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**UNIVERSITY OF SOUTH CAROLINA, AIKEN  
USC AIKEN GREENHOUSE REPACKAGING**

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**STATE PROJECT #H29-I337**

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**JUNE 10, 2014  
OWNER REVIEW**

  
A/E PROJECT # 12036.02

 **GMK**  
ASSOCIATES, INC.

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**SECTION 00001 - PROJECT TITLE PAGE**

**OWNER:**

University of South Carolina, Aiken  
471 University Parkway  
Aiken, South Carolina 29801

**ARCHITECTS, MECHANICAL AND ELECTRICAL ENGINEERS:**

GMK Associates, Inc.  
1201 Main Street, Suite 2100  
Columbia, South Carolina 29201  
tel: 803.256.0000  
fax: 803.255.7243  
www.gmka.com  
Architect: Jerome K. Simons [jsimons@gmka.com]  
Plumbing: Jeff Bernagozzi [jbernagozzi@gmka.com]  
Electrical: Brell Foster [bfoster@gmka.com]

**CIVIL ENGINEERS:**

Hass & Hilderbrand, Inc.  
133 Greenville Street, SW  
Post Office Box 3276  
Aiken, South Carolina 29801  
Contact: Tilden Hilderbrand  
email: tilden@hassandhilderbrand.com  
tel: 803.649.1316  
fax: 803.641.9197

**END OF PROJECT TITLE PAGE**

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**SE-310**  
**REQUEST FOR ADVERTISEMENT**

**PROJECT NAME:** USC Aiken Greenhouse Repackaging Rebid

**PROJECT NUMBER:** H29-I337

**PROJECT LOCATION:** USC Aiken, Aiken, South Carolina

Contractor may be subject to performance appraisal at close of project

**BID SECURITY REQUIRED?** Yes  No

**PERFORMANCE & PAYMENT BONDS REQUIRED?** Yes  No

**CONSTRUCTION COST RANGE:** \$70,000 - \$80,000

**DESCRIPTION OF PROJECT:** The project consists of the construction of an owner provided 2,100 square ft greenhouse using a greenhouse kit. The project also includes associated sitework, utilities, foundations, building base, electrical, plumbing, etc.

**A/E NAME:** GMK Associates, Inc.

**A/E CONTACT:** Jerome K. Simons

**A/E ADDRESS:** Street/PO Box: 1201 Main Street, Suite 2100

City: Columbia

State: South Carolina ZIP: 29201-

**EMAIL:** Jsimons@gmka.com

**TELEPHONE:** 803-256-0000

**FAX:** 803-255-7243

All questions & correspondence concerning this Invitation shall be addressed to the A/E.

**BIDDING DOCUMENTS/PLANS MAY BE OBTAINED FROM:** purchasing.sc.edu

**PLAN DEPOSIT AMOUNT:**        **IS DEPOSIT REFUNDABLE:** Yes  No

Only those Bidding Documents/Plans obtained from the above listed source(s) are official. Bidders rely on copies of Bidding Documents/Plans obtained from any other source at their own risk.

**BIDDING DOCUMENTS/PLANS ARE ALSO ON FILE FOR VIEWING PURPOSES ONLY AT** *(list name and location for each plan room or other entity):*

purchasing.sc.edu. It is the contractor's responsibility to download any documents from the purchasing website

\_\_\_\_\_  
\_\_\_\_\_

**PRE-BID CONFERENCE?** Yes  No  **MANDATORY ATTENDANCE?** Yes  No

**DATE:** 7/8/2014 **TIME:** 10:00 am **PLACE:** USC Aiken, Business and Education Building, Room 124

452 Scholar Loop, Aiken, South Carolina 29801

**AGENCY:** University of South Carolina

**NAME OF AGENCY PROCUREMENT OFFICER:** Juaquana Brookins

**ADDRESS:** Street/PO Box: 743 Greene Street

City: Columbia

State: South Carolina ZIP: 29208-

**EMAIL:** jbrookin@fmc.sc.edu

**TELEPHONE:** 803-777-3596

**FAX:** 803-777-7334

**BID CLOSING DATE:** 7/22/2014 **TIME:** 1:00 pm **LOCATION:** USC Facilities Office, Conference Room 53

743 Greene Street, Columbia, South Carolina 29208

**BID DELIVERY ADDRESSES:**

**HAND-DELIVERY:**

Attn: Juaquana Brookins

USC Facilities Office

743 Greene Street

Columbia, South Carolina 29208

**MAIL SERVICE:**

Attn: Juaquana Brookins

USC Facilities Office

743 Greene Street

Columbia, South Carolina 29208

**IS PROJECT WITHIN AGENCY CONSTRUCTION CERTIFICATION? (Agency MUST check one)** Yes  No

**APPROVED BY** *(Office of State Engineer):* \_\_\_\_\_

**DATE:** \_\_\_\_\_

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**SECTION 00200 - INSTRUCTIONS TO BIDDERS**

**FORM OF INSTRUCTIONS TO BIDDERS**

1.01 See AIA Document A701 (1997 Edition), Instructions to Bidders following this document.

- A. Copies of this document may be obtained from The American Institute of Architects, 1522 Richland Street, Columbia, SC 29201. Phone: 803-252-6050.

1.02 Refer to document 00201-OSE for modifications to this document.

**END OF INSTRUCTIONS TO BIDDERS**



**OSE FORM 00201****STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS**

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**OWNER:** University of South Carolina**PROJECT NUMBER:** H29-I337**PROJECT NAME:** USC Aiken Greenhouse Repackaging Rebid**PROJECT LOCATION:** Aiken, South Carolina**PROCUREMENT OFFICER:** Juaquana Brookins**1. STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS**

**1.1.** These Standard Supplemental Instructions To Bidders amend or supplement Instructions To Bidders (AIA Document A701-1997) and other provisions of Bidding and Contract Documents as indicated below.

**1.2.** Compliance with these Standard Supplemental Instructions is required by the Office of State Engineer (OSE) for all State projects when competitive sealed bidding is used as the method of procurement.

**1.3.** All provisions of A701-1997, which are not so amended or supplemented, remain in full force and effect.

**1.4.** Bidders are cautioned to carefully examine the Bidding and Contract Documents for additional instructions or requirements.

**2. MODIFICATIONS TO A701-1997**

**2.1.** *Delete Section 1.1 and insert the following:*

**1.1** Bidding Documents, collectively referred to as the **Invitation for Bids**, include the Bidding Requirements and the proposed Contract Documents. The Bidding Requirements consist of the Advertisement, Instructions to Bidders (A-701), Supplementary Instructions to Bidders, the bid form (SE-330), the Intent to Award Notice (SE-370), and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda issued prior to execution of the Contract, and other documents set forth in the Bidding Documents. Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.

**2.2.** *In Section 1.8, delete the words “and who meets the requirements set forth in the Bidding Documents”.*

**2.3.** *In Section 2.1, delete the word “making” and substitute the word “submitting.”*

**2.4.** *In Section 2.1.1:*

*After the words “Bidding Documents,” delete the word “or” and substitute the word “and.”*

*Insert the following at the end of this section:*

Bidders are expected to examine the Bidding Documents and Contract Documents thoroughly and should request an explanation of any ambiguities, discrepancies, errors, omissions, or conflicting statements. Failure to do so will be at the Bidder’s risk. Bidder assumes responsibility for any patent ambiguity that Bidder does not bring to the Owner’s attention prior to bid opening.

**2.5.** *In Section 2.1.3, insert the following after the term “Contract Documents” and before the period:*

and accepts full responsibility for any pre-bid existing conditions that would affect the Bid that could have been ascertained by a site visit. As provided in Regulation 19-445.2042(B), A bidder’s failure to attend an advertised pre-bid conference will not excuse its 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 State.

**OSE FORM 00201****STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS**

2.6. *Insert the following Sections 2.2 through 2.6:*

**2.2 CERTIFICATION OF INDEPENDENT PRICE DETERMINATION**

GIVING FALSE, MISLEADING, OR INCOMPLETE INFORMATION ON THIS CERTIFICATION MAY RENDER YOU SUBJECT TO PROSECUTION UNDER SECTION 16-9-10 OF THE SOUTH CAROLINA CODE OF LAWS AND OTHER APPLICABLE LAWS.

(a) By submitting an bid, the bidder certifies that—

(1) The prices in this bid have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other bidder or competitor relating to—

- (i) Those prices;
- (ii) The intention to submit an bid; or
- (iii) The methods or factors used to calculate the prices offered.

(2) The prices in this bid have not been and will not be knowingly disclosed by the bidder, directly or indirectly, to any other bidder or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the bidder to induce any other concern to submit or not to submit an bid for the purpose of restricting competition.

(b) Each signature on the bid is considered to be a certification by the signatory that the signatory—

(1) Is the person in the bidder's organization responsible for determining the prices being offered in this bid, and that the signatory has not participated and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this certification; or

(2)(i) Has been authorized, in writing, to act as agent for the bidder's principals in certifying that those principals have not participated, and will not participate in any action contrary to paragraphs (a)(1) through (a)(3) of this certification [As used in this subdivision (b)(2)(i), the term "principals" means the person(s) in the bidder's organization responsible for determining the prices offered in this bid];

(ii) As an authorized agent, does certify that the principals referenced in subdivision (b)(2)(i) of this certification have not participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this certification; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to paragraphs (a)(1) through (a)(3) of this certification.

(c) If the bidder deletes or modifies paragraph (a)(2) of this certification, the bidder must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

**2.3 DRUG FREE WORKPLACE**

By submitting a bid, the Bidder certifies that Bidder will maintain a drug free workplace in accordance with the requirements of Title 44, Chapter 107 of South Carolina Code of Laws, as amended.

**2.4 CERTIFICATION REGARDING DEBARMENT AND OTHER RESPONSIBILITY MATTERS**

(a) (1) By submitting an Bid, Bidder certifies, to the best of its knowledge and belief, that-

(i) Bidder and/or any of its Principals-

(A) Are not presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any state or federal agency;

(B) Have not, within a three-year period preceding this bid, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in

**OSE FORM 00201****STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS**

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 bids; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) 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)(i)(B) of this provision.

(ii) Bidder has not, within a three-year period preceding this bid, had one or more contracts terminated for default by any public (Federal, state, or local) entity.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons 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).

(b) Bidder shall provide immediate written notice to the Procurement Officer if, at any time prior to contract award, Bidder learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) If Bidder is unable to certify the representations stated in paragraphs (a)(1), Bid must submit a written explanation regarding its inability to make the certification. The certification will be considered in connection with a review of the Bidder's responsibility. Failure of the Bidder to furnish additional information as requested by the Procurement Officer may render the Bidder 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 Bidder 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 Bidder knowingly or in bad faith rendered an erroneous certification, in addition to other remedies available to the State, the Procurement Officer may terminate the contract resulting from this solicitation for default.

**2.5 ETHICS CERTIFICATE**

By submitting a bid, the bidder certifies that the bidder has and will comply with, and has not, and will not, induce a person to violate Title 8, Chapter 13 of the South Carolina Code of Laws, as amended (ethics act). The following statutes require special attention: Section 8-13-700, regarding use of official position for financial gain; Section 8-13-705, regarding gifts to influence action of public official; Section 8-13-720, regarding offering money for advice or assistance of public official; Sections 8-13-755 and 8-13-760, regarding restrictions on employment by former public official; Section 8-13-775, prohibiting public official with economic interests from acting on contracts; Section 8-13-790, regarding recovery of kickbacks; Section 8-13-1150, regarding statements to be filed by consultants; and Section 8-13-1342, regarding restrictions on contributions by contractor to candidate who participated in awarding of contract. The state may rescind any contract and recover all amounts expended as a result of any action taken in violation of this provision. If contractor participates, directly or indirectly, in the evaluation or award of public contracts, including without limitation, change orders or task orders regarding a public contract, contractor shall, if required by law to file such a statement, provide the statement required by Section 8-13-1150 to the procurement officer at the same time the law requires the statement to be filed.

**2.6 RESTRICTIONS APPLICABLE TO BIDDERS & GIFTS**

Violation of these restrictions may result in disqualification of your bid, suspension or debarment, and may constitute a violation of the state Ethics Act. (a) After issuance of the solicitation, ***bidder agrees not to discuss this procurement activity in any way with the Owner or its employees, agents or officials.*** All communications must be solely with the Procurement Officer. This restriction may be lifted by express written permission from the Procurement Officer. This restriction expires once a contract has been formed. (b) Unless otherwise approved in writing by the Procurement

**OSE FORM 00201****STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS**

Officer, *bidder agrees not to give anything to the Owner, any affiliated organizations, or the employees, agents or officials of either, prior to award.* (c) Bidder acknowledges that the policy of the State is that a governmental body should not accept or solicit a gift, directly or indirectly, from a donor if the governmental body has reason to believe the donor has or is seeking to obtain contractual or other business or financial relationships with the governmental body. Regulation 19-445.2165(C) broadly defines the term donor.

