module. Note: This diagnostic prevents nuisance latching diagnostics due to a momentary power loss - It does not protect motor/compressor from uncontrolled power reapplication. See Momentary Power Loss Diagnostic for this protection. This diagnostic is not active during the start mode before the transition complete input is proven. Thus a random power loss during a start would result in either a "Starter Fault Type 3" or a "Starter Did Not Transition" latching diagnostic.	Remote

Table 66. Starter diagnostics (continued)

Diagnostic Name and Source	Affects Target	Severity	Persistence	Active Modes [Inactive Modes]	Criteria	Reset Level
Power Loss - Compressor 1B	Cprsr	Immediate	NonLatch	All compressor running modes [all compressor starting and non-running modes]	The compressor had previously established currents while running and then all three phases of current were lost. Design: Less than 10% RLA, trip in 2.64 seconds. This diagnostic will preclude the Phase Loss Diagnostic and the Transition Complete Input Opened Diagnostic from being called out. To prevent this diagnostic from occurring with the intended disconnect of main power, the minimum time to trip must be greater than the guaranteed reset time of the Starter module.	Remote
Power Loss - Compressor 2A	Cprsr	Immediate	NonLatch	All compressor running modes [all compressor starting and non-running modes]	The compressor had previously established currents while running and then all three phases of current were lost. Design: Less than 10% RLA, trip in 2.64 seconds. This diagnostic will preclude the Phase Loss Diagnostic and the Transition Complete Input Opened Diagnostic from being called out. To prevent this diagnostic from occurring with the intended disconnect of main power, the minimum time to trip must be greater than the guaranteed reset time of the Starter module.	Remote
Power Loss - Compressor 2B	Cprsr	Immediate	NonLatch	All compressor running modes [all compressor starting and non-running modes]	The compressor had previously established currents while running and then all three phases of current were lost. Design: Less than 10% RLA, trip in 2.64 seconds. This diagnostic will preclude the Phase Loss Diagnostic and the Transition Complete Input Opened Diagnostic from being called out. To prevent this diagnostic from occurring with the intended disconnect of main power, the minimum time to trip must be greater than the guaranteed reset time of the Starter module.	Remote
Severe Current Imbalance - Compressor 1A	Circuit	Immediate	Latch	All Running Modes	A 30% Current Imbalance has been detected on one phase relative to the average of all 3 phases for 90 continuous seconds.	Local
Severe Current Imbalance - Compressor 1B	Circuit	Immediate	Latch	All Running Modes	A 30% Current Imbalance has been detected on one phase relative to the average of all 3 phases for 90 continuous seconds.	Local
Severe Current Imbalance - Compressor 2A	Circuit	Immediate	Latch	All Running Modes	A 30% Current Imbalance has been detected on one phase relative to the average of all 3 phases for 90 continuous seconds.	Local
Severe Current Imbalance - Compressor 2B	Circuit	Immediate	Latch	All Running Modes	A 30% Current Imbalance has been detected on one phase relative to the average of all 3 phases for 90 continuous seconds.	Local
Starter 1A Dry Run Test	Cprsr	Immediate	Latch	Starter Dry Run Mode	While in the Starter Dry Run Mode either 50% Line Voltage was sensed at the Potential Transformers or 10% RLA Current was sensed at the Current Transformers.	Local
Starter 1B Dry Run Test	Cprsr	Immediate	Latch	Starter Dry Run Mode	While in the Starter Dry Run Mode either 50% Line Voltage was sensed at the Potential Transformers or 10% RLA Current was sensed at the Current Transformers.	Local
Starter 2A Dry Run Test	Cprsr	Immediate	Latch	Starter Dry Run Mode	While in the Starter Dry Run Mode either 50% Line Voltage was sensed at the Potential Transformers or 10% RLA Current was sensed at the Current Transformers.	Local
Starter 2B Dry Run Test	Cprsr	Immediate	Latch	Starter Dry Run Mode	While in the Starter Dry Run Mode either 50% Line Voltage was sensed at the Potential Transformers or 10% RLA Current was sensed at the Current Transformers.	Local
Starter Contactor Interrupt Failure - Compressor 2A	Chiller	Special Mode	Latch	Starter Contactor not Energized [Starter Contactor Energized]	Detected compressor currents greater than 10% RLA on any or all phases when the compressor was commanded off. Detection time shall be 5 second minimum and 10 seconds maximum. On detection and until the controller is manually reset: generate diagnostic, energize the appropriate alarm relay, continue to energize the Evap Pump Output, continue to command the affected compressor off, fully unload the effected compressor and command a normal stop to all other compressors. For as long as current continues, perform liquid level and fan control on the circuit effected.	Local

Diagnostics

Table 66. Starter diagnostics (continued)

Diagnostic Name and Source	Affects Target	Severity	Persistence	Active Modes [Inactive Modes]	Criteria	Reset Level
Starter Contactor Interrupt Failure - Compressor 1A	Chiller	Special Mode	Latch	Starter Contactor not Energized [Starter Contactor Energized]	Detected compressor currents greater than 10% RLA on any or all phases when the compressor was commanded off. Detection time shall be 5 second minimum and 10 seconds maximum. On detection and until the controller is manually reset: generate diagnostic, energize the appropriate alarm relay, continue to energize the Evap Pump Output, continue to command the affected compressor off, fully unload the effected compressor and command a normal stop to all other compressors. For as long as current continues, perform liquid level and fan control on the circuit effected.	Local
Starter Contactor Interrupt Failure - Compressor 1B	Chiller	Special Mode	Latch	Starter Contactor not Energized [Starter Contactor Energized]	Detected compressor currents greater than 10% RLA on any or all phases when the compressor was commanded off. Detection time shall be 5 second minimum and 10 seconds maximum. On detection and until the controller is manually reset: generate diagnostic, energize the appropriate alarm relay, continue to energize the Evap Pump Output, continue to command the affected compressor off, fully unload the effected compressor and command a normal stop to all other compressors. For as long as current continues, perform liquid level and fan control on the circuit effected.	Local
Starter Contactor Interrupt Failure - Compressor 2B	Chiller	Special Mode	Latch	Starter Contactor not Energized [Starter Contactor Energized]	Detected compressor currents greater than 10% RLA on any or all phases when the compressor was commanded off. Detection time shall be 5 second minimum and 10 seconds maximum. On detection and until the controller is manually reset: generate diagnostic, energize the appropriate alarm relay, continue to energize the Evap Pump Output, continue to command the affected compressor off, fully unload the effected compressor and command a normal stop to all other compressors. For as long as current continues, perform liquid level and fan control on the circuit effected.	Local
Starter Did Not Transition - Compressor 1A	Cprsr	Immediate	Latch	On the first check after transition.	The Starter Module did not receive a transition complete signal in the designated time from its command to transition. The must hold time from the Starter Module transition command is 1 second. The Must trip time from the transition command is 6 seconds. Actual design is 2.5 seconds. This diagnostic is active only for Y-Delta, Auto-Transformer, Primary Reactor, and X-Line Starters.	Local
Starter Did Not Transition - Compressor 1B	Cprsr	Immediate	Latch	On the first check after transition.	The Starter Module did not receive a transition complete signal in the designated time from its command to transition. The must hold time from the Starter Module transition command is 1 second. The Must trip time from the transition command is 6 seconds. Actual design is 2.5 seconds. This diagnostic is active only for Y-Delta, Auto-Transformer, Primary Reactor, and X-Line Starters.	Local
Starter Did Not Transition - Compressor 2A	Cprsr	Immediate	Latch	On the first check after transition.	The Starter Module did not receive a transition complete signal in the designated time from its command to transition. The must hold time from the Starter Module transition command is 1 second. The Must trip time from the transition command is 6 seconds. Actual design is 2.5 seconds. This diagnostic is active only for Y-Delta, Auto-Transformer, Primary Reactor, and X-Line Starters.	Local
Starter Did Not Transition - Compressor 2B	Cprsr	Immediate	Latch	On the first check after transition.	The Starter Module did not receive a transition complete signal in the designated time from its command to transition. The must hold time from the Starter Module transition command is 1 second. The Must trip time from the transition command is 6 seconds. Actual design is 2.5 seconds. This diagnostic is active only for Y-Delta, Auto-Transformer, Primary Reactor, and X-Line Starters.	Local
Starter Fault Type I - Compressor 1A	Cprsr	Immediate	Latch	Starting - Y Delta Starters Only	This is a specific starter test where 1M(1K1) is closed first and a check is made to ensure that there are no currents detected by the CT's. If currents are detected when only 1M is closed first at start, then one of the other contactors is shorted.	Local
Starter Fault Type I - Compressor 1B	Cprsr	Immediate	Latch	Starting - Y Delta Starters Only	This is a specific starter test where 1M(1K1) is closed first and a check is made to ensure that there are no currents detected by the CT's. If currents are detected when only 1M is closed first at start, then one of the other contactors is shorted.	Local
Starter Fault Type I - Compressor 2A	Cprsr	Immediate	Latch	Starting - Y Delta Starters Only	This is a specific starter test where 1M(1K1) is closed first and a check is made to ensure that there are no currents detected by the CT's. If currents are detected when only 1M is closed first at start, then one of the other contactors is shorted.	Local

Table 66. Starter diagnostics (continued)