**2.7.** *Delete Section 3.1.1 and substitute the following:*

**3.1.1** Bidders may obtain complete sets of the Bidding Documents from the issuing office designated in the Advertisement in the number and for the deposit sum, if any, stated therein. If so provided in the Advertisement, the deposit will be refunded to all plan holders who return the Bidding Documents in good condition within ten days after receipt of Bids. The cost of replacement of missing or damaged documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the Bidding Documents and the Bidder's deposit will be refunded.

**2.8.** *Delete the language of Section 3.1.2 and insert the word "Reserved."*

**2.9.** *In Section 3.1.4, delete the words "and Architect may make" and substitute the words "has made."*

**2.10.** *Insert the following Section 3.1.5*

**3.1.5** All persons obtaining Bidding Documents from the issuing office designated in the Advertisement shall provide that office with Bidder's contact information to include the Bidder's name, telephone number, mailing address, and email address.

**2.11.** *In Section 3.2.2:*

*Delete the words "and Sub-bidders"*

*Delete the word "seven" and substitute the word "ten"*

**2.12.** *In Section 3.2.3:*

*In the first Sentence, insert the word "written" before the word "Addendum."*

*Insert the following at the end of the section:*

As provided in Regulation 19-445.2042(B), nothing stated at the pre-bid conference shall change the Bidding Documents unless a change is made by written Addendum.

**2.13.** *Insert the following at the end of Section 3.3.1:*

Reference in the Bidding Documents to a designated material, product, thing, or service by specific brand or trade name followed by the words "or equal" and "or approved equal" shall be interpreted as establishing a standard of quality and shall not be construed as limiting competition.

**2.14.** *Delete Section 3.3.2 and substitute the following:*

**3.3.2** No request to substitute materials, products, or equipment for materials, products, or equipment described in the Bidding Documents and no request for addition of a manufacturer or supplier to a list of approved manufacturers or suppliers in the Bidding Documents will be considered prior to receipt of Bids unless written request for approval has been received by the Architect at least ten days prior to the date for receipt of Bids established in the Invitation for Bids. Any subsequent extension of the date for receipt of Bids by addendum shall not extend the date for receipt of such requests unless the addendum so specifies. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final.

**2.15.** *Delete Section 3.4.3 and substitute the following:*

**3.4.3** Addenda will be issued no later than 120 hours prior to the time for receipt of Bids except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

**OSE FORM 00201****STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS****2.16. Insert the following Sections 3.4.5 and 3.4.6:**

**3.4.5** When the date for receipt of Bids is to be postponed and there is insufficient time to issue a written Addendum prior to the original Bid Date, Owner will notify prospective Bidders by telephone or other appropriate means with immediate follow up with a written Addendum. This Addendum will verify the postponement of the original Bid Date and establish a new Bid Date. The new Bid Date will be no earlier than the fifth (5th) calendar day after the date of issuance of the Addendum postponing the original Bid Date.

**3.4.6.** If an emergency or unanticipated event interrupts normal government processes so that bids cannot be received at the government office designated for receipt of bids by the exact time specified in the solicitation, 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 government processes resume. In lieu of an automatic extension, an Addendum may be issued to reschedule bid opening. If state offices are closed at the time a pre-bid or pre-proposal conference is scheduled, an Addendum will be issued to reschedule the conference. Useful information may be available at: [http://www.scemd.org/scgovweb/weather\\_alert.html](http://www.scemd.org/scgovweb/weather_alert.html)

**2.17. In Section 4.1.1, delete the word “forms” and substitute the words “SE-330 Bid Form.”****2.18. Delete Section 4.1.2 and substitute the following:**

**4.1.2** Any blanks on the bid form to be filled in by the Bidder shall be legibly executed in a non-erasable medium. Bids shall be signed in ink or other indelible media.

**2.19. Delete Section 4.1.3 and substitute the following:**

**4.1.3** Sums shall be expressed in figures.

**2.20. Insert the following at the end of Section 4.1.4:**

Bidder shall not make stipulations or qualify his bid in any manner not permitted on the bid form. An incomplete Bid or information not requested that is written on or attached to the Bid Form that could be considered a qualification of the Bid, may be cause for rejection of the Bid.

**2.21. Delete Section 4.1.5 and substitute the following:**

**4.1.5** All requested Alternates shall be bid. The failure of the bidder to indicate a price for an Alternate shall render the Bid non-responsive. Indicate the change to the Base Bid by entering the dollar amount and marking, as appropriate, the box for “ADD TO” or “DEDUCT FROM”. If no change in the Base Bid is required, enter “ZERO” or “No Change.” For add alternates to the base bid, Subcontractor(s) listed on page BF-2 of the Bid Form to perform Alternate Work may be used for both Alternates and Base Bid Work if Alternates are accepted.

**2.22. Delete Section 4.1.6 and substitute the following:**

**4.1.6** Pursuant to Title 11, Chapter 35, Section 3020(b)(i) of the South Carolina Code of Laws, as amended, Section 7 of the Bid Form sets forth a list of subcontractor specialties for which Bidder is required to list only the subcontractors Bidder will use to perform the work of each listed specialty. Bidder must follow the Instructions in the Bid Form for filling out this section of the Bid Form. Failure to properly fill out Section 7 may result in rejection of Bidder’s bid as non-responsive.

**2.23. Delete Section 4.1.7 and substitute the following:**

**4.1.7** Each copy of the Bid shall state the legal name of the Bidder and the nature of legal form of the Bidder. Each copy shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid submitted by an agent shall have a current power of attorney attached certifying the agent's authority to bind the Bidder.

**2.24. Delete Section 4.2.1 and substitute the following:**

**4.2.1** If required by the Invitation for Bids, each Bid shall be accompanied by a bid security in an amount of not less than five percent of the Base Bid. The bid security shall be a bid bond or a certified cashier’s check. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty.

**OSE FORM 00201****STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS**

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**2.25. Delete Section 4.2.2 and substitute the following:**

**4.2.2** If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney. The bid bond shall:

- .1** Be issued by a surety company licensed to do business in South Carolina;
- .2** Be issued by a surety company having, at a minimum, a "Best Rating" of "A" as stated in the most current publication of "Best's Key Rating Guide, Property-Casualty", which company shows a financial strength rating of at least five (5) times the contract price.
- .3** Be enclosed in the bid envelope at the time of Bid Opening, either in paper copy or as an electronic bid bond authorization number provided on the Bid Form and issued by a firm or organization authorized by the surety to receive, authenticate and issue binding electronic bid bonds on behalf the surety.

**2.26. Delete Section 4.2.3 and substitute the following:**

**4.2.3** By submitting a bid bond via an electronic bid bond authorization number on the Bid Form and signing the Bid Form, the Bidder certifies that an electronic bid bond has been executed by a Surety meeting the standards required by the Bidding Documents and the Bidder and Surety are firmly bound unto the State of South Carolina under the conditions provided in this Section 4.2.

**2.27. Insert the following Section 4.2.4:**

**4.2.4** The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and performance and payment bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

**2.28. Delete Section 4.3.1 and substitute the following:**

**4.3.1** All copies of the Bid, the bid security, if any, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall, unless hand delivered by the Bidder, be addressed to the Owner's designated purchasing office as shown in the Invitation for Bids. The envelope shall be identified with the Project name, the Bidder's name and address and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail or special delivery service (UPS, Federal Express, etc.), the envelope should be labeled "BID ENCLOSED" on the face thereof. Bidders hand delivering their Bids shall deliver Bids to the place of the Bid Opening as shown in the Invitation for Bids. Whether or not Bidders attend the Bid Opening, they shall give their Bids to the Owner's procurement officer or his/her designee as shown in the Invitation for Bids prior to the time of the Bid Opening.

**2.29. Insert the following Section 4.3.6 and substitute the following:**

**4.3.5** The official time for receipt of Bids will be determined by reference to the clock designated by the Owner's procurement officer or his/her designee. The procurement officer conducting the Bid Opening will determine and announce that the deadline has arrived and no further Bids or bid modifications will be accepted. All Bids and bid modifications in the possession of the procurement officer at the time the announcement is completed will be timely, whether or not the bid envelope has been date/time stamped or otherwise marked by the procurement officer.

**2.30. Delete Section 4.4.2 and substitute the following:**

**4.4.2** Prior to the time and date designated for receipt of Bids, a Bid submitted may be withdrawn in person or by written notice to the party receiving Bids at the place designated for receipt of Bids. Withdrawal by written notice shall be in writing over the signature of the Bidder.

**2.31. In Section 5.1, delete everything following the caption "OPENING OF BIDS" and substitute the following:**

**5.1.1** Bids received on time will be publicly opened and will be read aloud. Owner will not read aloud Bids that Owner determines, at the time of opening, to be non-responsive. .

**5.1.2** At bid opening, Owner will announce the date and location of the posting of the Notice of Intended Award.

**5.1.3** Owner will send a copy of the final Bid Tabulation to all Bidders within ten (10) working days of the Bid Opening.

**OSE FORM 00201****STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS**

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**5.1.4** If Owner determines to award the Project, Owner will, after posting a Notice of Intended Award, send a copy of the Notice to all Bidders.

**5.1.5** If only one Bid is received, Owner will open and consider the Bid.

**2.32.** *In Section 5.2, insert the section number “5.2.1” before the words of the “The Owner” at the beginning of the sentence.*

**2.33.** *Insert the following Sections 5.2.2 and 5.2.3:*

**5.2.2** The reasons for which the Owner will reject Bids include, but are not limited to:

- .1** Failure by a Bidder to be represented at a Mandatory Pre-Bid Conference or site visit;
- .2** Failure to deliver the Bid on time;
- .3** Failure to comply with Bid Security requirements, except as expressly allowed by law;
- .4** Listing an invalid electronic Bid Bond authorization number on the bid form;
- .5** Failure to Bid an Alternate, except as expressly allowed by law;
- .6** Failure to list qualified Subcontractors as required by law;
- .7** Showing any material modification(s) or exception(s) qualifying the Bid;
- .8** Faxing a Bid directly to the Owner or their representative; or
- .9** Failure to include a properly executed Power-of-Authority with the bid bond.

**5.2.3** The Owner may reject a Bid as nonresponsive 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 the Owner even though it may be the low evaluated bid, or if it is so unbalanced as to be tantamount to allowing an advance payment.

**2.34.** *Delete Section 6.1 and substitute the following:*

**6.1 CONTRACTOR'S RESPONSIBILITY**

Owner will make a determination of Bidder's responsibility before awarding a contract. Bidder shall provide all information and documentation requested by the Owner to support the Owner's evaluation of responsibility. Failure of Bidder to provide requested information is cause for the Owner, at its option, to determine the Bidder to be non-responsible

**2.35.** *Delete the language of Section 6.2 and insert the word “Reserved.”*

**2.36.** *Delete the language of Sections 6.3.2, 6.3.3, and 6.3.4 and insert the word “Reserved” after each Section Number.*

**2.37.** *Insert the following Section 6.4*

**6.4 CLARIFICATION**

Pursuant to Section 11-35-1520(8), the Procurement Officer may elect to communicate with a Bidder after opening for the purpose of clarifying either the Bid or the requirements of the Invitation for Bids. Such communications may be conducted only with Bidders who have submitted a Bid which obviously conforms in all material aspects to the Invitation for Bids and only in accordance with Appendix D (Paragraph A(6)) to the Manual for Planning and Execution of State Permanent Improvement, Part II. Clarification of a Bid must be documented in writing and included with the Bid. Clarifications may not be used to revise a Bid or the Invitation for Bids. [Section 11-35-1520(8); R.19-445.2080]

**2.38.** *Delete Section 7.1.2 and substitute the following:*

**7.1.2** The performance and payment bonds shall conform to the requirements of Section 11.4 of the General Conditions of the Contract. If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid.

**2.39.** *Delete the language of Section 7.1.3 and insert the word “Reserved.”*

**2.40.** *In Section 7.2, insert the words “CONTRACT, CERTIFICATES OF INSURANCE” into the caption after the word “Delivery.”*

**OSE FORM 00201****STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS****2.41. Delete Section 7.2.1 and substitute the following:**

**7.2.1** After expiration of the protest period, the Owner will tender a signed Contract for Construction to the Bidder and the Bidder shall return the fully executed Contract for Construction to the Owner within seven days thereafter. The Bidder shall deliver the required bonds and certificate of insurance to the Owner not later than three days following the date of execution of the Contract. Failure to deliver these documents as required shall entitle the Owner to consider the Bidder's failure as a refusal to enter into a contract in accordance with the terms and conditions of the Bidder's Bid and to make claim on the Bid Security for re-procurement cost.

**2.42. Delete the language of Section 7.2.2 and insert the word "Reserved."****2.43. Delete the language of Article 8 and insert the following:**

Unless otherwise required in the Bidding Documents, the Agreement for the Work will be written on South Carolina Modified AIA Document A101, 2007, Standard Form of Agreement Between Owner and Contractor as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor.

**2.44. Insert the following Article 9:****ARTICLE 9 MISCELLANEOUS****9.1 NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING  
IMPORTANT TAX NOTICE - NONRESIDENTS ONLY**

Withholding Requirements for Payments to Nonresidents: Section 12-8-550 of the South Carolina Code of Laws requires persons hiring or contracting with a nonresident conducting a business or performing personal services of a temporary nature within South Carolina to withhold 2% of each payment made to the nonresident. The withholding requirement does not apply to (1) payments on purchase orders for tangible personal property when the payments are not accompanied by services to be performed in South Carolina, (2) nonresidents who are not conducting business in South Carolina, (3) nonresidents for contracts that do not exceed \$10,000 in a calendar year, or (4) payments to a nonresident who (a) registers with either the S.C. Department of Revenue or the S.C. Secretary of State and (b) submits a Nonresident Taxpayer Registration Affidavit - Income Tax Withholding, Form I-312 to the person letting the contract.

For information about other withholding requirements (e.g., employee withholding), contact the Withholding Section at the South Carolina Department of Revenue at 803-898-5383 or visit the Department's website at: [www.sctax.org](http://www.sctax.org)

This notice is for informational purposes only. This Owner does not administer and has no authority over tax issues. All registration questions should be directed to the License and Registration Section at 803-898-5872 or to the South Carolina Department of Revenue, Registration Unit, Columbia, S.C. 29214-0140. All withholding questions should be directed to the Withholding Section at 803-898- 5383.

PLEASE SEE THE "NONRESIDENT TAXPAYER REGISTRATION AFFIDAVIT INCOME TAX WITHHOLDING" FORM (FORM NUMBER I-312) LOCATED AT:  
<http://www.sctax.org/Forms+and+Instructions/withholding/default.htm>.

**9.2 CONTRACTOR LICENSING**

Contractors and Subcontractors listed in Section 7 of the Bid Form who are required by the South Carolina Code of Laws to be licensed, must be licensed at the time of bidding.

**9.3 SUBMITTING CONFIDENTIAL INFORMATION**

For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the word "CONFIDENTIAL" every page, or portion thereof, that Bidder contends contains information that is exempt from public disclosure because it is either (a) a trade secret as defined in Section 30-4-40(a)(1), or (b) privileged & confidential, as that phrase is used in Section 11-35-410. For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the words "TRADE SECRET" every page, or portion thereof, that Bidder contends contains a trade secret as that term is defined by Section 39-8-20 of the Trade Secrets Act. For every document Bidder submits in response to or with regard to this solicitation or request, Bidder must separately mark with the word "PROTECTED" every page, or portion thereof, that Bidder contends is protected by Section 11-35-1810. All markings must be conspicuous; use color, bold, underlining, or some other method in order to conspicuously distinguish the mark from the other text. Do not mark your entire bid as confidential, trade secret, or protected! If your bid, or any part thereof, is improperly marked as confidential or trade



**OSE FORM 00201****STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS**

secret or protected, the State may, in its sole discretion, determine it nonresponsive. If only portions of a page are subject to some protection, do not mark the entire page. By submitting a response to this solicitation, Bidder (1) agrees to the public disclosure of every page of every document regarding this solicitation or request that was submitted at any time prior to entering into a contract (including, but not limited to, documents contained in a response, documents submitted to clarify a response, & documents submitted during negotiations), unless the page is conspicuously marked "TRADE SECRET" or "CONFIDENTIAL" or "PROTECTED", (2) agrees that any information not marked, as required by these bidding instructions, as a "Trade Secret" is not a trade secret as defined by the Trade Secrets Act, & (3) agrees that, notwithstanding any claims or markings otherwise, any prices, commissions, discounts, or other financial figures used to determine the award, as well as the final contract amount, are subject to public disclosure. In determining whether to release documents, the State will detrimentally rely on Bidders's marking of documents, as required by these bidding instructions, as being either "Confidential" or "Trade Secret" or "PROTECTED". By submitting a response, Bidder agrees to defend, indemnify & hold harmless the State of South Carolina, its officers & employees, from every claim, demand, loss, expense, cost, damage or injury, including attorney's fees, arising out of or resulting from the State withholding information that Bidder marked as "confidential" or "trade secret" or "PROTECTED".

**9.4 POSTING OF INTENT TO AWARD**

Notice of Intent to Award, SE-370, will be posted at the following location:

**Room or Area of Posting:** Reception Area

**Building Where Posted:** Facilities Management Center

**Address of Building:** 743 Greene Street, Columbia SC 29208

**WEB site address (if applicable):** [purchasing.sc.edu](http://purchasing.sc.edu)

**Posting date will be announced at bid opening.** In addition to posting the notice, the Owner will promptly send all responsive bidders a copy of the notice of intent to award and the final bid tabulation

**9.5 PROTEST OF SOLICITATION OR AWARD**

Any prospective bidder, offeror, contractor, or subcontractor who is aggrieved in connection with the solicitation of a contract shall protest within fifteen days of the date of issuance of the applicable solicitation document at issue. Any actual bidder, offeror, contractor, or subcontractor who is aggrieved in connection with the intended award or award of a contract shall protest within ten days of the date notification of intent to award is posted in accordance with Title 11, Chapter 35, Section 4210 of the South Carolina Code of Laws, as amended. A protest shall be in writing, shall set forth the grounds of the protest and the relief requested with enough particularity to give notice of the issues to be decided, and must be received by the State Engineer within the time provided.

Any protest must be addressed to the CPO, Office of State Engineer, and submitted in writing:

(a) by email to [protest-ose@mmo.sc.gov](mailto:protest-ose@mmo.sc.gov),

(b) by facsimile at 803-737-0639, or

(c) by post or delivery to 1201 Main Street, Suite 600, Columbia, SC 29201.

By submitting a protest to the foregoing email address, you (and any person acting on your behalf) consent to receive communications regarding your protest (and any related protests) at the e-mail address from which you sent your protest.

**9.6 SOLICITATION INFORMATION FROM SOURCES OTHER THAN OFFICIAL SOURCE**

South Carolina Business Opportunities (SCBO) is the official state government publication for State of South Carolina solicitations. Any information on State agency solicitations obtained from any other source is unofficial and any reliance placed on such information is at the bidder's sole risk and is without recourse under the South Carolina Consolidated Procurement Code.

**9.7 BUILDER'S RISK INSURANCE**

Bidder's are directed to Article 11.3 of the South Carolina Modified AIA Document A201, 2007 Edition, which, unless provided otherwise in the bid documents, requires the contractor to provide builder's risk insurance on the project.

**OSE FORM 00201**

**STANDARD SUPPLEMENTAL INSTRUCTIONS TO BIDDERS**

**9.8 TAX CREDIT FOR SUBCONTRACTING WITH MINORITY FIRMS**

Pursuant to Section 12-6-3350, taxpayers, who utilize certified minority subcontractors, may take a tax credit equal to 4% of the payments they make to said subcontractors. The payments claimed must be based on work performed directly for a South Carolina state contract. The credit is limited to a maximum of fifty thousand dollars annually. The taxpayer is eligible to claim the credit for 10 consecutive taxable years beginning with the taxable year in which the first payment is made to the subcontractor that qualifies for the credit. After the above ten consecutive taxable years, the taxpayer is no longer eligible for the credit. The credit may be claimed on Form TC-2, "Minority Business Credit." A copy of the subcontractor's certificate from the Governor's Office of Small and Minority Business (OSMBA) is to be attached to the contractor's income tax return. Taxpayers must maintain evidence of work performed for a State contract by the minority subcontractor. Questions regarding the tax credit and how to file are to be referred to: SC Department of Revenue, Research and Review, Phone: (803) 898-5786, Fax: (803) 898-5888. The subcontractor must be certified as to the criteria of a "Minority Firm" by the Governor's Office of Small and Minority Business Assistance (OSMBA). Certificates are issued to subcontractors upon successful completion of the certification process. Questions regarding subcontractor certification are to be referred to: Governor's Office of Small and Minority Business Assistance, Phone: (803) 734-0657, Fax: (803) 734-2498. Reference: SC §11-35-5010 – Definition for Minority Subcontractor & SC §11-35-5230 (B) – Regulations for Negotiating with State Minority Firms.

**§ 9.9 OTHER SPECIAL CONDITIONS OF THE WORK**

Section 00210 - Supplement A - Request for Information

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\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**END OF DOCUMENT**

**SECTION 00201 - SUPPLEMENT A - REQUEST FOR INFORMATION**

TO: GMK ASSOCIATES, INC. FROM: \_\_\_\_\_

ATTENTION: JEROME K. SIMONS

DATE/TIME: \_\_\_\_\_ TELEPHONE #: \_\_\_\_\_

FAX NUMBER: 803.255.7243 FAX #: \_\_\_\_\_

NUMBER OF PAGES \_\_\_\_\_ CONTACT: \_\_\_\_\_

PROJECT NAME: USC AIKEN GREENHOUSE

INSTRUCTIONS: IN SPACES PROVIDED BELOW, LIST SPECIFICATION SECTION AND/OR PLAN SHEET FOR WHICH INFORMATION OR CLARIFICATION IS NEEDED FOLLOWED BY DESCRIPTION OR REQUIRED INFORMATION. USE ADDITIONAL COPIES OF REQUEST FOR INFORMATION FORMS AS NEEDED FOR ADDITIONAL REQUESTS. LIMIT TO ONE QUESTION OR SUBJECT INQUIRY PER R.F.I.

SPECIFICATION SECTION(S):

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DRAWING SHEET(S):

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**END OF SECTION**

**SECTION 00300 - BID BOND**

**FORM OF BID BOND**

- 1.01 See AIA Document A310 (1970 Edition) , Bid Bond available at the office of GMK Associates, Inc., 1201 Main Street Suite 2100, Columbia, SC 29201. 803-256-0000 OR,
- A. Copies of this document may be obtained from The American Institute of Architects, 1522 Richland Street., Columbia, SC 29201. 803-252-6050.

**END OF SECTION**

**SE-330 – LUMP SUM BID  
BID FORM**

*Bidders shall submit bids on only Bid Form SE-330.*

**BID SUBMITTED BY:** \_\_\_\_\_  
(Bidder's Name)

**BID SUBMITTED TO:** University of South Carolina, Aiken  
(Owner's Name)

**FOR PROJECT: PROJECT NAME** USC Aiken Greenhouse Repackaging Rebid  
**PROJECT NUMBER** H29-I337

**OFFER**

§ 1. In response to the Invitation for Construction Bids and in compliance with the Instructions to Bidders for the above-named Project, the undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into a Contract with the Owner on the terms included in the Bidding Documents, and to perform all Work as specified or indicated in the Bidding Documents, for the prices and within the time frames indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

§ 2. Pursuant to Section 11-32-3030(1) of the SC Code of Laws, as amended, Bidder has submitted Bid Security as follows in the amount and form required by the Bidding Documents:

Bid Bond with Power of Attorney     Electronic Bid Bond     Cashier's Check

(Bidder check one)

§ 3. Bidder acknowledges the receipt of the following Addenda to the Bidding Documents and has incorporated the effects of said Addenda into this Bid:

**ADDENDUM No:** \_\_\_\_\_

§ 4. Bidder accepts all terms and conditions of the Invitation for Bids, including, without limitation, those dealing with the disposition of Bid Security. Bidder agrees that this Bid, including all Bid Alternates, if any, may not be revoked or withdrawn after the opening of bids, and shall remain open for acceptance for a period of 60 Days following the Bid Date, or for such longer period of time that Bidder may agree to in writing upon request of the Owner.

§ 5. Bidder herewith offers to provide all labor, materials, equipment, tools of trades and labor, accessories, appliances, warranties and guarantees, and to pay all royalties, fees, permits, licenses and applicable taxes necessary to complete the following items of construction work:

**§ 6.1 BASE BID WORK** *(as indicated in the Bidding Documents and generally described as follows):* The project consists of the construction of an owner provided 2,100 square foot greenhouse using a greenhouse kit. The project also includes associated sitework, utilities, foundations, building base, electrical, plumbing etc.,

\_\_\_\_\_, which sum is hereafter called the Base Bid.

(Bidder - insert Base Bid Amount on line above)

**SE-330 – LUMP SUM BID  
BID FORM**

§ 6.2 BID ALTERNATES - as indicated in the Bidding Documents and generally described as follows:

**ALTERNATE # 1** (*Brief Description*): The electrical contractor's scope of work shall consist of furnishing and installing all electrical elements as shown in Weatherhead Detail 2/E2.0 and Power Riser Diagram as shown on Sheet E2.0. This shall include and not be limited to 225A Panel "P1" and all circuit breakers, CT meter, weatherhead and all associated conduit and wire required for a complete installation.