Diagnostic Name and Source	Affects Target	Severity	Persistence	Active Modes [Inactive Modes]	Criteria	Reset Level
Starter Fault Type I - Compressor 2B	Cprsr	Immediate	Latch	Starting - Y Delta Starters Only	This is a specific starter test where 1M(1K1) is closed first and a check is made to ensure that there are no currents detected by the CT's. If currents are detected when only 1M is closed first at start, then one of the other contactors is shorted.	Local
Starter Fault Type II - Compressor 1A	Cprsr	Immediate	Latch	Starting All types of starters	a. This is a specific starter test where the Shorting Contactor (1K3) is individually energized and a check is made to ensure that there are no currents detected by the CT's. If current is detected when only S is energized at Start, then 1M is shorted. b. This test in a. above applies to all forms of starters (Note: It is understood that many starters do not connect to the Shorting Contactor.).	Local
Starter Fault Type II - Compressor 1B	Cprsr	Immediate	Latch	Starting - All types of starters	a. This is a specific starter test where the Shorting Contactor (1K3) is individually energized and a check is made to ensure that there are no currents detected by the CT's. If current is detected when only S is energized at Start, then 1M is shorted. b. This test in a. above applies to all forms of starters (Note: It is understood that many starters do not connect to the Shorting Contactor.).	Local
Starter Fault Type II - Compressor 2A	Cprsr	Immediate	Latch	Starting - All types of starters	a. This is a specific starter test where the Shorting Contactor (1K3) is individually energized and a check is made to ensure that there are no currents detected by the CT's. If current is detected when only S is energized at Start, then 1M is shorted. b. This test in a. above applies to all forms of starters (Note: It is understood that many starters do not connect to the Shorting Contactor.).	Local
Starter Fault Type II - Compressor 2B	Cprsr	Immediate	Latch	Starting - All types of starters	a. This is a specific starter test where the Shorting Contactor (1K3) is individually energized and a check is made to ensure that there are no currents detected by the CT's. If current is detected when only S is energized at Start, then 1M is shorted. b. This test in a. above applies to all forms of starters (Note: It is understood that many starters do not connect to the Shorting Contactor.).	Local
Starter Fault Type III - Compressor 1A	Cprsr	Immediate	Latch	Starting [Adaptive Frequency Starter Type]	As part of the normal start sequence to apply power to the compressor, the Shorting Contactor (1K3) and then the Main Contactor (1K1) were energized. 1.6 seconds later there were no currents detected by the CT's for the last 1.2 Seconds on all three phases. The test above applies to all forms of starters except Adaptive Frequency Drives.	Local
Starter Fault Type III - Compressor 1B	Cprsr	Immediate	Latch	Starting [Adaptive Frequency Starter Type]	As part of the normal start sequence to apply power to the compressor, the Shorting Contactor (1K3) and then the Main Contactor (1K1) were energized. 1.6 seconds later there were no currents detected by the CT's for the last 1.2 seconds on all three phases. The test above applies to all forms of starters except Adaptive Frequency Drives.	Local
Starter Fault Type III - Compressor 2A	Cprsr	Immediate	Latch	Starting [Adaptive Frequency Starter Type]	As part of the normal start sequence to apply power to the compressor, the Shorting Contactor (1K3) and then the Main Contactor (1K1) were energized. 1.6 seconds later there were no currents detected by the CT's for the last 1.2 seconds on all three phases. The test above applies to all forms of starters except Adaptive Frequency Drives.	Local
Starter Fault Type III - Compressor 2B	Cprsr	Immediate	Latch	Starting [Adaptive Frequency Starter Type]	As part of the normal start sequence to apply power to the compressor, the Shorting Contactor (1K3) and then the Main Contactor (1K1) were energized. 1.6 seconds later there were no currents detected by the CT's for the last 1.2 seconds on all three phases. The test above applies to all forms of starters except Adaptive Frequency Drives.	Local
Transition Complete Input Opened - Compressor 1A	Cprsr	Immediate	Latch	All running modes	The Transition Complete input was found to be opened with the compressor motor running after a successful completion of transition. This is active only for Y-Delta, Auto-Transformer, Primary Reactor, and X-Line Starters. To prevent this diagnostic from occurring as the result of a power loss to the contactors, the minimum time to trip must be greater than the trip time for the power loss diagnostic.	Local
Transition Complete Input Opened - Compressor 1B	Cprsr	Immediate	Latch	All running modes	The Transition Complete input was found to be opened with the compressor motor running after a successful completion of transition. This is active only for Y-Delta, Auto-Transformer, Primary Reactor, and X-Line Starters. To prevent this diagnostic from occurring as the result of a power loss to the contactors, the minimum time to trip must be greater than the trip time for the power loss diagnostic.	Local



Diagnostics

Table 66. Starter diagnostics (continued)

Diagnostic Name and Source	Affects Target	Severity	Persistence	Active Modes [Inactive Modes]	Criteria	Reset Level
Transition Complete Input Opened - Compressor 2A	Cprsr	Immediate	Latch	All running modes	The Transition Complete input was found to be opened with the compressor motor running after a successful completion of transition. This is active only for Y-Delta, Auto-Transformer, Primary Reactor, and X-Line Starters. To prevent this diagnostic from occurring as the result of a power loss to the contactors, the minimum time to trip must be greater than the trip time for the power loss diagnostic.	Local
Transition Complete Input Opened - Compressor 2B	Cprsr	Immediate	Latch	All running modes	The Transition Complete input was found to be opened with the compressor motor running after a successful completion of transition. This is active only for Y-Delta, Auto-Transformer, Primary Reactor, and X-Line Starters. To prevent this diagnostic from occurring as the result of a power loss to the contactors, the minimum time to trip must be greater than the trip time for the power loss diagnostic.	Local
Transition Complete Input Shorted - Compressor 1A	Cprsr	Immediate	Latch	Pre-Start	The Transition Complete input was found to be shorted before the compressor was started. This is active for all electromechanical starters.	Local
Transition Complete Input Shorted - Compressor 1B	Cprsr	Immediate	Latch	Pre-Start	The Transition Complete input was found to be shorted before the compressor was started. This is active for all electromechanical starters.	Local
Transition Complete Input Shorted - Compressor 2A	Cprsr	Immediate	Latch	Pre-Start	The Transition Complete input was found to be shorted before the compressor was started. This is active for all electromechanical starters.	Local
Transition Complete Input Shorted - Compressor 2B	Cprsr	Immediate	Latch	Pre-Start	The Transition Complete input was found to be shorted before the compressor was started. This is active for all electromechanical starters.	Local
Under Voltage	Chiller	Normal	NonLatch	Pre-Start and Any Ckt(s) Energzd	Nom. trip: 60 seconds at less than 87.5%, 2.8% at 200V 1.8% at 575V, Auto Reset at 90% or greater.	Remote

Main Processor Diagnostics

Table 67. Main processor diagnostics

Diagnostic Name	Affects Target	Severity	Persistence	Active Modes [Inactive Modes]	Criteria	Reset Level
BAS Communication Lost	None	Special	NonLatch	All	The BAS was setup as "installed" at the MP and the Comm 3 Iliid lost communications with the BAS for 15 contiguous minutes after it had been established. Refer to Section on Setpoint Arbitration to determine how setpoints and operating modes may be effected by the comm loss. The chiller follows the value of the Tracer Default Run Command which can be previously written by Tracer and stored nonvolatily by the MP (either use local or shutdown).	Remote
BAS Failed to Establish Communication	None	Special	NonLatch	At power-up	The BAS was setup as "installed" and the BAS did not communicate with the MP within 15 minutes after power-up. Refer to Section on Setpoint Arbitration to determine how setpoints and operating modes may be effected. Note: The original requirement for this was 2 minutes, but was implemented at 15 minutes for RTAC.	Remote
Check Clock	Chiller	Info	Latch	All	The real time clock had detected loss of its oscillator at some time in the past. Check / replace battery? This diagnostic can be effectively cleared only by writing a new value to the chiller's time clock using the TechView or DynaView's "set chiller time" functions.	Remote
Condenser Fan Variable Speed Drive Fault - Circuit 1 (Drive 1)	All inverters on this circuit	Special Mode	Latch	Prestart and Running w/ Variable Spd Fan enabled	The MP has received a fault signal from the respective condenser fan Variable Speed Inverter Drive, and unsuccessfully attempted (5 times within 1 minute of each other) to clear the fault. The 4th attempt removes power from the inverter to create a power up reset. If the fault does not clear, the MP will revert to constant speed operation without the use of the inverter's fan. The inverter must be manually bypassed, and fan outputs rebound, for full fixed speed fan operation.	Remote

Table 67. Main processor diagnostics (continued)

Diagnostic Name	Affects Target	Severity	Persist-ence	Active Modes		Criteria	Reset Level
				[Inactive Modes]			
Condenser Fan Variable Speed Drive Fault - Circuit 1 Drive 2	All inverters on this circuit	Special Mode	Latch	Prestart and Running w/ Variable Spd Fan enabled		The MP has received a fault signal from the respective condenser fan Variable Speed Inverter Drive, and unsuccessfully attempted (5 times within 1 minute of each other) to clear the fault. The 4th attempt removes power from the inverter to create a power up reset. If the fault does not clear, the MP will revert to constant speed operation without the use of the inverter's fan. The inverter must be manually bypassed, and fan outputs rebound, for full fixed speed fan operation.	Remote
Condenser Fan Variable Speed Drive Fault - Circuit 2 (Drive 1)	All inverters on this circuit	Special Mode	Latch	Prestart and Running w/ Variable Spd Fan enabled		The MP has received a fault signal from the respective condenser fan Variable Speed Inverter Drive, and unsuccessfully attempted (5 times within 1 minute of each other) to clear the fault. The 4th attempt removes power from the inverter to create a power up reset. If the fault does not clear, the MP will revert to constant speed operation without the use of the inverter's fan. The inverter must be manually bypassed, and fan outputs rebound, for full fixed speed fan operation.	Remote
Condenser Fan Variable Speed Drive Fault - Circuit 2 (Drive 2)	All inverters on this circuit	Special Mode	Latch	Prestart and Running w/ Variable Spd Fan enabled		The MP has received a fault signal from the respective condenser fan Variable Speed Inverter Drive, and unsuccessfully attempted (5 times within 1 minute of each other) to clear the fault. The 4th attempt removes power from the inverter to create a power up reset. If the fault does not clear, the MP will revert to constant speed operation without the use of the inverter's fan. The inverter must be manually bypassed, and fan outputs rebound, for full fixed speed fan operation.	Remote
Condenser Refrigerant Pressure Transducer - Circuit 1	Circuit	Immediate	Latch	All	Bad Sensor or LLID		Remote
Condenser Refrigerant Pressure Transducer - Circuit 2	Circuit	Immediate	Latch	All	Bad Sensor or LLID		Remote
Emergency Stop	Chiller	Immediate	Latch	All	a. EMERGENCY STOP input is open. An external interlock has tripped. Time to trip from input opening to unit stop shall be 0.1 to 1.0 seconds.		Local
Evaporator Entering Water Temperature Sensor	Chilled Water Reset	Info	Latch	All	Bad Sensor or LLID a. Normal operation, no effects on control. b. Chiller shall remove any Return or Constant Return Chilled Water Reset, if it was in effect. Apply slew rates per Chilled Water Reset spec.		Remote
Evaporator Leaving Water Temperature Sensor	Chiller	Normal	Latch	All	Bad Sensor or LLID		Remote
Evaporator Liquid Level Sensor - Circuit 1	Circuit	Immediate	Latch	All	Bad Sensor or LLID		Remote
Evaporator Liquid Level Sensor - Circuit 2	Circuit	Immediate	Latch	All	Bad Sensor or LLID		Remote
Evaporator Rfgt Drain - Circuit 1	Circuit	NA	Latch	Circuit non-running modes [Drain Valve commanded closed]	This diagnostic is effective only with Remote Evap units. The liquid level of the respective evaporator was not seen to be below the level of -21.2 mm within 5 minutes of the commanded opening of its Drain Valve Solenoid. The diagnostic will not be active if the drain valve is commanded closed.		Remote
Evaporator Rfgt Drain - Circuit 2	Circuit	NA	Latch	Circuit non-running modes [Drain Valve commanded closed]	This diagnostic is effective only with Remote Evap units. The liquid level of the respective evaporator was not seen to be below the level of -21.2 mm within 5 minutes of the commanded opening of its Drain Valve Solenoid Valve. The diagnostic will not be active if the drain valve is commanded closed.		Remote
Evaporator Water Flow (Entering Water Temp)	Chiller	Immediate Shutdown	Latching	Any Ckt Energized [No Ckts Energized]	The entering evaporator water temp fell below the leaving evaporator water temp by more than 2°F for 180°F-sec, minimum trip time 1 minute.		Remote
Evaporator Water Flow (High Approach Temperature)- Circuit 1	Chiller	Immediate Shutdown	Latching	Ckt Energized [Ckt Not Energized]	Large evaporator approach temps, low evap sat temps, and presence of liquid refrigerant, suggest this circuit is running with no or reversed evaporator water flow.		Remote