ADD TO or  DEDUCT FROM BASE BID: \_\_\_\_\_

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

**ALTERNATE # 2** (*Brief Description*): The electrical contractor's scope of work shall consist of furnishing and installing all the electrical elements as shown in Weatherhead Detail 2/E2.0 and Power Riser Diagram as shown on Sheet E2.0. This shall include and not be limited to 225A Panel "P1" and all circuit breakers, CT meter, weatherhead and all associated conduit and wire required for a complete installation. The electrical contractor shall also furnish and install all materials and labor to upfit Greenhouse #2 and the connector greenhouse structure as well. This shall include and not be limited to all light fixture not included in the greenhouse kit, light switches, receptacles, disconnect switches, junction boxes and all associated conduit and wiring required for a complete installation per the design as indicated on the electrical drawings as shown on sheet E2.0, V1.0, V2.0 and V3.0.

ADD TO or  DEDUCT FROM BASE BID: \_\_\_\_\_

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

**ALTERNATE # 3** (*Brief Description*): All labor and materials associated with the installation of the two 1" data conduits indicated on drawing C-101 shall be deleted from the scope of work including the trenching, asphalt patches, handholes, conduit, etc.

ADD TO or  DEDUCT FROM BASE BID: \_\_\_\_\_

(Bidder to Mark appropriate box to clearly indicate the price adjustment offered for each alternate)

**SE-330 – LUMP SUM BID  
BID FORM**

**§ 7. LISTING OF PROPOSED SUBCONTRACTORS PURSUANT TO SECTION 3020(b)(i), CHAPTER 35, TITLE 11 OF THE SOUTH CAROLINA CODE OF LAWS, AS AMENDED – (See Instructions on the following page BF-2A)**

Bidder shall use the below-listed Subcontractors in the performance of the Subcontractor Specialty work listed:

<b>SUBCONTRACTOR SPECIALTY</b> <b>By License Classification and/or Subclassification</b> (Completed by Owner)	<b>SUBCONTRACTOR'S PRIME CONTRACTOR'S NAME</b> (Must be completed by Bidder) <b>BASE BID</b>	<b>SUBCONTRACTOR'S PRIME CONTRACTOR'S SC LICENSE NUMBER</b>
Plumbing		
Electrical		
<b>ALTERNATE 1</b>		
Electrical		
<b>ALTERNATE 2</b>		
Electrical		
<b>ALTERNATE 3</b>		

If a Bid Alternate is accepted, Subcontractors listed for the Bid Alternate shall be used for the work of both the Alternate and the Base Bid work.

## **INSTRUCTIONS FOR SUBCONTRACTOR LISTING**

- 1.** Section 7 of the Bid Form sets forth a list of subcontractor specialties for which bidder is required to identify by name the subcontractor(s) Bidder will use to perform the work of each listed specialty. Bidder must identify only the subcontractor(s) who will perform the work and no others.
- 2.** For purposes of subcontractor listing, a Subcontractor is an entity who will perform work or render service to the prime contractor to or about the construction site. Material suppliers, manufacturers, and fabricators that will not perform physical work at the site of the project but will only supply materials or equipment to the bidder or proposed subcontractor(s) are not subcontractors and Bidder should not insert their names in the spaces provided on the bid form. Likewise, Bidder should not insert the names of sub-subcontractors in the spaces provided on the bid form but only the names of those entities with which bidder will contract directly.
- 3.** Bidder must only insert the names of subcontractors who are qualified to perform the work of the listed specialties as specified in the Bidding Documents and South Carolina Licensing Laws.
- 4.** If under the terms of the Bidding Documents, Bidder is qualified to perform the work of a specialty listed and Bidder does not intend to subcontract such work but to use Bidder's own employees to perform such work, the Bidder must insert its own name in the space provided for that specialty.
- 5.** If Bidder intends to use multiple subcontractors to perform the work of a single specialty listing, Bidder must insert the name of each subcontractor Bidder will use, preferably separating the name of each by the word **"and"**. If Bidder intends to use both his own employees to perform a part of the work of a single specialty listing and to use one or more subcontractors to perform the remaining work for that specialty listing, bidder must insert his own name and the name of each subcontractor, preferably separating the name of each with the word **"and"**.
- 6.** Bidder may not list subcontractors in the alternative nor in a form that may be reasonably construed at the time of bid opening as a listing in the alternative. A listing that requires subsequent explanation to determine whether or not it is a listing in the alternative is non-responsive. If bidder intends to use multiple entities to perform the work for a single specialty listing, bidder must clearly set forth on the bid form such intent. Bidder may accomplish this by simply inserting the word **"and"** between the name of each entity listed for that specialty. Owner will reject as non-responsive a listing that contains the names of multiple subcontractors separated by a blank space, the word "or", a virgule (that is a /), or any separator that the Owner may reasonably interpret as a listing in the alternative.
- 7.** If Bidder is awarded the contract, bidder must, except with the approval of the owner for good cause shown, use the listed entities to perform the work for which they are listed.
- 8.** If bidder is awarded the contract, bidder will not be allowed to substitute another entity as subcontractor in place of a subcontractor listed in Section 7 of the Bid except for one or more of the reasons allowed by the SC Code of Laws.
- 9.** Bidder's failure to insert a name for each listed specialty subcontractor will render the Bid non-responsive.



**SE-330 – LUMP SUM BID  
BID FORM**

**§ 8. LIST OF MANUFACTURERS, MATERIAL SUPPLIERS, AND SUBCONTRACTORS OTHER THAN SUBCONTRACTORS LISTED IN SECTION 7 ABOVE (FOR INFORMATION ONLY):** Pursuant to instructions in the Invitation for Bids, if any, Bidder will provide to Owner upon the Owner's request and within 24 hours of such request, a listing of manufacturers, material suppliers, and subcontractors, other than those listed in Section 7 above, that Bidder intends to use on the project. Bidder acknowledges and agrees that this list is provided for purposes of determining responsibility and not pursuant to the subcontractor listing requirements of SC Code Ann § 11-35-3020(b)(i).

**§ 9. TIME OF CONTRACT PERFORMANCE AND LIQUIDATED DAMAGES**

a. **CONTRACT TIME:** Bidder agrees that the Date of Commencement of the Work shall be established in a Notice to Proceed to be issued by the Owner. Bidder agrees to substantially complete the Work within **120** calendar days from the Date of Commencement, subject to adjustments as provided in the Contract Documents.

b. **LIQUIDATED DAMAGES:** Bidder further agrees that from the compensation to be paid, the Owner shall retain as Liquidated Damages the sum of **\$250.00** for each calendar day the actual construction time required to achieve Substantial Completion exceeds the specified or adjusted time for Substantial Completion as provided in the Contract Documents. This sum is intended by the parties as the predetermined measure of compensation for actual damages, not as a penalty for nonperformance.

**§ 10. AGREEMENTS**

a. Bidder agrees that this bid is subject to the requirements of the law of the State of South Carolina.

b. Bidder agrees that at any time prior to the issuance of the Notice to Proceed for this Project, this Project may be canceled for the convenience of, and without cost to, the State.

c. Bidder agrees that neither the State of South Carolina nor any of its agencies, employees or agents shall be responsible for any bid preparation costs, or any costs or charges of any type, should all bids be rejected or the Project canceled for any reason prior to the issuance of the Notice to Proceed.

**§ 11. ELECTRONIC BID BOND**

By signing below, the Principal is affirming that the identified electronic bid bond has been executed and that the Principal and Surety are firmly bound unto the State of South Carolina under the terms and conditions of the AIA Document A310, Bid Bond, included in the Bidding Documents.

**Electronic Bid Bond Number:** \_\_\_\_\_

**Signature and Title:** \_\_\_\_\_

**SE-330 – LUMP SUM BID  
BID FORM**

**BIDDER'S TAXPAYER IDENTIFICATION**

FEDERAL EMPLOYER'S IDENTIFICATION NUMBER: \_\_\_\_\_

*OR*

SOCIAL SECURITY NUMBER: \_\_\_\_\_

**CONTRACTOR'S CLASSIFICATIONS AND SUBCLASSIFICATIONS WITH LIMITATIONS**

*Classification(s) & Limits:* \_\_\_\_\_

*Subclassification(s) & Limits:* \_\_\_\_\_

*SC Contractor's License Number(s):* \_\_\_\_\_

BY SIGNING THIS BID, THE PERSON SIGNING REAFFIRMS ALL REPRESENTATIONS AND CERTIFICATIONS MADE BY BOTH THE PERSON SIGNING AND THE BIDDER, INCLUDING WITHOUT LIMITATION, THOSE APPEARING IN ARTICLE 2 OF THE INSTRUCTIONS TO BIDDER. THE INVITATION FOR BIDS, AS DEFINED IN THE INSTRUCTIONS TO BIDDERS, IS EXPRESSLY INCORPORATE BY REFERENCE.

**SIGNATURE**

**BIDDER'S LEGAL NAME:** \_\_\_\_\_

**ADDRESS:** \_\_\_\_\_  
\_\_\_\_\_

**BY:** \_\_\_\_\_  
*(Signature)*

**DATE:** \_\_\_\_\_

**TITLE:** \_\_\_\_\_

**TELEPHONE:** \_\_\_\_\_

**EMAIL:** \_\_\_\_\_

**SECTION 00500 - AGREEMENT**

PART 1 GENERAL

FORM OF AGREEMENT

2.01 RELATED REQUIREMENTS

- A. Section 00700 - General Conditions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

AIA DOCUMENT A101-2007, STANDARD FORM OF AGREEMENT BETWEEN OWNER AND CONTRACTOR, FORMS THE BASIS OF CONTRACT BETWEEN THE OWNER AND CONTRACTOR.

5.01 This document is not bound within the project manual.

- A. Copies of this document may be obtained from The American Institute of Architects, 1522 Richland Street., Columbia, SC 29201. 803-252-6050.
- B. OR it can be viewed at the offices of GMK Associates, Inc., 1201 Main Street Suite 2100 Columbia, SC 29201 (803)256-0000

5.02 Refer to document 00501-OSE 2011 for modifications to this document.

END OF AGREEMENT

**OSE FORM 00501**  
**STANDARD MODIFICATIONS TO AGREEMENT BETWEEN**  
**OWNER AND CONTRACTOR**

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**OWNER:** University of South Carolina

**PROJECT NUMBER:** H29-I337

**PROJECT NAME:** USC Aiken Greenhouse Repackaging Rebid

**1. STANDARD MODIFICATIONS TO AIA A101-2007**

**1.1.** These Standard Modifications amend or supplement the *Standard Form of Agreement Between Owner and Contractor* (AIA Document A101-2007) and other provisions of Bidding and Contract Documents as indicated below.

**1.2.** All provisions of A101-2007, which are not so amended or supplemented, remain in full force and effect.

**2. MODIFICATIONS TO A101**

**2.1.** *Insert the following at the end of Article 1:*

Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.

**2.2.** *Delete Section 3.1 and substitute the following:*

**3.1** The Date of Commencement of the Work shall be the date fixed in a Notice to Proceed issued by the Owner. The Owner shall issue the Notice to Proceed to the Contractor in writing, no less than seven days prior to the Date of Commencement. Unless otherwise provided elsewhere in the contract documents, and provided the contractor has secured all required insurance and surety bonds, the contractor may commence work immediately after receipt of the Notice to Proceed.

**2.3.** *Delete Section 3.2 and substitute the following:*

**3.2** The Contract Time shall be measured from the Date of Commencement as provided in Section 9(a) of the Bid Form (SE-330) for this Project. Contractor agrees that if the Contractor fails to achieve Substantial Completion of the Work within the Contract Time, the Owner shall be entitled to withhold or recover from the Contractor liquidated damages in the amounts set forth in Section 9(b) of the Bid Form (SE-330), subject to adjustments of this Contract Time as provided in the Contract Documents.

**2.4.** *In Section 5.1.1, insert the words “and Owner” after the phrase “Payment submitted to the Architect.”*

**2.5.** *Delete Section 5.1.3 and substitute the following:*

**5.1.3** The Owner shall make payment of the certified amount to the Contractor not later than 21 days after receipt of the Application for Payment.

**2.6.** *In Section 5.1.6, Insert the following after the phrase “Subject to other provisions of the Contract Documents”:*

and subject to Title 12, Chapter 8, Section 550 of the South Carolina Code of Laws, as amended (Withholding Requirements for Payments to Non-Residents)

*In the spaces provided in Sub-Sections 1 and 2 for inserting the retainage amount, insert “three and one-half percent (3.5%).”*

**OSE FORM 00501**  
**STANDARD MODIFICATIONS TO AGREEMENT BETWEEN**  
**OWNER AND CONTRACTOR**

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2.7. *In Section 5.1.8, delete the word “follows” and the colon and substitute the following:*

set forth in S.C. Code Ann. § 11-35-3030(4).