Diagnosics

Table 67. Main processor diagnosics (continued)

Diagnostic Name	Affects Target	Severity	Persist-ence	Active Modes		Criteria	Reset Level
				[Inactive Modes]			
Evaporator Water Flow (High Approach Temperature)- Circuit 2	Chiller	Immediate Shutdown	Latching	Ckt Energized [Ckt Not Energized]		Large evaporator approach temps, low evap sat temps, and presence of liquid refrigerant, suggest this circuit is running with no or reversed evaporator water flow.	Remote
Evaporator Water Flow Lost	Chiller	Immediate	NonLatch	Whenever Evap Pump is commanded on due to Auto mode and certain off-cycle diagnosics		a. The Evaporator water flow switch input was open for more than 6-10 sec (HV binary input) or 20-25* sec (for factory mtd low voltage binary input) b. This diagnostic does not de-energize the evap pump output c. 6-10 seconds of contiguous flow shall clear this diagnostic. d. Even though the pump times out in the STOP modes, this diagnostic shall not be called out in the STOP modes, (with the exception of pump override due to certain off-cycle diagnosics). * could be longer if water temps are rapidly changing warmer	Remote
Evaporator Water Flow Overdue	Chiller	Normal	NonLatch	Whenever Evap Pump is commanded on due to Auto mode and certain off-cycle diagnosics		Evaporator water flow was not proven within 4:15 (RTAC Rev 20 and earlier) or 20:00 (RTAC Rev 21) of the Evaporator water pump relay being energized. With SW Rev 17.0 and earlier, the diagnostic will de-energize the Evaporator Water Pump output. It will be re-energized if the diagnostic clears with the return of flow and the chiller will be allowed to restart normally (to accommodate external control of pump) With SW Rev 18.0 and later, the pump command status will not be effected. In the case of certain "Off-cycle" diagnosics in which the pump is overridden to on, the delay to callout of the diagnostic is shortened to 4:15.	Remote
External Chilled Water Setpoint	None	Info	NonLatch	All		a. Function Not "Enabled": no diagnosics. b. "Enabled ": Out-Of-Range Low or Hi or bad LLID, set diagnostic, default CWS to next level of priority (e.g. Front Panel SetPoint). This Info diagnostic will automatically reset if the input returns to the normal range.	Remote
External Current Limit Setpoint	None	Info	NonLatch	All		a. Not "Enabled": no diagnosics. b. "Enabled ": Out-Of-Range Low or Hi or bad LLID, set diagnostic, default CLS to next level of priority (e.g. Front Panel SetPoint). This Info diagnostic will automatically reset if the input returns to the normal range.	Remote
High Differential Refrigerant Pressure - Circuit 1	Circuit	Normal	Latch	Cprsr Energized		The system differential pressure for the respective circuit was above 275 Psid for 2 consecutive samples or more than 10 seconds.	Remote
High Differential Refrigerant Pressure - Circuit 2	Circuit	Normal	Latch	Cprsr Energized		The system differential pressure for the respective circuit was above 275 Psid for 2 consecutive samples or more than 10 seconds	Remote
High Evaporator Liquid Level - Circuit 1	Circuit	Normal	Latch	Starter Contactor Energized [all Stop modes]		The liquid level sensor is seen to be at or near its high end of range for 80 contiguous minutes while the compressor is running. (The diagnostic timer will hold, but not clear when the circuit is off). Design: 80% or more of bit count corresponding to +21.2 mm or more liquid level for 80 minutes)	Remote
High Evaporator Liquid Level - Circuit 2	Circuit	Normal	Latch	Starter Contactor Energized [all Stop modes]		The liquid level sensor is seen to be at or near its high end of range for 80 contiguous minutes while the compressor is running. (The diagnostic timer will hold, but not clear when the circuit is off). Design: 80% or more of bit count corresponding to +21.2 mm or more liquid level for 80 minutes)	Remote
High Evaporator Refrigerant Pressure	Chiller	Immediate	NonLatch	All		The evaporator refrigerant pressure of either circuit has risen above 190 psig. The evaporator water pump relay will be de-energized to stop the pump regardless of why the pump is running (and the chiller will be prevented from starting) The diagnostic will auto reset and the pump will return to normal control when all of the evaporator pressures fall below 185 psig. The primary purpose is to stop the evaporator water pump and its associated pump heat from causing refrigerant side pressures, close to the evaporator relief valve setting, when the chiller is not running, such as could occur with Evap Water Flow Overdue or Evaporator Water Flow Loss Diagnosics.	Remote

Table 67. Main processor diagnostics (continued)

Diagnostic Name	Affects Target	Severity	Persist-ence	Active Modes		Criteria	Reset Level
				[Inactive Modes]			
High Evaporator Water Temperature	Chiller	Info and Special Action (Pre RTAC Refresh Rev 39)	NonLatch	Only effective if either 1)Evap Wtr Flow Overdue, 2)Evap Wtr Flow Loss, or 3)Low Evap Rfght Temp,-Unit Off, diagnostic is active.		The leaving water temperature exceeded the high evap water temp limit (TV service menu settable -default 105F) for 15 continuous seconds. The evaporator water pump relay will be de-energized to stop the pump but only if it is running due to one of the diagnostics listed on the left. The diagnostic will auto reset and the pump will return to normal control when the temperature falls 5 F below the trip setting. The primary purpose is to stop the evaporator water pump and its associated pump heat from causing excessive waterside temperatures and waterside pressures when the chiller is not running but the evap pump is on due to either Evap Water Flow Overdue, Evaporator Water Flow Loss, or Low Evap Temp - Unit Off Diagnostics. This diagnostic will not auto clear solely due to the clearing of the enabling diagnostic.	Remote
High Evaporator Water Temperature	Chiller	Immediate Shutdown (Beginning with RTAC Refresh Rev 39)	Latch	Only effective if either 1)Evap Wtr Flow Overdue 2)Evap Wtr Flow Loss, or 3)Low Evap Rfght Temp,-Unit Off, diagnostic is active.		The leaving water temperature exceeded the high evap water temp limit (TV service menu settable -default 105F) for 15 continuous seconds, with one of the three diagnostics on the left already active. The evaporator water pump relay will be de-energized to stop the pump. The diagnostic can only be cleared by a manual reset and will clear regardless of the temperature. (although the diagnostic may reoccur based on the trip criteria). The primary purpose is to stop the evaporator water pump and its associated pump heat from causing excessive waterside temperatures (and waterside pressures) when the chiller is not running but the evap pump is on due to a pump override to "on" (as can be caused by a bad flow switches failure to close and prove flow).	Local
High Oil Temperature - Compressor 1B	Cprsr 1B	Immediate	Latch	All		The respective oil temperature as supplied to the compressor, exceeded 200 F for 2 consecutive samples or for over 10 seconds. Note: As part of the Compressor High Temperature Limit Mode (aka Minimum Limit), the running compressor's female load step will be forced loaded when its oil temperature exceeds 190F and returned to normal control when the oil temperature falls below 170 F.	Remote
High Oil Temperature - Compressor 2B	Cprsr 2B	Immediate	Latch	All		The respective oil temperature as supplied to the compressor, exceeded 200 F for 2 consecutive samples or for over 10 seconds. Note: As part of the Compressor High Temperature Limit Mode (aka Minimum Limit), the running compressor's female load step will be forced loaded when its oil temperature exceeds 190F and returned to normal control when the oil temperature falls below 170 F.	Remote
High Oil Temperature - Compressor 1A	Cprsr 1A	Immediate	Latch	All		The respective oil temperature as supplied to the compressor, exceeded 200 F for 2 consecutive samples or for over 10 seconds. Note: As part of the Compressor High Temperature Limit Mode (aka Minimum Limit), the running compressor's female load step will be forced loaded when its oil temperature exceeds 190F and returned to normal control when the oil temperature falls below 170 F.	Remote
High Oil Temperature - Compressor 2A	Cprsr 2A	Immediate	Latch	All		The respective oil temperature as supplied to the compressor, exceeded 200 F for 2 consecutive samples or for over 10 seconds. Note: As part of the Compressor High Temperature Limit Mode (aka Minimum Limit), the running compressor's female load step will be forced loaded when its oil temperature exceeds 190F and returned to normal control when the oil temperature falls below 170 F.	Remote
High Pressure Cutout - Compressor 1A	Circuit	Immediate	Latch	All		A high pressure cutout was detected on Compressor 1A; trip at 315 ± 5 PSIG. Note: Other diagnostics that may occur as an expected consequence of the HPC trip will be suppressed from annunciation. These include Phase Loss, Power Loss, and Transition Complete Input Open.	Local
High Pressure Cutout - Compressor 1B	Circuit	Immediate	Latch	All		A high pressure cutout was detected on Compressor 1A; trip at 315 ± 5 PSIG. Note: Other diagnostics that may occur as an expected consequence of the HPC trip will be suppressed from annunciation. These include Phase Loss, Power Loss, and Transition Complete Input Open.	Local



Diagnostics

Table 67. Main processor diagnostics (continued)

Diagnostic Name	Affects		Persist-ence	Active Modes		Criteria	Reset Level
	Target	Severity		[Inactive Modes]			
High Pressure Cutout - Compressor 2A	Circuit	Immediate	Latch	All		A high pressure cutout was detected on Compressor 1A; trip at 315 ± 5 PSIG. Note: Other diagnostics that may occur as an expected consequence of the HPC trip will be suppressed from announcement. These include Phase Loss, Power Loss, and Transition Complete Input Open.	Local
High Pressure Cutout - Compressor 2B	Circuit	Immediate	Latch	All		A high pressure cutout was detected on Compressor 1A; trip at 315 ± 5 PSIG. Note: Other diagnostics that may occur as an expected consequence of the HPC trip will be suppressed from announcement. These include Phase Loss, Power Loss, and Transition Complete Input Open.	Local
Intermediate Oil Pressure Transducer - Compressor 1A	Cprsr 1A	Immediate	Latch	All		Bad Sensor or LLID	Remote
Intermediate Oil Pressure Transducer - Compressor 1B	Cprsr 1B	Immediate	Latch	All		Bad Sensor or LLID	Remote
Intermediate Oil Pressure Transducer - Compressor 2A	Cprsr 2A	Immediate	Latch	All		Bad Sensor or LLID	Remote
Intermediate Oil Pressure Transducer - Compressor 2B	Cprsr 2B	Immediate	Latch	All		Bad Sensor or LLID	Remote
Low Chilled Water Temp: Unit Off	Evap Pump	Special Mode	NonLatch	Unit in Stop Mode, or in Auto Mode and No Ckt(s) Energzd [Any Ckt Energzd]		The leaving Evaporator water temp. fell below the leaving water temp cutout setting for 30 degree F seconds while the Chiller is in the Stop mode, or in Auto mode with no compressors running. Energize Evap Water pump Relay until diagnostic auto resets, then return to normal evap pump control. Automatic reset occurs when the temp rises 2°F (1.1°C) above the cutout setting for 30 minutes.	Remote
Low Chilled Water Temp: Unit On	Chiller	Immediate and Special Mode	NonLatch	Any Ckts] Energzd [No Ckt(s) Energzd]		The evaporator water temp. fell below the cutout setpoint for 30 degree F Seconds while the compressor was running. Automatic reset occurs when the temperature rises 2°F (1.1°C) above the cutout setting for 2 minutes. This diagnostic shall not de-energize the Evaporator Water Pump Output.	Remote
Low Differential Refrigerant Pressure - Circuit 1	Circuit	Immediate	Latch	Cprsr Energized		The system differential pressure for the respective circuit was below 35 Psid for more than 2000 Psid-sec with either a 1 minute (single cprsr circuit) or 2.5 minute (manifolded cprsr circuit) ignore time from the start of the circuit.	Remote
Low Differential Refrigerant Pressure - Circuit 2	Circuit	Immediate	Latch	Cprsr Energized		The system differential pressure for the respective circuit was below 35 Psid for more than 2000 Psid-sec with either a 1 minute (single cprsr circuit) or 2.5 minute (manifolded cprsr circuit) ignore time from the start of the circuit.	Remote
Low Evaporator Liquid Level - Circuit 1	None	Info	NonLatch	Starter Contactor Energized [all Stop modes]		The liquid level sensor is seen to be at or near its low end of range for 80 contiguous minutes while the compressor is running. Design: 20% or less of bit count corresponding to -21.2 mm or less liquid level for 80 minutes)	Remote
Low Evaporator Liquid Level - Circuit 2	None	Info	NonLatch	Starter Contactor Energized [all Stop modes]		The liquid level sensor is seen to be at or near its low end of range for 80 contiguous minutes while the compressor is running. Design: 20% or less of bit count corresponding to -21.2 mm or less liquid level for 80 minutes)	Remote
Low Evaporator Refrigerant Temperature - Circuit 1	Circuit	Immediate	Latch	All Ckt Running Modes		The inferred Saturated Evap Refrigerant Temperature (calculated from suction pressure transducer dropped below the Low Refrigerant Temperature Cutout Setpoint for 1125 F-sec with a 8 F-sec/sec max integral rate applied during circuit startup transient (or 4°F-s/s if manifolded and only one cprsr running) while the circuit was running early in the circuit's cycle. The minimum LRTC setpoint is -5 F (18.7 Psia) the point at which oil separates from the refrigerant. During the time that the trip integral is non zero, the unload solenoid(s) of the running compressors on the circuit, shall be energized continuously and the load solenoid shall be off. Normal load/unload operation will be resumed if the trip integral decays to zero by temps above the cutout setpoint. The integral is held nonvolatily though power down, is continuously calculated, and can decay during the circuit's off cycle as conditions warrant.	Remote

Table 67. Main processor diagnostics (continued)

Diagnostic Name	Affects Target	Severity	Persist-ence	Active Modes [Inactive Modes]	Criteria	Reset Level
Low Evaporator Refrigerant Temperature - Circuit 2	Circuit	Immediate	Latch	All Ckt Running Modes	The inferred Saturated Evap Refrigerant Temperature (calculated from suction pressure transducer dropped below the Low Refrigerant Temperature Cutout Setpoint for 1125 F-sec with a 8 F-sec/sec max integral rate applied during circuit startup transient (or 4°F-s/s if manifolded and only one cprsr running) while the circuit was running early in the circuit's cycle. The minimum LRTC setpoint is -5 F (18.7 Psia) the point at which oil separates from the refrigerant. During the time that the trip integral is non zero, the unload solenoid(s) of the running compressors on the circuit, shall be energized continuously and the load solenoid shall be off. Normal load/unload operation will be resumed if the trip integral decays to zero by temps above the cutout setpoint. The integral is held nonvolatily though power down, is continuously calculated, and can decay during the circuit's off cycle as conditions warrant.	Remote
Low Evaporator Temp - Ckt 1: Unit Off	Evap Pump	Special Mode	NonLatch	Unit in Stop Mode, or in Auto Mode and No Ckt's Energzd [Any Ckt Energzd]	Any of the evap sat temps fell below the water temp cutout setting while the respective evap liquid level was greater than -21.2mm for 150 degree F seconds while Chiller is in the Stop mode, or in Auto mode with no compressors running. Energize Evap Water pump Relay until diagnostic auto resets, then return to normal evap pump control. Automatic reset occurs when either the evap temp rises 2 F (1.1 C) above the cutout setting or the liquid level falls below -21.2mm for 30 minutes	Remote
Low Evaporator Temp - Ckt 2: Unit Off	Evap Pump	Special Mode	NonLatch	Unit in Stop Mode, or in Auto Mode and No Ckt's Energzd [Any Ckt Energzd]	Any of the evap sat temps fell below the water temp cutout setting while the respective evap liquid level was greater than -21.2mm for 150 degree F seconds while Chiller is in the Stop mode, or in Auto mode with no compressors running. Energize Evap Water pump Relay until diagnostic auto resets, then return to normal evap pump control. Automatic reset occurs when either the evap temp rises 2 F (1.1 C) above the cutout setting or the liquid level falls below -21.2mm for 30 minutes	Remote
Low Oil Flow - Compressor 1A	Cprsr	Immediate	Latch	Cprsr Energized and Delta P above 35 Psid	The intermediate oil pressure transducer for this compressor was out of the acceptable pressure range for 15 seconds, while the Delta Pressure was greater than 35 Psid.: Acceptable range is $0.50 > (PC-PI) / (PC-PE)$ for the first 2.5 minutes of operation, and $0.25 > (PC-PI) / (PC-PE)$ thereafter,	Local
Low Oil Flow - Compressor 1B	Cprsr	Immediate	Latch	Cprsr Energized and Delta P above 35 Psid	The intermediate oil pressure transducer for this compressor was out of the acceptable pressure range for 15 seconds, while the Delta Pressure was greater than 35 Psid.: Acceptable range is $0.50 > (PC-PI) / (PC-PE)$ for the first 2.5 minutes of operation, and $0.25 > (PC-PI) / (PC-PE)$ thereafter,	Local
Low Oil Flow - Compressor 2A	Cprsr	Immediate	Latch	Cprsr Energized and Delta P above 35 Psid	The intermediate oil pressure transducer for this compressor was out of the acceptable pressure range for 15 seconds, while the Delta Pressure was greater than 35Psid.: Acceptable range is $0.50 > (PC-PI) / (PC-PE)$ for the first 2.5 minutes of operation, and $0.25 > (PC-PI) / (PC-PE)$ thereafter,.	Local
Low Oil Flow - Compressor 2B	Cprsr	Immediate	Latch	Cprsr Energized and Delta P above 35 Psid	The intermediate oil pressure transducer for this compressor was out of the acceptable pressure range for 15 seconds, while the Delta Pressure was greater than 35 Psid.: Acceptable range is $0.50 > (PC-PI) / (PC-PE)$ for the first 2.5 minutes of operation, and $0.25 > (PC-PI) / (PC-PE)$ thereafter,	Local
Low Suction Refrigerant Pressure - Circuit 1	Circuit	Immediate	Latch	Cprsr Prestart and Cprsr Energized	a. The Suction Refrigerant Pressure (or either of the compressor suction pressures) dropped below 10 Psia just prior to compressor start (after EXV preposition). b. The pressure fell below 16 Psia while running after the ignore time had expired, or fell below 10 Psia (or 5 Psia in sftw prior to Oct'02) before the ignore time had expired. The ignore time is function of outdoor air temperature. Note: Part b. is identical to Low Evaporator Refrigerant Temperature diagnostic except for the trip integral and trip point settings.	Local
Low Suction Refrigerant Pressure - Circuit 2	Circuit	Immediate	Latch	Cprsr Prestart and Cprsr Energized	a. The Suction Refrigerant Pressure (or either of the compressor suction pressures) dropped below 10 Psia just prior to compressor start (after EXV preposition). b. The pressure fell below 16 Psia while running after the ignore time had expired, or fell below 10 Psia (or 5 Psia in sftw prior to Oct'02) before the ignore time had expired. The ignore time is function of outdoor air temperature. Note: Part b. is identical to Low Evaporator Refrigerant Temperature diagnostic except for the trip integral and trip point settings.	Local