2.8. *In Section 5.1.9, delete the words “Except with the Owner’s prior approval, the” before the word “Contractor.”*

2.9. *In Section 5.2.2, delete the number 30 and substitute the number 21, delete everything following the words “Certificate for Payment” and place a period at the end of the resulting sentence.*

2.10. *Delete the language of Sections 6.1 and 6.2 and substitute the word “Reserved” for the deleted language of each Section .*

2.11. *Delete the language of Section 8.2 and substitute the word “Reserved.”*

2.12. *In Section 8.3, make the word “Representative” in the title plural, delete everything following the title, and substitute the following:*

**8.3.1** Owner designates the individual listed below as its Senior Representative (“Owner's Senior Representative”), which individual has the responsibility for and, subject to Section 7.2.1 of the General Conditions, the authority to resolve disputes under Section 15.6 of the General Conditions:

**Name:** Tom Opal  
**Title:** USC Senior Project Manager  
**Address:** 743 Greene Street, Columbia, South Carolina 29208  
**Telephone:** 803-777-5996      **FAX:** 803-777-8739  
**Email:** topal@fmc.sc.edu

**8.3.2** Owner designates the individual listed below as its Owner's Representative, which individual has the authority and responsibility set forth in Section 2.1.1 of the General Conditions:

**Name:** Troy Green  
**Title:** USC Project Manager  
**Address:** 743 Greene Street, Columbia, South Carolina 29208  
**Telephone:** 803-777-8256 **FAX:** 803-777-8739  
**Email:** green@fmc.sc.edu

2.13. *In Section 8.4, make the word “Representative” in the title plural, delete everything following the title, and substitute the following:*

**8.4.1** Contractor designates the individual listed below as its Senior Representative (“Contractor's Senior Representative”), which individual has the responsibility for and authority to resolve disputes under Section 15.6 of the General Conditions:

**Name:** \_\_\_\_\_  
**Title:** \_\_\_\_\_  
**Address:** \_\_\_\_\_  
**Telephone:** \_\_\_\_\_      **FAX:** \_\_\_\_\_  
**Email:** \_\_\_\_\_

**OSE FORM 00501**  
**STANDARD MODIFICATIONS TO AGREEMENT BETWEEN**  
**OWNER AND CONTRACTOR**

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8.4.2 Contractor designates the individual listed below as its Contractor's Representative, which individual has the authority and responsibility set forth in Section 3.1.1 of the General Conditions:

Name: \_\_\_\_\_  
Title: \_\_\_\_\_  
Address: \_\_\_\_\_  
Telephone: \_\_\_\_\_ FAX: \_\_\_\_\_  
Email: \_\_\_\_\_

2.14. *Add the following Section 8.6.1:*

8.6.1 The Architect's representative:

Name: Jerome K. Simons  
Title: Project Architect  
Address: 1201 Main Street, Suite 2100, Columbia, South Carolina 29201  
Telephone: 803-256-0000 FAX: 803-255-7243  
Email: jsimons@gmka.com

2.15. *In Section 9.1.7, Sub-Section 2, list the following documents in the space provided for listing documents:*

Invitation for Construction Bids (SE-310)  
Instructions to Bidders (AIA Document A701-1997)  
Standard Supplemental Instructions to Bidders (OSE Form 00201)  
Contractor's Bid (Completed SE-330)  
Notice of Intent to Award (Completed SE-370)  
Certificate of procurement authority issued by the SC Budget & Control Board

2.16. *In Article 10, delete everything after the first sentence.*

**END OF DOCUMENT**

**SECTION 00700 - GENERAL CONDITIONS**

**FORM OF GENERAL CONDITIONS**

AIA DOCUMENT A201, 2007 EDITION, GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, IS THE GENERAL CONDITIONS BETWEEN THE OWNER AND CONTRACTOR.

2.01 This document is not bound within the project manual.

- A. Copies of this document may be obtained from The American Institute of Architects, 1522 Richland Street., Columbia, SC 29201. 803-252-6050.
- B. OR it can be viewed at the offices of GMK Associates, Inc., 1201 Main Street Suite 2100 Columbia, SC 29201 (803)256-0000

**SUPPLEMENTARY CONDITIONS**

3.01 Refer to Document 00811-OSE 2011 for amendments to these General Conditions.

**END OF DOCUMENT 00700**

**SECTION 00800 - SUPPLEMENTARY CONDITIONS**

**PART 1 GENERAL**

**1.01 SUMMARY**

1.02 These Supplementary Conditions amend and supplement the General Conditions defined in Document 00700 and other provisions of the Contract Documents as indicated below. All provisions that are not so amended or supplemented remain in full force and effect.

**1.03 MODIFICATIONS TO GENERAL CONDITIONS**

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF DOCUMENT**



**OSE FORM 00811**  
**STANDARD SUPPLEMENTARY CONDITIONS**

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**OWNER:** University of South Carolina  
**PROJECT NUMBER:** H29-I337  
**PROJECT NAME:** USC Aiken Greenhouse Repackaging Rebid

**1 GENERAL CONDITIONS**

The *General Conditions of the Contract for Construction*, AIA Document A201, 2007 Edition, Articles 1 through 15 inclusive, is a part of this Contract and is incorporated as fully as if herein set forth. For brevity, AIA Document A201 is also referred to in the Contract Documents collectively as the "General Conditions."

**2 STANDARD SUPPLEMENTARY CONDITIONS**

**2.1** The following supplements modify, delete and/or add to the General Conditions. Where any portion of the General Conditions is modified or any paragraph, Section or clause thereof is modified or deleted by these Supplementary Conditions, the unaltered provisions of the General Conditions shall remain in effect.

**2.2** Unless otherwise stated, the terms used in these Standard Supplementary Conditions which are defined in the General Conditions have the meanings assigned to them in the General Conditions.

**3 MODIFICATIONS TO A201-2007**

**3.1** *Insert the following at the end of Section 1.1.1:*

Any reference in this document to the Agreement between the Owner and Contractor, AIA Document A101, or some abbreviated reference thereof, shall mean the AIA A101, 2007 Edition as modified by OSE Form 00501 – Standard Modification to Agreement Between Owner and Contractor. Any reference in this document to the General Conditions of the Contract for Construction, AIA Document A201, or some abbreviated reference thereof, shall mean the AIA A201, 2007 Edition as modified by OSE Form 00811 – Standard Supplementary Conditions.

**3.2** *Delete the language of Section 1.1.8 and substitute the word "Reserved."*

**3.3** *Add the following Section 1.1.9:*

**1.1.9 NOTICE TO PROCEED**

Notice to Proceed is a document issued by the Owner to the Contractor, with a copy to the Architect, directing the Contractor to begin prosecution of the Work in accordance with the requirements of the Contract Documents. The Notice to Proceed shall fix the date on which the Contract Time will commence.

**3.4** *Insert the following at the end of Section 1.2.1:*

In the event of patent ambiguities within or between parts of the Contract Documents, the contractor shall 1) provide the better quality or greater quantity of Work, or 2) comply with the more stringent requirement, either or both in accordance with the Architect’s interpretation.

**3.5** *Delete Section 1.5.1 and substitute the following:*

**1.5.1** The Architect and the Architect’s consultants shall be deemed the authors and owners of their respective Instruments of Service and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as a violation of the Architect’s or Architect’s consultants’ reserved rights.

**OSE FORM 00811**  
**STANDARD SUPPLEMENTARY CONDITIONS**

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**3.6** *Delete Section 2.1.1 and substitute the following:*

**2.1.1** The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner’s approval or authorization, except as provided in Section 7.1.2. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term “Owner” means the Owner or the Owner’s Representative. [Reference § 8.2 of the Agreement.]

**3.7** *Delete Section 2.1.2 and substitute the following:*

**2.1.2** The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to post Notice of Project Commencement pursuant to Title 29, Chapter 5, Section 23 of the South Carolina Code of Laws, as amended.

**3.8** *Delete Section 2.2.3 and substitute the following:*

**2.2.3** The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. Subject to the Contractor’s obligations, including those in Section 3.2, the Contractor shall be entitled to rely on the accuracy of information furnished by the Owner pursuant to this Section but shall exercise proper precautions relating to the safe performance of the Work.

**3.9** *Replace the period at the end of the last sentence of Section 2.2.4 with a semicolon and insert the following after the inserted semicolon:*

“however, the Owner does not warrant the accuracy of any such information requested by the Contractor that is not otherwise required of the Owner by the Contract Documents. Neither the Owner nor the Architect shall be required to conduct investigations or to furnish the Contractor with any information concerning subsurface characteristics or other conditions of the area where the Work is to be performed beyond that which is provide in the Contract Documents.”

**3.10** *Delete Section 2.2.5 and substitute the following:*

**2.2.5** Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor with ten copies of the Contract Documents. The Contractor may make reproductions of the Contract Documents pursuant to Section 1.5.2. All copies of the drawings and specifications, except the Contractor’s record set, shall be returned or suitably accounted for to the Owner, on request, upon completion of the Work.

**3.11** *Add the following Sections 2.2.6 and 2.2.7:*

**2.2.6** The Owner assumes no responsibility for any conclusions or interpretation made by the Contractor based on information made available by the Owner.

**2.2.7** The Owner shall obtain, at its own cost, general building and specialty inspection services as required by the Contract Documents. The Contractor shall be responsible for payment of any charges imposed for reinspections.

**3.12** *Delete Section 2.4 and substitute the following:*

**2.4** If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect, including but not limited to providing necessary resources, with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Directive shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner’s expenses and compensation for the Architect’s additional services made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

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**STANDARD SUPPLEMENTARY CONDITIONS**

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**3.13** *Insert the following at the end of Section 3.2.1:*

The Contractor acknowledges 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 Owner, 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 Owner.

**3.14** *In the third sentence of Section 3.2.4, insert the word “latent” before the word “errors.”*

**3.15** *In the last sentence of Section 3.3.1, insert the words “by the Owner in writing” after the word “instructed.”*

**3.16** *Delete the third sentence of Section 3.5 and substitute the following sentences:*

Work, materials, or equipment not conforming to these requirements shall be considered defective. Unless caused by the Contractor or a subcontractor at any tier, the Contractor’s warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage.

**3.17** *Insert the following at the end of Section 3.6:*

The Contractor shall comply with the requirements of Title 12, Chapter 9 of the South Carolina Code of Laws, as amended, regarding withholding tax for nonresidents, employees, contractors and subcontractors.

**3.18** *In Section 3.7.1, delete the words “the building permit as well as for other” and insert the following sentence at the end of this section:*

Pursuant to Title 10, Chapter 1, Section 180 of the South Carolina Code of Laws, as amended, no local general or specialty building permits are required for state buildings.

**3.19** *Delete the last sentence of Section 3.7.5 and substitute the following:*

Adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 7.3.3.

**3.20** *Delete the last sentence of Section 3.8.2.3 and substitute the following:*

The amount of the Change Order shall reflect the difference between actual costs, as documented by invoices, and the allowances under Section 3.8.2.1.

**3.21** *In Section 3.9.1, insert a comma after the word “superintendent” in the first sentence and insert the following after the inserted comma:*

acceptable to the Owner,

**3.22** *Delete Section 3.9.2 and substitute the following:*

**3.9.2** The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner the name and qualifications of a proposed superintendent. The Owner may reply within 14 days to the Contractor in writing stating (1) whether the Owner has reasonable objection to the proposed superintendent or (2) that the

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Owner requires additional time to review. Failure of the Owner to reply within the 14-day period shall constitute notice of no reasonable objection.

**3.23** *After the first sentence in Section 3.9.3, insert the following sentence:*

The Contractor shall notify the Owner, in writing, of any proposed change in the superintendent, including the reason therefore, prior to making such change.

**3.24** *Delete Section 3.10.3 and substitute the following:*

**3.10.3** Additional requirements, if any, for the construction schedule are as follows:  
(Check box if applicable to this Contract))

The construction schedule shall be in a detailed precedence-style critical path management (CPM) or primavera-type format satisfactory to the Owner and the Architect that shall also (1) provide a graphic representation of all activities and events that will occur during performance of the work; (2) identify each phase of construction and occupancy; and (3) set forth dates that are critical in ensuring the timely and orderly completion of the Work in accordance with the requirements of the Contract Documents (hereinafter referred to as "Milestone Dates"). Upon review and acceptance by the Owner and the Architect of the Milestone Dates, the construction schedule shall be deemed part of the Contract Documents and attached to the Agreement as Exhibit "A." If not accepted, the construction schedule shall be promptly revised by the Contractor in accordance with the recommendations of the Owner and the Architect and resubmitted for acceptance. The Contractor shall monitor the progress of the Work for conformance with the requirements of the construction schedule and shall promptly advise the Owner of any delays or potential delays. Whenever the approved construction schedule no longer reflects actual conditions and progress of the work or the Contract Time is modified in accordance with the terms of the Contract Documents, the Contractor shall update the accepted construction schedule to reflect such conditions. In the event any progress report indicates any delays, the Contractor shall propose an affirmative plan to correct the delay, including overtime and/or additional labor, if necessary. In no event shall any progress report constitute an adjustment in the Contract Time, any Milestone Date, or the Contract Sum unless any such adjustment is agreed to by the Owner and authorized pursuant to Change Order.

**3.25** *Add the following Section 3.10.4:*

**3.10.4** Owner's review and acceptance of Contractor's schedule is not conducted for the purpose of either determining its accuracy and completeness or approving the construction means, methods, techniques, sequences or procedures. The Owner's approval shall not relieve the Contractor of any obligations. Unless expressly addressed in a Modification, the Owner's approval of a schedule shall not change the Contract Time.

**3.26** *Add the following Section 3.12.5.1:*

**3.12.5.1** The fire sprinkler shop drawings shall be prepared by a licensed fire sprinkler contractor and shall accurately reflect actual conditions affecting the required layout of the fire sprinkler system. The fire sprinkler contractor shall certify the accuracy of his shop drawings prior to submitting them for review and approval. The fire sprinkler shop drawings shall be reviewed and approved by the Architect's engineer of record who, upon approving the sprinkler shop drawings will submit them to the State Fire Marshal or other authorities having jurisdiction for review and approval. The Architect's engineer of record will submit a copy of the State Fire Marshal's approval letter to the Contractor, Architect, and OSE. Unless authorized in writing by OSE, neither the Contractor nor subcontractor at any tier shall submit the fire sprinkler shop drawings directly to the State Fire Marshal or other authorities having jurisdiction for approval.

**3.27** *In the fourth sentence of Section 3.12.10, after the comma following the words "licensed design professional," insert the following:*

who shall comply with reasonable requirements of the Owner regarding qualifications and insurance and

**3.28** *In Section 3.13, insert the section number "3.13.1" before the opening words "The Contractors shall."*

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**STANDARD SUPPLEMENTARY CONDITIONS**

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**3.29** Add the following Sections 3.13.2 and 3.13.3:

**3.13.2** Protection of construction materials and equipment stored at the Project site from weather, theft, vandalism, damage, and all other adversity is solely the responsibility of the Contractor. The Contractor shall perform the work in a manner that affords reasonable access, both vehicular and pedestrian, to the site of the Work and all adjacent areas. The Work shall be performed, to the fullest extent reasonably possible, in such a manner that public areas adjacent to the site of the Work shall be free from all debris, building materials, and equipment likely to cause hazardous conditions.

**3.13.3** The Contractor and any entity for whom the Contractor is responsible shall not erect any sign on the Project site without the prior written consent of the Owner.

**3.30** *In the first sentence of Section 3.18.1, after the parenthetical “...(other than the Work itself),...” and before the word “...but...”, insert the following:*

including loss of use resulting therefrom,

**3.31** *Delete Section 4.1.1 and substitute the following:*

**4.1.1** The Architect is that person or entity identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

**3.32** *Insert the following at the end of Section 4.2.1:*

Any reference in the Contract Documents to the Architect taking action or rendering a decision with a “reasonable time” is understood to mean no more than fourteen days, unless otherwise specified in the Contract Documents or otherwise agreed to by the parties.

**3.33** *Delete the first sentence of Section 4.2.2 and substitute the following:*

The Architect will visit the site as necessary to fulfill its obligation to the Owner for inspection services, if any, and, at a minimum, to assure conformance with the Architect’s design as shown in the Contract Documents and to observe the progress and quality of the various components of the Contractor’s Work, and to determine if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents.

**3.34** *Delete the first sentence of Section 4.2.3 and substitute the following:*

On the basis of the site visits, the Architect will keep the Owner informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work.

**3.35** *In Section 4.2.5, after the words “evaluations of the” and before the word “Contractor’s,” insert the following:*

Work completed and correlated with the

**3.36** *Delete the first sentence of Section 4.2.11 and substitute the following:*

**4.2.11** The Architect will, in the first instance, interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. Upon receipt of such request, the Architect will promptly provide the non-requesting party with a copy of the request.

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**STANDARD SUPPLEMENTARY CONDITIONS**

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**3.37** *Insert the following at the end of Section 4.2.12:*

If either party disputes the Architects interpretation or decision, that party may proceed as provided in Article 15. The Architect’s interpretations and decisions may be, but need not be, accorded any deference in any review conducted pursuant to law or the Contract Documents.

**3.38** *Delete Section 4.2.14 and substitute the following:*

The Architect will review and respond to requests for information about the Contract Documents so as to avoid delay to the construction of the Project. The Architect’s response to such requests will be made in writing with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information. Any response to a request for information must be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. Unless issued pursuant to a Modification, supplemental Drawings or Specifications will not involve an adjustment to the Contract Sum or Contract Time.

**3.39** *Delete Section 5.2.1 and substitute the following:*

**5.2.1** Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, within fourteen days after posting of the Notice of Intent to Award the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (excluding Listed Subcontractors but including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Owner may reply within 14 days to the Contractor in writing stating (1) whether the Owner has reasonable objection to any such proposed person or entity. Failure of the Owner to reply within the 14 day period shall constitute notice of no reasonable objection.

**3.40** *Delete Section 5.2.2 and substitute the following:*

**5.2.2** The Contractor shall not contract with a proposed person or entity to whom the Owner has made reasonable and timely objection. The Owner shall not direct the Contractor to contract with any specific individual or entity for supplies or services unless such supplies and services are necessary for completion of the Work and the specified individual or entity is the only source of such supply or services.

**3.41** *In the first sentence of Section 5.2.3, delete the words “...or Architect...” in the two places they appear.*

**3.42** *Delete the words “...or Architect...” in the in the first sentence of Section 5.2.4 and insert the following sentence at the end of Section 5.2.4:*

The Contractor’s request for substitution must be made to the Owner in writing accompanied by supporting information.

**3.43** *Add the following Section 5.2.5:*

**5.2.5** A Subcontractor identified in the Contractor’s Bid in response the specialty subcontractor listing requirements of Section 7 of the Bid Form (SE-330) may only be substituted in accordance with and as permitted by the provisions of Title 11, Chapter 35, Section 3021 of the South Carolina Code of Laws, as amended. A proposed substitute for a Listed Subcontractor shall be subject to the Owner’s approval as set forth is Section 5.2.3.

**3.44** *In Section 5.3, delete everything following the heading “SUBCONTRACTUAL RELATIONS” and insert the following Sections 5.3.1, 5.3.2, 5.3.3, and 5.3.4:*

**5.3.1** By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor’s Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not

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prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise herein or in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.3.2 Without limitation on the generality of Section 5.3.1, each Subcontract agreement and each Sub-subcontract agreement shall include, and shall be deemed to include, the following Sections of these General Conditions: 3.2, 3.5, 3.18, 5.3, 5.4, 6.2.2, 7.3.3, 7.5, 7.6, 13.1, 13.12, 14.3, 14.4, and 15.1.6.

§ 5.3.3 Each Subcontract Agreement and each Sub-subcontract agreement shall exclude, and shall be deemed to exclude, Sections 13.2.1 and 13.6 and all of Article 15, except Section 15.1.6, of these General Conditions. In the place of these excluded sections of the General Conditions, each Subcontract Agreement and each Sub-subcontract may include Sections 13.2.1 and 13.6 and all of Article 15, except Section 15.1.6, of AIA Document A201-2007, Conditions of the Contract, as originally issued by the American Institute of Architects.

§ 5.3.4 The Contractor shall assure the Owner that all agreements between the Contractor and its Subcontractor incorporate the provisions of Subparagraph 5.3.1 as necessary to preserve and protect the rights of the Owner and the Architect under the Contract Documents with respect to the work to be performed by Subcontractors so that the subcontracting thereof will not prejudice such rights. The Contractor’s assurance shall be in the form of an affidavit or in such other form as the Owner may approve. Upon request, the Contractor shall provide the Owner or Architect with copies of any or all subcontracts or purchase orders.

3.45 *Delete the last sentence of Section 5.4.1.*

3.46 *Add the following Sections 5.4.4, 5.4.5 and 5.4.6:*

§ 5.4.4 Each subcontract shall specifically provide that the Owner shall only be responsible to the subcontractor for those obligations of the Contractor that accrue subsequent to the Owner’s exercise of any rights under this conditional assignment.

§ 5.4.5 Each subcontract shall specifically provide that the Subcontractor agrees to perform portions of the Work assigned to the Owner in accordance with the Contract Documents.

§ 5.4.6 Nothing in this Section 5.4 shall act to reduce or discharge the Contractor’s payment bond surety’s obligations to claimants for claims arising prior to the Owner’s exercise of any rights under this conditional assignment.

3.47 *Delete the language of Section 6.1.4 and substitute the word “Reserved.”*

3.48 *Insert the following at the end of Section 7.1.2:*

If the amount of a Modification exceeds the limits of the Owner’s Construction Change Order Certification (reference Section 9.1.7.2 of the Agreement), then the Owner’s agreement is not effective, and Work may not proceed, until approved in writing by the Office of State Engineer.

3.49 *Delete Section 7.2.1 and substitute the following:*

7.2.1 A Change Order is a written instrument prepared by the Architect (using State Form SE-480 “Construction Change Order”) and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- .1 The change in the Work;

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- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

**3.50** *Add the following Sections 7.2.2, 7.2.3, 7.2.4, and 7.2.5:*

**7.2.2** If a Change Order provides for an adjustment to the Contract Sum, the adjustment must be calculated in accordance with Section 7.3.3.

**7.2.3** At the Owner’s request, the Contractor shall prepare a proposal to perform the work of a proposed Change Order setting forth the amount of the proposed adjustment, if any, in the Contract Sum; and the extent of the proposed adjustment, if any, in the Contract Time. Any proposed adjustment in the Contract sum shall be prepared in accordance with Section 7.2.2. The Owner’s request shall include any revisions to the Drawings or Specifications necessary to define any changes in the Work. Within fifteen days of receiving the request, the Contractor shall submit the proposal to the Owner and Architect along with all documentation required by Section 7.6.

**7.2.4** If the Contractor requests a Change Order, the request shall set forth the proposed change in the Work and shall be prepared in accordance with Section 7.2.3. If the Contractor requests a change to the Work that involves a revision to either the Drawings or Specifications, the Contractor shall reimburse the Owner for any expenditures associated with the Architects’ review of the proposed revisions, except to the extent the revisions are accepted by execution of a Change Order.

**7.2.5** Agreement on any Change Order shall constitute a final settlement of all matters relating to the change in the Work that is the subject of the Change Order, including, but not limited to, any adjustments to the Contract Sum or the Contract Time.

**3.51** *Delete 7.3.3 and substitute the following:*

**7.3.3 PRICE ADJUSTMENTS**

**§ 7.3.3.1** If any Modification, including a Construction Change Directive, provides for an adjustment to the Contract Sum, the adjustment shall be based on whichever of the following methods is the most valid approximation of the actual cost to the contractor, with overhead and profit as allowed by Section 7.5:

- .1 Mutual acceptance of a lump sum;
- .2 Unit prices stated in the Contract Documents, except as provided in Section 7.3.4, or subsequently agreed upon;
- .3 Cost attributable to the events or situations under applicable clauses with adjustment of profits or fee, all as specified in the contract, or subsequently agreed upon by the parties, or by some other method as the parties may agree; or
- .4 As provided in Section 7.3.7.

**§ 7.3.3.2** Consistent with Section 7.6, costs must be properly itemized and supported by substantiating data sufficient to permit evaluation before commencement of the pertinent performance or as soon after that as practicable. All costs incurred by the Contractor must be justifiably compared with prevailing industry standards. Except as provided in Section 7.5, all adjustments to the Contract Price shall be limited to job specific costs and shall not include indirect costs, overhead, home office overhead, or profit.

**3.52** *Delete Section 7.3.7 and substitute the following:*

**7.3.7** If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall make an initial determination, consistent with Section 7.3.3, of the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in Section 7.5. In such case, and also under Section 7.3.3.1.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:



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- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others; and
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work.

3.53 Delete Section 7.3.8 and substitute the following:

7.3.8 Using the percentages stated in Section 7.5, any adjustment to the Contract Sum for deleted work shall include any overhead and profit attributable to the cost for the deleted Work.

3.54 Add the following Sections 7.5 and 7.6:

**7.5 AGREED OVERHEAD AND PROFIT RATES**

7.5.1 For any adjustment to the Contract Sum for which overhead and profit may be recovered, other than those made pursuant to Unit Prices stated in the Contract Documents, the Contractor agrees to charge and accept, as full payment for overhead and profit, the following percentages of costs attributable to the change in the Work. The percentages cited below shall be considered to include all indirect costs including, but not limited to: field and office managers, supervisors and assistants, incidental job burdens, small tools, and general overhead allocations. The allowable percentages for overhead and profit are as follows:

- .1 To the Contractor for work performed by the Contractor's own forces, 17% of the Contractor's actual costs.
- .2 To each Subcontractor for work performed by the Subcontractor's own forces, 17% of the subcontractor's actual costs.
- .3 To the Contractor for work performed by a subcontractor, 10% of the subcontractor's actual costs (not including the subcontractor's overhead and profit).