Diagnostics

Table 67. Main processor diagnostics (continued)

Diagnostic Name	Affects Target	Severity	Persist-ence	Active Modes [Inactive Modes]	Criteria	Reset Level
Low Suction Refrigerant Pressure - Cprsr 1B	Circuit	Immediate	Latch	Cprsr Prestart and Cprsr Energized	a. The Suction Refrigerant Pressure (or either of the compressor suction pressures) dropped below 10 Psia just prior to compressor start (after EXV preposition). b. The pressure fell below 16 Psia while running after the ignore time had expired, or fell below 10 Psia (or 5 Psia in sftw prior to Oct'02) before the ignore time had expired. The ignore time is function of outdoor air temperature. Note: Part b. is identical to Low Evaporator Refrigerant Temperature diagnostic except for the trip integral and trip point settings.	Local
Low Suction Refrigerant Pressure - Cprsr 2B	Circuit	Immediate	Latch	Cprsr Prestart and Cprsr Energized	a. The Suction Refrigerant Pressure (or either of the compressor suction pressures) dropped below 10 Psia just prior to compressor start (after EXV preposition). b. The pressure fell below 16 Psia while running after the ignore time had expired, or fell below 10 Psia (or 5 Psia in sftw prior to Oct'02) before the ignore time had expired. The ignore time is function of outdoor air temperature. Note: Part b. is identical to Low Evaporator Refrigerant Temperature diagnostic except for the trip integral and trip point settings.	Local
MP Application Memory CRC Error	Chiller	Immediate	Latch	All Modes	Memory error criteria TBD	Remote
MP: Could not Store Starts and Hours	None	Info	Latch	All	MP has determined there was an error with the previous power down store. Starts and Hours may have been lost for the last 24 hours.	Remote
MP: Invalid Configuration	None	Immediate	Latch	All	MP has an invalid configuration based on the current software installed	Remote
MP: Non-Volatile Block Test Error	None	Info	Latch	All	MP has determined there was an error with a block in the Non-Volatile memory. Check settings.	Remote
MP: Non-Volatile Memory Reformat	None	Info	Latch	All	MP has determined there was an error in a sector of the Non-Volatile memory and it was reformatted. Check settings.	Remote
MP: Reset Has Occurred	None	Info	NonLatch	All	The main processor has successfully come out of a reset and built its application. A reset may have been due to a power up, installing new software or configuration. This diagnostic is immediately and automatically cleared and thus can only be seen in the Historic Diagnostic List in TechView	Remote
Oil Flow Fault - Compressor 1A	Circuit	Immediate	Latch	Starter Contactor Energized [all Stop modes]	The Intermediate Oil Pressure Transducer for this cprsr is reading a pressure either above its respective circuit's Condenser Pressure by 15 Psia or more, or below its respective Suction Pressure 10 Psia or more for 30 seconds continuously.	Local
Oil Flow Fault - Compressor 1B	Circuit	Immediate	Latch	Starter Contactor Energized [all Stop modes]	The Intermediate Oil Pressure Transducer for this cprsr is reading a pressure either above its respective circuit's Condenser Pressure by 15 Psia or more, or below its respective Suction Pressure 10 Psia or more for 30 seconds continuously.	Local
Oil Flow Fault - Compressor 2A	Circuit	Immediate	Latch	Starter Contactor Energized [all Stop modes]	The Intermediate Oil Pressure Transducer for this cprsr is reading a pressure either above its respective circuit's Condenser Pressure by 15 Psia or more, or below its respective Suction Pressure 10 Psia or more for 30 seconds continuously.	Local
Oil Flow Fault - Compressor 2B	Circuit	Immediate	Latch	Starter Contactor Energized [all Stop modes]	The Intermediate Oil Pressure Transducer for this cprsr is reading a pressure either above its respective circuit's Condenser Pressure by 15 Psia or more, or below its respective Suction Pressure 10 Psia or more for 30 seconds continuously.	Local
Oil Temperature Sensor - Cprsr 1B	Circuit	Normal	Latch	All	Bad Sensor or LLID	Remote
Oil Temperature Sensor - Cprsr 2B	Circuit	Normal	Latch	All	Bad Sensor or LLID	Remote
Oil Temperature Sensor -Cprsr 1A	Circuit	Normal	Latch	All	Bad Sensor or LLID	Remote
Oil Temperature Sensor -Cprsr 2A	Circuit	Normal	Latch	All	Bad Sensor or LLID	Remote
Outdoor Air Temperature Sensor	Chiller	Normal	Latch	All	Bad Sensor or LLID. Note that if this diagnostic occurs, operational pumpdown will be performed regardless of the last valid temperature	Remote
Pumpdown Terminated - Circuit 1	None	Info	NonLatch	Pumpdown Mode	The pumpdown cycle for this circuit was terminated abnormally due to excessive time or due to a specific set of diagnostic criteria - but w/o associated latching diagnostics	Remote

Table 67. Main processor diagnostics (continued)

Diagnostic Name	Affects Target	Severity	Persist-ence	Active Modes		Criteria	Reset Level
				[Inactive Modes]			
Pumpdown Terminated - Circuit 2	None	Info	NonLatch	Pumpdown Mode		The pumpdown cycle for this circuit was terminated abnormally due to excessive time or due to a specific set of diagnostic criteria - but w/o associated latching diagnostics	Remote
Software Error 1001: Call Trane Service (beginning with Rev 29)				All		Reported if a compressor is found to be running without chilled water flow for three minutes. Previously, this error would be identified after five minutes.	
Software Error 1002: Call Trane Service (beginning with Rev 29)				All		Reported if state chart misalignment in stopped or inactive state occurs.	
Software Error 1003: Call Trane Service (beginning with Rev 29)				All		Reported if state chart misalignment in stopping state occurs.	
Software Error Number: 1001 (Rev 28)	All functions	Immediate	Latch - power down reset is reqd	All		A high level software watchdog has detected a condition in which there was a continuous 5 minute period of compressor operation, with neither chilled water flow nor a" contactor interrupt failure" diagnostic active. The occurrence of this software error message suggests an internal software state chart misalignment has occurred. The events that led up to this failure, if known, should be recorded and transmitted to Trane Controls Engineering - (SW rev 24 and higher)	
Starter Failed to Arm/Start - Cprsr 1A	Cprsr	Info	Latch	All		Starter failed to arm or start within the allotted time (15 seconds).	Local
Starter Failed to Arm/Start - Cprsr 1B	Cprsr	Info	Latch	All		Starter failed to arm or start within the allotted time (15 seconds).	Local
Starter Failed to Arm/Start - Cprsr 2A	Cprsr	Info	Latch	All		Starter failed to arm or start within the allotted time (15 seconds).	Local
Starter Failed to Arm/Start - Cprsr 2B	Cprsr	Info	Latch	All		Starter failed to arm or start within the allotted time (15 seconds).	Local
Starter Module Memory Error Type 1 - Starter 2A	None	Info	Latch	All		Checksum on RAM copy of the Starter LLID configuration failed. Configuration recalled from EEPROM.	Local
Starter Module Memory Error Type 1 - Starter 2B	None	Info	Latch	All		Checksum on RAM copy of the Starter LLID configuration failed. Configuration recalled from EEPROM.	Local
Starter Module Memory Error Type 1-Starter 1A	None	Info	Latch	All		Checksum on RAM copy of the Starter LLID configuration failed. Configuration recalled from EEPROM.	Local
Starter Module Memory Error Type 1-Starter 1B	None	Info	Latch	All		Checksum on RAM copy of the Starter LLID configuration failed. Configuration recalled from EEPROM.	Local
Starter Module Memory Error Type 2 - Starter 1A	Cprsr	Immediate	Latch	All		Checksum on EEPROM copy of the Starter LLID configuration failed. Factor default values used.	Local
Starter Module Memory Error Type 2 - Starter 1B	Cprsr	Immediate	Latch	All		Checksum on EEPROM copy of the Starter LLID configuration failed. Factor default values used.	Local
Starter Module Memory Error Type 2 - Starter 2A	Cprsr	Immediate	Latch	All		Checksum on EEPROM copy of the Starter LLID configuration failed. Factor default values used.	Local
Starter Module Memory Error Type 2 - Starter 2B	Cprsr	Immediate	Latch	All		Checksum on EEPROM copy of the Starter LLID configuration failed. Factor default values used.	Local
Starter Panel High Temperature Limit - Panel 1, Cprsr 1B	Cprsr 1B	Special Mode	NonLatch	All		Starter Panel High Limit Thermostat (170 F) trip was detected. Note: Other diagnostics that may occur as an expected consequence of the Panel High Temp Limit trip will be suppressed from annunciation. These include Phase Loss, Power Loss, and Transition Complete Input Open for Cprsr 1B	Local
Starter Panel High Temperature Limit - Panel 1, Cprsr 2A	Cprsr 2A	Special Mode	NonLatch	All		Starter Panel High Limit Thermostat (170 F) trip was detected. Note: Other diagnostics that may occur as an expected consequence of the Panel High Temp Limit trip will be suppressed from annunciation. These include Phase Loss, Power Loss, and Transition Complete Input Open for Cprsr 2A	Local



Diagnostics

Table 67. Main processor diagnostics (continued)