**7.6 PRICING DATA AND AUDIT**

**§ 7.6.1 Cost or Pricing Data.**

Upon request of the Owner or Architect, Contractor shall submit cost or pricing data prior to execution of a Modification which exceeds \$500,000. Contractor shall certify that, to the best of its knowledge and belief, the cost or pricing data submitted is accurate, complete, and current as of a mutually determined specified date prior to the date of pricing the Modification. Contractor's price, including profit, shall be adjusted to exclude any significant sums by which such price was increased because Contractor furnished cost or pricing data that was inaccurate, incomplete, or not current as of the date specified by the parties. Notwithstanding Subparagraph 9.10.4, such adjustments may be made after final payment to the Contractor.

§ 7.6.2 Cost or pricing data means all facts that, as of the date specified by the parties, prudent buyers and sellers would reasonably expect to affect price negotiations significantly. Cost or pricing data are factual, not judgmental; and are verifiable. While they do not indicate the accuracy of the prospective contractor's judgment about estimated future costs or projections, they do include the data forming the basis for that judgment. Cost or pricing data are more than historical accounting data; they are all the facts that can be reasonably expected to contribute to the soundness of estimates of future costs and to the validity of determinations of costs already incurred.

**§ 7.6.3 Records Retention.**

As used in Section 7.6, the term "records" means any books or records that relate to cost or pricing data that Contractor is required to submit pursuant to Section 7.6.1. Contractor shall maintain records for three years from the date of final payment, or longer if requested by the chief procurement officer. The Owner may audit Contractor's records at reasonable times and places.

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**3.55** Delete Section 8.2.2 and substitute the following:

**8.2.2** The Contractor shall not knowingly commence operations on the site or elsewhere prior to the effective date of surety bonds and insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such surety bonds or insurance.

**3.56** Delete Section 8.3.1 and substitute the following:

**8.3.1** If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the control of the Contractor and any subcontractor at any tier; or by delay authorized by the Owner pending dispute resolution; or by other causes that the Architect determines may justify delay, then to the extent such delay will prevent the Contractor from achieving Substantial Completion within the Contract Time and provided the delay (1) is not caused by the fault or negligence of the Contractor or a subcontractor at any tier and (2) is not due to unusual delay in the delivery of supplies, machinery, equipment, or services when such supplies, machinery, equipment, or services were obtainable from other sources in sufficient time for the Contractor to meet the required delivery, the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

**3.57** Insert the following at the end of Section 9.1:

All changes to the Contract Sum shall be adjusted in accordance with Section 7.3.3.

**3.58** Delete Section 9.2 and substitute the following:

**9.2 SCHEDULE OF VALUES**

**9.2.1** The Contractor shall submit to the Architect, within ten days of full execution of the Agreement, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor’s Applications for Payment. As requested by the Architect, the Contractor and each Subcontractor shall prepare a trade payment breakdown for the Work for which each is responsible, such breakdown being submitted on a uniform standardized format approved by the Architect and Owner. The breakdown shall be divided in detail, using convenient units, sufficient to accurately determine the value of completed Work during the course of the Project. The Contractor shall update the schedule of values as required by either the Architect or Owner as necessary to reflect:

- .1 the description of Work (listing labor and material separately);
- .2 the total value;
- .3 the percent and value of the Work completed to date;
- .4 the percent and value of previous amounts billed; and
- .5 the current percent completed and amount billed.

**9.2.2** Any schedule of values or trade breakdown that fails to include sufficient detail, is unbalanced, or exhibits "front-loading" of the value of the Work shall be rejected. If a schedule of values or trade breakdown is used as the basis for payment and later determined to be inaccurate, sufficient funds shall be withheld from future Applications for Payment to ensure an adequate reserve (exclusive of normal retainage) to complete the Work.

**3.59** Delete Section 9.3.1 and substitute the following:

Monthly, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2., for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor’s right to payment as the Owner or Architect may require (such as copies of requisitions from Subcontractors and material suppliers) and shall reflect retainage and any other adjustments provided in Section 5 of the Agreement. If required by the Owner or Architect, the Application for Payment shall be accompanied by a current construction schedule.

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**3.60** In Section 9.3.2, add the following words to the end of the second sentence:

provided such materials or equipment will be subsequently incorporated in the Work

*Insert the following at the end of Section 9.3.2:*

The Contractor shall 1) protect such materials from diversion, vandalism, theft, destruction, and damage, 2) mark such materials specifically for use on the Project, and 3) segregate such materials from other materials at the storage facility. The Architect and the Owner shall have the right to make inspections of the storage areas at any time.

**3.61** *In Section 9.4.2, in the first sentence, after the words “Work has progressed to the point indicated,” insert the following:*

in both the Application for Payment and, if required to be submitted by the Contractor, the accompanying current construction schedule

*In the last sentence, delete the third item starting with “(3) reviewed copies” and ending with “Contractor’s right to payment,”*

**3.62** *In Section 9.5.1, in the first sentence, delete the word “may” after the opening words “The Architect” and substitute the word “shall.”*

*In Section 9.5.1, insert the following sentence after the first sentence:*

The Architect shall withhold a Certificate of Payment if the Application for Payment is not accompanied by the current construction schedule required by Section 3.10.1.

**3.63** *In Section 9.6.2, delete the word “The...” at the beginning of the first sentence and substitute the following:*

Pursuant to Chapter 6 of Title 29 of the South Carolina Code of Laws, as amended, the

**3.64** *Delete Section 9.7 and substitute following:*

**9.7 FAILURE OF PAYMENT**

If the Architect does not issue a Certificate for Payment to the Owner, through no fault of the Contractor, within seven days after receipt of the Contractor’s Application for Payment, or if the Owner does not pay the Contractor within seven days after the time established in the Contract Documents the amount certified by the Architect or awarded by a final dispute resolution order, then the Contractor may, upon seven additional days’ written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased, in accordance with the provisions of Section 7.3.3, by the amount of the Contractor’s reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

**3.65** *Insert the following words at the end of the sentence in Section 9.8.1:*

and when all required occupancy permits, if any, have been issued and copies of same have been delivered to the Owner.

**3.66** *In Section 9.8.2, insert the word “written” after the word “comprehensive” and before the word “list.”*

**3.67** *Delete Section 9.8.3 and substitute the following:*

**9.8.3.1** Upon receipt of the Contractor’s list, the Architect, with the Owner and any other person the Architect or the Owner choose, will make an inspection on a date and at a time mutually agreeable to the Architect, Owner, and Contractor, to determine whether the Work or designated portion thereof is substantially complete. The Contractor shall furnish access for the inspection and testing as provided in this Contract. The inspection shall include a

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demonstration by the Contractor that all equipment, systems and operable components of the Work function properly and in accordance with the Contract Documents. If the Architect’s inspection discloses any item, whether or not included on the Contractor’s list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion. If more than one Substantial Completion inspection is required, the Contractor shall reimburse the Owner for all costs of reinspections or, at the Owner’s option, the costs may be deducted from payments due to the Contractor.

**9.8.3.2** If the Architect and Owner concur in the Contractor’s assessment that the Work or a portion of the Work is safe to occupy, the Owner and Contractor may arrange for a Certificate of Occupancy Inspection by OSE. The Owner, Architect, and Contractor shall be present at OSE’s inspection. Upon verifying that the Work or a portion of the Work is substantially complete and safe to occupy, OSE will issue, as appropriate, a Full or Partial Certificate of Occupancy.

**3.68** *In the second sentence of Section 9.8.5, delete the words “and consent of surety, if any.”*

**3.69** *In the first sentence of Section 9.9.1, delete the words “Section 11.3.1.5” and substitute the words “Section 11.3.1.3.”*

**3.70** *Delete Section 9.10.1 and substitute the following:*

**9.10.1** Unless the parties agree otherwise in the Certificate of Substantial Completion, the Contractor shall achieve Final Completion no later than thirty days after Substantial Completion. Upon receipt of the Contractor’s written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect, with the Owner and any other person the Architect or the Owner choose, will make an inspection on a date and at a time mutually agreeable to the Architect, Owner, and Contractor, and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect’s knowledge, information and belief, and on the basis of the Architect’s on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect’s final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor’s being entitled to final payment have been fulfilled. If more than one Final Completion inspection is required, the Contractor shall reimburse the Owner for all costs of reinspections or, at the Owner’s option, the costs may be deducted from payments due to the Contractor. If the Contractor does not achieve final completion within thirty days after Substantial Completion or the timeframe agreed to by the parties in the Certificate of Substantial Completion, whichever is greater, the Contractor shall be responsible for any additional Architectural fees resulting from the delay.

**3.71** *Delete the first sentence of Section 9.10.2 and substitute the following:*

Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner’s property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days’ prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, (6) required Training Manuals, (7) equipment Operations and Maintenance Manuals, (8) any certificates of testing, inspection or approval required by the Contract Documents and not previously provided (9) all warranties and guarantees required under or pursuant to the Contract Documents, and (10) one copy of the Documents required by Section 3.11.

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**3.72** Delete the first sentence of Section 9.10.3 and substitute the following:

If, after Substantial Completion of the Work, final completion thereof is delayed 60 days through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted.

**3.73** Delete Section 9.10.5 and substitute the following:

**§9.10.5** Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those specific claims in stated amounts that have been previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

**3.74** Add the following Section 9.10.6:

**9.10.6** If OSE has not previously issued a Certificate of Occupancy for the entire Project, the Parties shall arrange for a representative of OSE to participate in the Final Completion Inspection. Representatives of the State Fire Marshal’s Office and other authorities having jurisdiction may be present at the Final Completion Inspection or otherwise inspect the completed Work and advise the Owner whether the Work meets their respective requirements for the Project.

**3.75** Delete Section 10.3.1 and substitute the following:

**10.3.1** If the Contractor encounters a hazardous material or substance which was not discoverable as provided in Section 3.2.1 and not required by the Contract Documents, and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons or serious loss to real or personal property resulting from such material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing. Hazardous materials or substances are those hazardous, toxic, or radioactive materials or substances subject to regulations by applicable governmental authorities having jurisdiction, such as, but not limited to, the S.C. Department of Health and Environmental Control, the U.S. Environmental Protection Agency, and the U.S. Nuclear Regulatory Commission.

**3.76** Insert the following at the end of Section 10.3.2:

In the absence of agreement, the Architect will make an interim determination regarding any delay or impact on the Contractor’s additional costs. The Architect’s interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15. Any adjustment in the Contract Sum shall be determined in accordance with Section 7.3.3.

**3.77** Delete Section 10.3.3 and substitute the following:

**10.3.3** The Work in the affected area shall be resumed immediately following the occurrence of any one of the following events: (a) the Owner causes remedial work to be performed that results in the absence of hazardous materials or substances; (b) the Owner and the Contractor, by written agreement, decide to resume performance of the Work; or (c) the Work may safely and lawfully proceed, as determined by an appropriate governmental authority or as evidenced by a written report to both the Owner and the Contractor, which is prepared by an environmental engineer reasonably satisfactory to both the Owner and the Contractor.

**3.78** In Section 10.3.5, delete the word “The” at the beginning of the sentence and substitute the following:

In addition to its obligations under Section 3.18, the

**3.79** Delete the language of Section 10.3.6 and substitute the word “Reserved.”

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**3.80** *Insert the following at the end of Section 10.4:*

The Contractor shall immediately give the Architect notice of the emergency. This initial notice may be oral followed within five days by a written notice setting forth the nature and scope of the emergency. Within fourteen days of the start of the emergency, the Contractor shall give the Architect a written estimate of the cost and probable effect of delay on the progress of the Work.

**3.81** *Delete 11.1.2 and substitute the following:*

**11.1.2** The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified below or required by law, whichever coverage is greater. Coverages shall be written on an occurrence basis and shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor’s completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

- (1) COMMERCIAL GENERAL LIABILITY:**
  - (a) General Aggregate (per project) ..... \$1,000,000
  - (b) Products/Completed Operations ..... \$1,000,000
  - (c) Personal and Advertising Injury ..... \$1,000,000
  - (d) Each Occurrence ..... \$1,000,000
  - (e) Fire Damage (Any one fire) ..... \$50,000
  - (f) Medical Expense (Any one person) ..... \$5,000
  
- (2) BUSINESS AUTO LIABILITY (including All Owned, Non-owned, and Hired Vehicles):**
  - (a) Combined Single Limit ..... \$1,000,000
  
- (3) WORKER’S COMPENSATION:**
  - (a) State Statutory
  - (b) Employers Liability ..... \$100,000 Per Acc.  
..... \$500,000 Disease, Policy Limit  
..... \$100,000 Disease, Each Employee

In lieu of separate insurance policies for Commercial General Liability, Business Auto Liability, and Employers Liability, the Contractor may provide an umbrella policy meeting or exceeding all coverage requirements set forth in this Section 11.1.2. The umbrella policy limits shall not be less than \$3,000,000.