Diagnostic Name	Affects Target	Severity	Persist-ence	Active Modes		Criteria	Reset Level
				[Inactive Modes]			
Starter Panel High Temperature Limit - Panel 2, Cprsr 2B	Cprsr 2B	Special Mode	NonLatch	All		Starter Panel High Limit Thermostat (170 F) trip was detected. Note: Other diagnostics that may occur as an expected consequence of the Panel High Temp Limit trip will be suppressed from annunciation. These include Phase Loss, Power Loss, and Transition Complete Input Open for Cprsr 2B	Local
Suction Refrigerant Pressure Transducer - Circuit 1, Compressor 1A	Special	Immediate	Latch	All		Bad Sensor or LLID Circuit target if no isolation valves, Compressor target if isolation valves. Design Note: In the case of manifolded compressors w/o isolation valves, the occurrence of this diagnostic will also generate a comm loss with the nonexistent Suction Press Cprsr 1B in order to accomplish circuit shutdown.	Remote
Suction Refrigerant Pressure Transducer - Circuit 1, Compressor 1B	Cprsr 1B	Immediate	Latch	All		Bad Sensor or LLID. Design Note: For circuits with manifolded compressors w/o isolation valve option, this diagnostic will occur with the preceding diagnostic, even though this transducer is not required or installed.	Remote
Suction Refrigerant Pressure Transducer - Circuit 2, Compressor 2A	Special	Immediate	Latch	All		Bad Sensor or LLID Circuit target if no isolation valves, Compressor target if isolation valves. Design Note: In the case of manifolded compressors w/o isolation valves, the occurrence of this diagnostic will also generate a comm loss with the nonexistent Suction Press Cprsr 2B in order to accomplish circuit shutdown.	Remote
Suction Refrigerant Pressure Transducer - Circuit 2, Compressor 2B	Cprsr 2B	Immediate	Latch	All		Bad Sensor or LLID. Design Note: For circuits with manifolded compressors w/o isolation valve option, this diagnostic will occur with the preceding diagnostic, even though this transducer is not required or installed	Remote
Very Low Evaporator Refrigerant Pressure - Circuit 1	Chiller	Immediate	Latch	All [compressor or circuit in manual lockout]		The evaporator pressure dropped below 8 psia (or 5 psia in sftw prior to Oct '02) regardless of whether or not compressors are running on that circuit. This diagnostic was created to prevent compressor failures due to cross binding by forcing an entire chiller shutdown. If a given compressor or circuit is locked out, the suction pressure transducer(s) associated with it, will be excluded from causing this diagnostic.	Local
Very Low Evaporator Refrigerant Pressure - Circuit 2	Chiller	Immediate	Latch	All [compressor or circuit in manual lockout]		The evaporator pressure dropped below 8 psia (or 5 psia in sftw prior to Oct '02) regardless of whether or not compressors are running on that circuit. This diagnostic was created to prevent compressor failures due to cross binding by forcing an entire chiller shutdown. If a given compressor or circuit is locked out, the suction pressure transducer(s) associated with it, will be excluded from causing this diagnostic.	Local

Communication Diagnostics

The following communication loss diagnostics will not occur unless that input or output is required to be present by the particular configuration and installed options for the chiller.

Communication diagnostics (with the exception of "Excessive Loss of Comm" are named by the Functional Name of the input or output that is no longer being heard

from by the Main Processor. Many LLIDs, such as the Quad Relay LLID, have more than one functional output associated with it. A comm loss with such a multiple function board, will generate multiple diagnostics. Refer to the Chiller's wiring diagrams to relate the occurrence of multiple communication diagnostics back to the physical LLID boards that they have been assigned to (bound).

Table 68. Communication diagnostics

Diagnostic Name	Affects Target	Severity	Persist-ence	Active Modes		Criteria	Reset Level
				[Inactive Modes]			
Comm Loss: Chilled Water Flow Switch	Chiller	Immediate	Latch	All		Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Cond Rfgr Pressure, Circuit #1	Circuit	Immediate	Latch	All		Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Cond Rfgr Pressure, Circuit #2	Circuit	Immediate	Latch	All		Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote

Table 68. Communication diagnostics (continued)

Diagnostic Name	Affects Target	Severity	Persistence	Active Modes [Inactive Modes]	Criteria	Reset Level
Comm Loss: Electronic Expansion Valve, Circuit #1	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Electronic Expansion Valve, Circuit #2	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Emergency Stop	Chiller	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Evap Oil Return Valve, Cprsr 1A	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Evap Oil Return Valve, Cprsr 1B	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Evap Oil Return Valve, Cprsr 2A	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Evap Oil Return Valve, Cprsr 2B	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Evaporator Entering Water Temperature	Chilled Water Reset	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Chiller shall remove any Return or Constant Return Chilled Water Reset, if it was in effect. Apply slew rates per Chilled Water Reset spec.	Remote
Comm Loss: Evaporator Leaving Water Temperature	Chiller	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Evaporator Rfgt Drain Valve - Ckt 1	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Evaporator Rfgt Drain Valve - Ckt 2	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Evaporator Rfgt Liquid Level, Circuit #1	Circuit	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Evaporator Rfgt Liquid Level, Circuit #2	Circuit	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Evaporator Rfgt Pressure, Circuit #1	Circuit	Immediate	Latch	All [Ckt/Cprsr lock out]	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Note: This diagnostic is replaced by diagnostic 5FB below with Rev 15.0	Remote
Comm Loss: Evaporator Rfgt Pressure, Circuit #2	Circuit	Immediate	Latch	All [Ckt/Cprsr lock out]	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Note: This diagnostic is replaced by diagnostic 5FD below with Rev 15.0	Remote
Comm Loss: Evaporator Water Pump Control	Chiller	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: External Auto/Stop	Chiller	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: External Chilled Water Setpoint	External Chilled Water Setpoint	Special Mode	NonLatch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Chiller shall discontinue use of the External Chilled Water Setpoint source and revert to the next higher priority for setpoint arbitration	Remote
Comm Loss: External Circuit Lockout, Circuit #1	Circuit	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. MP will nonvolatily hold the lockout state (enabled or disabled) that was in effect at the time of comm loss.	Remote
Comm Loss: External Circuit Lockout, Circuit #2	Circuit	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. MP will nonvolatily hold the lockout state (enabled or disabled) that was in effect at the time of comm loss	Remote
Comm Loss: External Current Limit Setpoint	External Current Limit setpoint	Special Mode	NonLatch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Chiller shall discontinue use of the External Current limit setpoint and revert to the next higher priority for Current Limit setpoint arbitration	Remote



Diagnostics

Table 68. Communication diagnostics (continued)

Diagnostic Name	Affects Target	Severity	Persist-ence	Active Modes [Inactive Modes]	Criteria	Reset Level
Comm Loss: Fan Control Circuit #1, Stage #1	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Fan Control Circuit #1, Stage #2	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Fan Control Circuit #1, Stage #3	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Fan Control Circuit #1, Stage #4	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Fan Control Circuit #2, Stage #1	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Fan Control Circuit #2, Stage #2	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Fan Control Circuit #2, Stage #3	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Fan Control Circuit #2, Stage #4	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Fan Inverter Fault, Circuit #1 or Circuit #1, Drive 1	Inverter	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Operate the remaining fans as fixed speed fan deck.	Remote
Comm Loss: Fan Inverter Fault, Circuit #1, Drive 2	Inverter	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Operate the remaining fans as fixed speed fan deck.	Remote
Comm Loss: Fan Inverter Fault, Circuit #2 or Circuit #2, Drive 1	Inverter	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Operate the remaining fans as fixed speed fan deck.	Remote
Comm Loss: Fan Inverter Fault, Circuit #2, Drive 2	Inverter	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Operate the remaining fans as fixed speed fan deck.	Remote
Comm Loss: Fan Inverter Power, Circuit #1 or Circuit #1 Drive 1 and 2	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Fan Inverter Power, Circuit #2 or Circuit #2 Drive 1 and 2	Circuit	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Fan Inverter Speed Command, Circuit #1 or Circuit #1 Drive 1 and 2	Inverter	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Operate the remaining fans as fixed speed fan deck.	Remote
Comm Loss: Fan Inverter Speed Command, Circuit #2 or Circuit #2 Drive 1 and 2	Inverter	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Operate the remaining fans as fixed speed fan deck.	Remote
Comm Loss: Female Step Load Compressor 1A	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Female Step Load Compressor 1B	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Female Step Load Compressor 2A	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Female Step Load Compressor 2B	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: High Pressure Cutout Switch, Cprsr 1A	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: High Pressure Cutout Switch, Cprsr 1B	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote

Table 68. Communication diagnostics (continued)

Diagnostic Name	Affects Target	Severity	Persist-ence	Active Modes [Inactive Modes]	Criteria	Reset Level
Comm Loss: High Pressure Cutout Switch, Cprsr 2A	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: High Pressure Cutout Switch, Cprsr 2B	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Ice-Machine Control	Ice Making Mode	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Chiller shall revert to normal (non-ice building) mode regardless of last state.	Remote
Comm Loss: Ice-Making Status	Ice-Machine	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Chiller shall revert to normal (non-ice building) mode regardless of last state.	Remote
Comm Loss: Intermediate Oil Pressure, Cprsr 1A	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Intermediate Oil Pressure, Cprsr 1B	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Intermediate Oil Pressure, Cprsr 2A	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Intermediate Oil Pressure, Cprsr 2B	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Local BAS Interface	None	Special Mode	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Male Port Load Compressor 1A	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Male Port Load Compressor 1B	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Male Port Load Compressor 2A	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Male Port Load Compressor 2B	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Male Port Unload Compressor 1A	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Male Port Unload Compressor 1B	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Male Port Unload Compressor 2A	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Male Port Unload Compressor 2B	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Oil Temperature, Circuit #1 or Cprsr 1A	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Oil Temperature, Circuit #2 or Cprsr 2A	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Oil Temperature, Cprsr 1B	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Oil Temperature, Cprsr 2B	Cprsr	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Outdoor Air Temperature	Chiller	Normal	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Note that if this diagnostic occurs, operational pumpdown will be performed regardless of the last valid temperature	Remote
Comm Loss: Starter 1A	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Local



Diagnostics

Table 68. Communication diagnostics (continued)

Diagnostic Name	Affects Target	Severity	Persist-ence	Active Modes [Inactive Modes]	Criteria	Reset Level
Comm Loss: Starter 1B	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Local
Comm Loss: Starter 2A	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Local
Comm Loss: Starter 2B	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Local
Comm Loss: Starter Panel High Temperature Limit - Panel 1, Cprsr 2A	None	Info	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Local
Comm Loss: Starter Panel High Temperature Limit - Panel 1, Cprsr 1B	None	Info	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Local
Comm Loss: Starter Panel High Temperature Limit - Panel 2, Cprsr 2B	None	Info	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Local
Comm Loss: Status/Annunciation Relays	None	Info	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period.	Remote
Comm Loss: Suction Pressure Cprsr 1A	Special	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Circuit target if no isolation valves, Compressor target if isolation valves or simplex. Design Note: In the case of manifolded compressors w/ no isolation valves, the occurrence of this diagnostic will also generate a comm loss with the nonexistent Suction Press Cprsr 1B in order to accomplish circuit shutdown.	Remote
Comm Loss: Suction Pressure Cprsr 1B	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Design Note: For circuits with manifolded compressors w/o isolation valve option, this diagnostic will occur with the preceding diagnostic, even though this transducer is not required or installed.	Remote
Comm Loss: Suction Pressure Cprsr 2A	Special	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Circuit target if no isolation valves, Compressor target if isolation valves or simplex. Design Note: In the case of manifolded compressors w/ no isolation valves, the occurrence of this diagnostic will also generate a comm loss with the nonexistent Suction Press Cprsr 2B in order to accomplish circuit shutdown.	Remote
Comm Loss: Suction Pressure Cprsr 2B	Cprsr	Immediate	Latch	All	Continual loss of communication between the MP and the Functional ID has occurred for a 30 second period. Design Note: For circuits with manifolded compressors w/o isolation valve option, this diagnostic will occur with the preceding diagnostic, even though this transducer is not required or installed.	Remote
Excessive Loss of Comm	Chiller	Immediate	Latch	All	Loss of comm with 75% or more (Rev 18 and earlier 10%) of the llds configured for the system has been detected. This diagnostic will suppress the callout of all subsequent comm loss diagnostics. Check power supply(s) and power disconnects - troubleshoot LLIDS buss using TechView	Remote
Starter 1A Comm Loss: MP	Cprsr	Immediate	Latch	All	Starter has had a loss of communication with MP for a 15 second period.	Local
Starter 1B Comm Loss: MP	Cprsr	Immediate	Latch	All	Starter has had a loss of communication with MP for a 15 second period.	Local
Starter 2A Comm Loss: MP	Cprsr	Immediate	Latch	All	Starter has had a loss of communication with MP for a 15 second period.	Local
Starter 2B Comm Loss: MP	Cprsr	Immediate	Latch	All	Starter has had a loss of communication with MP for a 15 second period.	Local

Main Processor Boot Messages and Diagnostics

Table 69. Main processor boot messages and diagnostics

DynaView Display Message	Description Troubleshooting
A Valid Configuration is Present	A valid configuration is present in the MP's nonvolatile memory. The configuration is a set of variables and settings that define the physical makeup of this particular chiller. These include: number/airflow,/and type of fans, number/and size of compressors, special features, characteristics, and control options. // Temporary display of this screen is part of the normal power up sequence.
App Present. Running Selftest... Selftest Passed	An application has been detected in the Main Processor's nonvolatile memory and the boot code is proceeding to run a check on its entirety. 8 seconds later, the boot code had completed and passed the (CRC) test. // Temporary display of this screen is part of the normal power up sequence.
App Present. Running Selftest... Err3: CRC Failure	An application has been detected in Main Processor's nonvolatile memory and the boot code is proceeding to run a check on its entirety. A few seconds later, the boot code had completed but failed the (CRC) test. //Connect a TechView Service Tool to the MP's serial port, provide chiller model number (configuration information) and download the configuration if prompted by TechView. Then proceed to download the most recent RTAC application or specific version as recommended by Technical Service. Note that this error display may also occur during the programming process, if the MP never had a valid application any time prior to the download. If the problem persists, replace the MP.
Boot Software Part Numbers: LS Flash --> 6200-0318-04 MS Flash --> 6200-0319-04	The "boot code" is the portion of the code that is resident in all MPs regardless of what application code (if any) is loaded. Its main function is to run power up tests and provide a means for downloading application code via the MP's serial connection. The Part numbers for the code are displayed in the lower left hand corner of the DynaView during the early portion of the power up sequence and during special programming and converter modes. See below. For the EasyView, the extension of the boot code part number is displayed for approximately 3 immediately following power up. // This is normal, but you should provide this information when contacting Technical Service about power up problems.
Converter Mode	A command was received from the Service Tool (Tech View) to stop the running application and run in the "converter mode". In this mode the MP acts as a simple gateway and allows the TechView service computer to talk to all the LLIDS on the IPC3 bus.
Err2: RAM Addr Test #1 Failure	There were RAM errors detected in RAM Address Test #1. // Recycle power, if error persists, replace MP.
Err2: RAM Addr Test #2 Failure	There were RAM errors detected in RAM Address Test #2. //Recycle power, if the error persists, replace MP.
Err2: RAM Pattern 1 Failure	There were RAM errors detected in RAM Test Pattern #1. // Recycle power, if the error persists, replace MP.
Err2: RAM Pattern 2 Failure	There were RAM errors detected in RAM Test Pattern #2. //Recycle power, if the error persists, replace MP.
Err4: UnHandled Interrupt Restart Timer: [3 sec countdown timer]	An unhandled interrupt has occurred while running the application code. This event will normally cause a safe shutdown of the entire chiller. Once the countdown timer reaches 0, the processor will reset, clear diagnostics, and attempt to restart the application and allow a normal restart of chiller as appropriate. // This condition might occur due to a severe electro-magnetic transient such as can be caused by a near lightning strike. Such events should be rare or isolated and if no damage results to the CH.530 control system, the Chiller will experience a shutdown and restart. If this occurs more persistently it may be due to an MP hardware problem. Try replacing the MP. If replacement of the MP proves ineffective, the problem may be a result of extremely high radiated or conducted EMI. Contact Technical Service. If this screen occurs immediately after a software download, attempt to reload both the configuration and the application. Failing this, contact Technical Service.
Err5: Operating System Error Restart Timer: [30 sec countdown timer]	An Operating System error has occurred while running the application code. This event will normally cause a safe shutdown of the entire chiller. Once the countdown timer reaches 0, the processor will reset, clear diagnostics, and attempt to restart the application and allow a normal restart of chiller as appropriate. // See Err 4 above
Err6: Watch Dog Timer Error Restart Timer: [30 sec countdown timer]	A Watch Dog Timer Error has occurred while running the application code. This event will normally cause a safe shutdown of the entire chiller. Once the countdown timer reaches 0, the processor will reset, clear diagnostics, and attempt to restart the application allowing a normal restart of chiller as appropriate.
Err7: Unknown Error Restart Timer: [30 sec countdown timer]	An unknown Error has occurred while running the application code. This event will normally cause a safe shutdown of the entire chiller. Once the countdown timer reaches 0, the processor will reset, clear diagnostics, and attempt to restart the application allowing a normal restart of chiller as appropriate
Err8: Held in Boot by User Key Press	The boot detected a key press in the center of the DynaView or both the + and - keys pressed on an EasyView while the MP was in the boot code. Upon seeing this message the user can use Techview to connect to the MP to perform a software download or another service tool function.
No Application Present Please Load Application...	No Main Processor Application is present - There are no RAM Test Errors. // Connect a TechView Service Tool to the MP's serial port, provide chiller model number (configuration information) and download the configuration if prompted by TechView. Then proceed to download the most recent RTAC application or specific version as recommended by Technical Service.
Programming Mode	A command was received by the MP from the Tech View Service Tool and the MP is in the process of first erasing and then writing the program code to its internal Flash (nonvolatile) Memory. Note that if the MP never had a prior application already in memory, the error code "Err3"will be displayed instead of this, during the programming download process.



Unit Wiring

Table 70 provides a list of field wiring diagrams, electrical schematics and connection diagrams for 120-500 ton RTAC units. The complete unit wiring package is documented in RTAC-SVE01*-EN. A laminated wiring diagram kit is also shipped with each RTAC unit.

Table 70. RTAC unit wiring drawing numbers

Drawing Number	Description
Sheet 1	Table of Contents & Notes
Sheet 2	Legend
Sheet 3 (X-Line)	Compressor 1A (X-Line)
Sheet 3 (Y-Delta)	Compressor 1A (Y-delta)
Sheet 4 (X-Line)	Compressor 2A (X-Line)
Sheet 4 (Y-Delta)	Compressor 2A (Y-delta)
2309-2097	Schematic - 2 Compressor Units
Sheet 5	Fans, Std & Prem, Medium Air Cooled
Sheet 6	Fans, 140 & 155 Std, 120 & 130 Prem 50 Hz
Sheet 7	Fans 225, 250 Prem 60 Hz, 185 & 200 Extra 60 Hz
Sheet 8	VSD Fans - Circuits 1 & 2
Sheet 9	Controls
Sheet 10	LLID Bus
Sheet 11	Remote Evaporator
Sheet 1	Table of Contents & Notes
Sheet 2	Devices, Descriptions & Designations
Sheet 3	Compressor Power 1A & Fan Control Ckt 1
Sheet 4	Compressor Power 1B
2309-4621	Schematic - 3 Compressor Units, X-Line
Sheet 5	Compressor Power 2A & Fan Control Ckt 2
Sheet 6	Fan Power Circuit 1
Sheet 7	Fan Power Circuit 2
Sheet 8	Common Control - Panel LLIDs
Sheet 9	Common Control - Panel LLIDs
Sheet 10	Common Control - Panel LLIDs
Sheet 1	Table of Contents & Notes
Sheet 2	Devices, Descriptions & Designations
Sheet 3	Compressor Power 1A & Fan Control Ckt 1
Sheet 4	Compressor Power 1B
2309-4622	Schematic - 3 Compressor, Units Y-Delta
Sheet 5	Compressor Power 2A & Fan Control Ckt 2
Sheet 6	Fan Power Circuit 1
Sheet 7	Fan Power Circuit 2
Sheet 8	Common Control - Panel LLIDs
Sheet 9	Common Control - Panel LLIDs
Sheet 10	Common Control - Panel LLIDs

Table 70. RTAC unit wiring drawing numbers

Drawing Number	Description	
2309-4623	Sheet 1	Table of Contents & Notes
	Sheet 2	Devices, Descriptions & Designations
	Sheet 3	Compressor Power 1A & Fan Control Ckt 1
	Sheet 4	Compressor Power 1B
	Sheet 5	Compressor Power 2A & Fan Control Ckt 2
	Sheet 6	Compressor Power 2B
	Sheet 7	Fan Power Circuit 1
	Sheet 8	Fan Power Circuit 2
	Sheet 9	Common Control - Panel LLIDs
	Sheet 10	Common Control - Panel LLIDs
	Sheet 11	Common Control - Panel LLIDs
2309-4624	Sheet 1	Table of Contents & Notes
	Sheet 2	Devices, Descriptions & Designations
	Sheet 3	Compressor Power 1A & Fan Control Ckt 1
	Sheet 4	Compressor Power 1B
	Sheet 5	Compressor Power 2A & Fan Control Ckt 2
	Sheet 6	Compressor Power 2B
	Sheet 7	Fan Power Circuit 1
	Sheet 8	Fan Power Circuit 2
	Sheet 9	Common Control - Panel LLIDs
	Sheet 10	Common Control - Panel LLIDs
	Sheet 11	Common Control - Panel LLIDs
2309-4871	Component Location	2 Compressor Units
2309-4874	Component Location	3 Compressor Units
2309-4873	Component Location	4 Compressor Units
2309-4872	Component Location	2 Compressor - Optional Remote Evaporator
2309-2248	Field Layout	2 Compressor Units
2309-2239	Field Layout	3 or 4 Compressor Units
2309-2208	Field Wiring; RTAC, 2 Compressor Units	2 Compressor Units
2309-2223	Field Wiring	3 or 4 Compressor Units, Single Source Power
2309-2222	Field Wiring	3 or 4 Compressor Units, Dual Source Power
2309-7572	Sequence of Operation	2 Compressor Units
2309-7581	Sequence of Operation	3 or 4 Compressor Units



Log and Check Sheet

The operator log and check sheet are included for use as appropriate, for installation completion verification before Trane start-up is scheduled, and for reference during the Trane start-up.

Where the log or check sheet also exists outside of this publication as standalone literature, the literature order number is also listed.

- RTAC Series R Air-Cooled Chiller Installation Completion Check Sheet and Request for Trane Service (RLC-ADF003*-EN)
- Operator Log
- Start-Up Test Log



RTAC Series R[®] Air-Cooled Chiller Installation Completion Check Sheet and Request for Trane Service

Important: A copy of this completed form must be submitted to the Trane service agency that will be responsible for the start-up of the chiller. Start-up will NOT proceed unless applicable items listed in this form have been satisfactorily completed.

To:	Trane Service Office:
S.O. Number:	Serial Numbers:
Job/Project Name:	
Address:	
The following items are being installed and will be completed by:	

Important: Start-up must be performed by Trane or an agent of Trane specifically authorized to perform start-up of Trane[®] products. Contractor shall provide Trane (or an agent of Trane specifically authorized to perform start-up) with notice of the scheduled start-up at least two weeks prior to the scheduled start-up.

Check boxes if the task is complete or if the answer is "yes."

1. Screw Chiller

- Installation meets foundation requirements.
- Verify service clearances meet requirements.
- In place and piped.
- Isolation pads or neoprene pads installed (optional).

2. Piping

Chilled water piping connected to:

- Evaporator
- Air handling units
- Pumps
- Flow switch or flow proving device installed
- Required strainer installed in entering evaporator water piping and cleaned
- Water supply connected to filling system (expansion tank)
- Systems filled
- Pumps run, air bled from system
- Relief valve ventilation piping installed (if applicable)
- Flow balancing valves installed in leaving chilled water
- Gauges, thermometers and air vents installed on both sides of evaporator

3. Wiring

- Wire size per submittal, NEC and applicable local electrical codes. Verify only copper conductors used.
- Full power available, and within utilization range.
- Interconnecting wiring to remote evaporator (if applicable)
- External interlocks (flow switch, pumps auxiliary, etc.)
- Chilled water pump (connected and tested)
- 115 Vac power available for service tools (recommended)
- All controls installed and connected

4. Testing

- Dry nitrogen available for pressure testing (if required)
- Trace gas amounts of R-134a available for leak testing (if required)

5. Refrigerant on job site (if required)

6. Systems can be operated under load conditions

7. Owner awareness

- If it is required by local code, is a self-contained breathing apparatus available?
- Has the owner been fully instructed on the proper use of refrigerant?
- Does the owner have a copy of the MSDS for refrigerant?
- Was the owner given a copy of the Refrigerant Handling Guidelines?

Note: Additional time required to properly complete the start-up and commissioning, due to any incompleteness of the installation, will be invoiced at prevailing rates.

This is to certify that the Trane® equipment has been properly and completely installed, and that the applicable items listed above have been satisfactorily completed.

Important: It is required that the chiller heaters are energized for a minimum of 24 hours prior to start up. Therefore, the chiller should have power for this amount of time before Trane Service arrives to do start-up of the equipment.

Checklist completed by: _____

Signed: _____ Date: _____

In accordance with your quotation and our purchase order number _____, we will therefore require the presence of Trane service on this site, for the purpose of start-up and commissioning, by _____ (date).

Note: Minimum two-week advance notification is required to allow scheduling of the chiller start-up.

Additional comments/instructions: _____

Note: A copy of this completed form must be submitted to the Trane Service Office that will be responsible for start-up of chiller.

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Trane has a policy of continuous product and product data improvement and reserves the right to change design and specifications without notice.





Operator Log

RTAC CHILLER LOG						
Job Name			Job Location			
Model #			Serial #			
Status View: *						
Chiller Tab:	15 min	30 min	45 min	15 min	30 min	45 min
Operating Mode						
Outdoor Air Temperature	F or C					
Active Chill Water Setpoint	F or C					
Active Current Limit Setpoint						
Evaporator Entering Water Temp.	F or C					
Evaporator Leaving Water Temp.	F or C					
	Circuit 1 Tab			Circuit 2 Tab		
External Hardwired Lockout	Not Locked out/ Locked out			Not Locked out/ Locked out		
Front Panel Lockout	Not Locked out/ Locked out			Not Locked out/ Locked out		
	15 min	30 min	45 min	15 min	30 min	45 min
AirFlow	%					
Inverter Speed	%					
Condenser Refrigerant Pressure	psig/kPa					
Saturated Condenser Rfgt. Temp.	F or C					
Differential Refrigerant Pressure	psid/kPA					
Evaporator Refrigerant Pressure	psig/kPa					
Saturated Evaporator Rfgt.Temp.	F or C					
EXV Position	%					
Evaporator Rfgt Liquid Level	in/mm					
	Compressor 1A Tab			Compressor 1B Tab		
Operating Mode						
Hours	Hrs/mins			Hrs/mins		
Starts						
	15 min	30 min	45 min	15 min	30 min	45 min
Phase A - B Voltage	volts					
Average Line Current	%RLA					
Line 1 current	amps					
Line 2 current	amps					
Line 3 current	amps					
Line 1 current	%RLA					
Line 2 current	%RLA					
Line 3 current	%RLA					
Evaporator Oil Return Solenoid	open/closed	open/closed	open/closed	open/closed	open/closed	open/closed
Supply Oil Temperature	F or C					
Intermediate Oil Pressure	psig/kPa					
Female Step solenoid	load/unload	load/unload	load/unload	load/unload	load/unload	load/unload
High Pressure Cutout switch	good/tripped	good/tripped	good/tripped	good/tripped	good/tripped	good/tripped
Comments:						



RTAC CHILLER LOG						
	Compressor 2A Tab			Compressor 2B Tab		
Operating Mode						
Hours	Hrs/mins			Hrs/mins		
Starts						
	15 min	30 min	45 min	15 min	30 min	45 min
Phase A - B Voltage	volts					
Average Line Current	%RLA					
Line 1 current	amps					
Line 2 current	amps					
Line 3 current	amps					
Line 1 current	%RLA					
Line 2 current	%RLA					
Line 3 current	%RLA					
Evaporator Oil Return Solenoid	open/closed	open/closed	open/closed	open/closed	open/closed	open/closed
Supply Oil Temperature	F or C					
Intermediate Oil Pressure	psig/kPa					
Female Step solenoid	load/unload	load/unload	load/unload	load/unload	load/unload	load/unload
High Pressure Cutout switch	good/tripped	good/tripped	good/tripped	good/tripped	good/tripped	good/tripped
Comments:						



RTAC Start-Up Test Log

RTAC START-UP TEST LOG			
Model #			
Job Name		Job Location	
CRC #		Serial #	
Sales Order #	Ship Date	Job Elevation (ft. above sea level)	
Starter Data:		Start-up Only	
Manufacturer		Chiller Appearance on arrival:	
Type: (wye-delta or x-line)		Machine gauge pressure:	ckt1/ckt2
Vendor ID #/ Model #:		Machine CH.530 pressure	ckt1/ckt2
Volts	Amps	Hz	Unit R-134a Charge
			lbs
Compressor Data:		Unit oil charge (OIL00048)	gal
Compressor A:		Pressure Test (if required)	
	Model #:	Vacuum after leak test=	mm
	Serial #	Standing Vacuum test=	mm rise in hrs
	RLA	Current Transformers	
	KW	Part number ("X" code and 2-digit extension)	
	Volts	X	
	HZ	X	
Compressor B:		X	
	Model #:	X	
	Serial #	X	
	RLA	X	
	KW	Summary of Options Installed	
	Volts	Y N	Tracer Communications Interface
	HZ	Y N	Ice Making
Compressor C:		Y N Other	
	Model #:	Y N Other	
	Serial #	Y N Other	
	RLA	Evap Design Conditions	
	KW	GPM	PSID
	Volts	Entering Water:	Leaving Water:
	HZ	% Glycol:	
Compressor D:		Type of Glycol:	
	Model #:	Evap Actual Conditions	
	Serial #	GPM	PSID
	RLA	Entering Water:	Leaving Water:
	KW	% Glycol:	
	Volts	Type of Glycol:	
	HZ		
Owner Witness Signature:			



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