**3.82** *Delete Section 11.1.3 and substitute the following:*

**11.1.3** Prior to commencement of the Work, and thereafter upon replacement of each required policy of insurance, Contractor shall provide to the Owner a written endorsement to the Contractor’s general liability insurance policy that:

- (i) names the Owner as an additional insureds for claims caused in whole or in part by the Contractor’s negligent acts or omissions during the Contractor’s operations;
- (ii) provides that no material alteration, cancellation, non-renewal, or expiration of the coverage contained in such policy shall have effect unless all additional insureds have been given at least ten (10) days prior written notice of cancellation for non-payment of premiums and thirty (30) days prior written notice of cancellation for any other reason; and
- (iii) provides that the Contractor’s liability insurance policy shall be primary, with any liability insurance of the Owner as secondary and noncontributory.

Prior to commencement of the Work, and thereafter upon renewal or replacement of each required policy of insurance, Contractor shall provide to the Owner a signed, original certificate of liability insurance (ACORD 25). Consistent with this Section 11.1, the certificate shall identify the types of insurance, state the limits of liability for each type of coverage, name the Owner a Consultants as Certificate Holder, provide that the general aggregate limit applies per project, and provide that coverage is written on an occurrence basis. Both the certificates and the

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endorsements must be received directly from either the Contractor's insurance agent or the insurance company. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, naming the Owner as an additional insured for claims made under the Contractor's completed operations, and otherwise meeting the above requirements, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

**3.83** *Delete Section 11.1.4 and substitute the following:*

**11.1.4** A failure by the Owner either (i) to demand a certificate of insurance or written endorsement required by Section 11.1, or (ii) to reject a certificate or endorsement on the grounds that it fails to comply with Section 11.1 shall not be considered a waiver of Contractor's obligations to obtain the required insurance.

**3.84** *In Section 11.3.1, delete the first sentence and substitute the following:*

Unless otherwise provided in the Contract Documents, the Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis.

**3.85** *Delete the language of Section 11.3.1.2 and substitute the word "Reserved."*

**3.86** *Delete the language of Section 11.3.1.3 and substitute the word "Reserved."*

**3.87** *Delete Section 11.3.2 and substitute the following:*

**11.3.2 BOILER AND MACHINERY INSURANCE**

The Contractor shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall both be named insureds.

**3.88** *Delete Section 11.3.3 and substitute the following:*

**11.3.3 LOSS OF USE INSURANCE**

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. To the extent any losses are covered and paid for by such insurance, the Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

**3.89** *Delete Section 11.3.4 and substitute the following:*

**11.3.4** If the Owner requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Contractor shall, if possible, include such insurance, and the cost thereof shall be charged to the Owner by appropriate Change Order.

**3.90** *Delete the language of Section 11.3.5 and substitute the word "Reserved."*

**3.91** *Delete Section 11.3.6 and substitute the following:*

**11.3.6** Before an exposure to loss may occur, the Contractor shall file with the Owner a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Owner.

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**3.92** Delete the first sentence of Section 11.3.7 and substitute the following:

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect’s consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent the property insurance provided by the Contractor pursuant to this Section 11.3 covers and pays for the damage, except such rights as they have to proceeds of such insurance held by the Contractor as fiduciary.

**3.93** Delete the first sentence of Section 11.3.8 and substitute the following:

A loss insured under the Contractor’s property insurance shall be adjusted by the Contractor as fiduciary and made payable to the Contractor as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10.

**3.94** Delete Section 11.3.9 and substitute the following:

**11.3.9** If required in writing by a party in interest, the Contractor as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Contractor’s duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Contractor shall deposit in a separate account proceeds so received, which the Contractor shall distribute in accordance with such agreement as the parties in interest may reach. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor.

**3.95** Delete Section 11.3.10 and substitute the following:

**11.3.10** The Contractor as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Contractor’s exercise of this power; if such objection is made, the dispute shall be resolved in the manner provided in the contract between the parties in dispute as the method of binding dispute resolution. The Contractor as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with a final order or determination issued by the appropriate authority having jurisdiction over the dispute..

**3.96** Delete Section 11.4.1 and substitute the following:

**11.4.1** Before commencing any services hereunder, the Contractor shall provide the Owner with Performance and Payment Bonds, each in an amount not less than the Contract Price set forth in Article 4 of the Agreement. The Surety shall have, at a minimum, a "Best Rating" of "A" as stated in the most current publication of "Best's Key Rating Guide, Property-Casualty". In addition, the Surety shall have a minimum "Best Financial Strength Category" of "Class V", and in no case less than five (5) times the contract amount. The Performance Bond shall be written on Form SE-355, "Performance Bond" and the Payment Bond shall written on Form SE-357, "Labor and Material Payment Bond", and both shall be made payable to the Owner.

**3.97** Delete Section 11.4.2 and substitute the following:

**11.4.2** The Performance and Labor and Material Payment Bonds shall:

- .1** be issued by a surety company licensed to do business in South Carolina;
- .2** be accompanied by a current power of attorney and certified by the attorney-in-fact who executes the bond on the behalf of the surety company; and
- .3** remain in effect for a period not less than one (1) year following the date of Substantial Completion or the time required to resolve any items of incomplete Work and the payment of any disputed amounts, whichever time period is longer.



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**3.98** *Add the following Sections 11.4.3 and 11.4.4:*

**11.4.3** Any bonds required by this Contract shall meet the requirements of the South Carolina Code of Laws and Regulations, as amended.

**11.4.4** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

**3.99** *Delete Section 12.1.1 and substitute the following:*

**12.1.1** If a portion of the Work is covered contrary to the to requirements specifically expressed in the Contract Documents, including inspections of work-in-progress required by all authorities having jurisdiction over the Project, it must, upon demand of the Architect or authority having jurisdiction, be uncovered for observation and be replaced at the Contractor’s expense without change in the Contract Time.

**3.100** *In Section 12.2.2.1, delete the words “and to make a claim for breach of warranty” at the end of the third sentence.*

**3.101** *In Section 12.2.2.3, add the following to the end of the sentence:*

unless otherwise provided in the Contract Documents.

**3.102** *Insert the following at the end of Section 12.2.4:*

If, prior to the date of Substantial Completion, the Contractor, a Subcontractor, or anyone for whom either is responsible, uses or damages any portion of the Work, including, without limitation, mechanical, electrical, plumbing, and other building systems, machinery, equipment, or other mechanical device, the Contractor shall cause such item to be restored to "like new" condition at no expense to the Owner.

**3.103** *Delete Section 13.1 and substitute the following:*

**13.1 GOVERNING LAW**

The Contract, any dispute, claim, or controversy relating to the Contract, and all the rights and obligations of the parties shall, in all respects, be interpreted, construed, enforced and governed by and under the laws of the State of South Carolina, except its choice of law rules.

**3.104** *Delete Section 13.2, including its Sub-Sections 13.2.1 and 13.2.2, and substitute the following:*

**13.2 SUCCESSORS AND ASSIGNS**

The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole, or in part, without written consent of the other and then only in accordance with and as permitted by Regulation 19-445.2180 of the South Carolina Code of Regulations, as amended. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

**3.105** *Delete Section 13.3 and substitute the following:*

**13.3 WRITTEN NOTICE**

Unless otherwise permitted herein, all notices contemplated by the Contract Documents shall be in writing and shall be deemed given:

- .1 upon actual delivery, if delivery is by hand;
- .2 upon receipt by the transmitting party of confirmation or reply, if delivery is by electronic mail, facsimile, telex or telegram;
- .3 upon receipt, if delivery is by the United States mail.

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Notice to Contractor shall be to the address provided in Section 8.3.2 of the Agreement. Notice to Owner shall be to the address provided in Section 8.2.2 of the Agreement. Either party may designate a different address for notice by giving notice in accordance with this paragraph.

**3.106** *In Section 13.4.1, insert the following at the beginning of the sentence:*

Unless expressly provided otherwise,

**3.107** *Add the following Section 13.4.3:*

**13.4.3** Notwithstanding Section 9.10.4, the rights and obligations which, by their nature, would continue beyond the termination, cancellation, rejection, or expiration of this contract shall survive such termination, cancellation, rejection, or expiration, including, but not limited to, the rights and obligations created by the following clauses:

**1.5** Ownership and Use of Drawings, Specifications and Other Instruments of Service;

**3.5** Warranty

**3.17** Royalties, Patents and Copyrights

**3.18** Indemnification

**7.6** Cost or Pricing Data

**11.1** Contractor's Liability Insurance

**11.4** Performance and Payment Bond

**15.1.6** Claims for Listed Damages

**15.1.7** Waiver of Claims Against the Architect

**15.6** Dispute Resolution

**15.4** Service of Process

**3.108** *Delete Section 13.6 and substitute the following:*

**13.6 INTEREST**

Payments due to the Contractor and unpaid under the Contract Documents shall bear interest only if and to the extent allowed by Title 29, Chapter 6, Article 1 of the South Carolina Code of Laws. Amounts due to the Owner shall bear interest at the rate of one percent a month or a pro rata fraction thereof on the unpaid balance as may be due.

**3.109** *Delete the language of Section 13.7 and substitute the word "Reserved."*

**3.110** *Add the following Sections 13.8 through 13.16:*

**13.8 PROCUREMENT OF MATERIALS BY OWNER**

The Contractor accepts assignment of all purchase orders and other agreements for procurement of materials and equipment by the Owner that are identified as part of the Contract Documents. The Contractor shall, upon delivery, be responsible for the storage, protection, proper installation, and preservation of such Owner purchased items, if any, as if the Contractor were the original purchaser. The Contract Sum includes, without limitation, all costs and expenses in connection with delivery, storage, insurance, installation, and testing of items covered in any assigned purchase orders or agreements. Unless the Contract Documents specifically provide otherwise, all Contractor warranty of workmanship and correction of the Work obligations under the Contract Documents shall apply to the Contractor's installation of and modifications to any Owner purchased items,.

**13.9 INTERPRETATION OF BUILDING CODES**

As required by Title 10, Chapter 1, Section 180 of the South Carolina Code of Laws, as amended, OSE shall determine the enforcement and interpretation of all building codes and referenced standards on state buildings. The Contractor shall refer any questions, comments, or directives from local officials to the Owner and OSE for resolution.

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**13.10 MINORITY BUSINESS ENTERPRISES**

Contractor shall notify Owner of each Minority Business Enterprise (MBE) providing labor, materials, equipment, or supplies to the Project under a contract with the Contractor. Contractor’s notification shall be via the first monthly status report submitted to the Owner after execution of the contract with the MBE. For each such MBE, the Contractor shall provide the MBE’s name, address, and telephone number, the nature of the work to be performed or materials or equipment to be supplied by the MBE, whether the MBE is certified by the South Carolina Office of Small and Minority Business Assistance, and the value of the contract.

**13.11 SEVERABILITY**

If any provision or any part of a provision of the Contract Documents shall be finally determined to be superseded, invalid, illegal, or otherwise unenforceable pursuant to any applicable Legal Requirements, such determination shall not impair or otherwise affect the validity, legality, or enforceability of the remaining provision or parts of the provision of the Contract Documents, which shall remain in full force and effect as if the unenforceable provision or part were deleted.

**13.12 ILLEGAL IMMIGRATION**

Contractor certifies and agrees that it will comply with the applicable requirements of Title 8, Chapter 14 of the South Carolina Code of Laws and agrees to provide to the State upon request any documentation required to establish either: (a) that Title 8, Chapter 14 is inapplicable both to Contractor and its subcontractors or sub-subcontractors; or (b) that Contractor and its subcontractors or sub-subcontractors are in compliance with Title 8, Chapter 14. Pursuant to Section 8-14-60, "A person who knowingly makes or files any false, fictitious, or fraudulent document, statement, or report pursuant to this chapter is guilty of a felony, and, upon conviction, must be fined within the discretion of the court or imprisoned for not more than five years, or both." Contractor agrees to include in any contracts with its subcontractors language requiring its subcontractors to (a) comply with the applicable requirements of Title 8, Chapter 14, and (b) include in their contracts with the sub-subcontractors language requiring the sub-subcontractors to comply with the applicable requirements of Title 8, Chapter 14. (An overview is available at [www.procurement.sc.gov](http://www.procurement.sc.gov))

**13.13 SETOFF**

The Owner shall have all of its common law, equitable, and statutory rights of set-off.

**13.14 DRUG-FREE WORKPLACE**

The Contractor certifies to the Owner that Contractor will provide a Drug-Free Workplace, as required by Title 44, Chapter 107 of the South Carolina Code of Laws, as amended.

**13.15 FALSE CLAIMS**

According to the S.C. Code of Laws § 16-13-240, "a person who by false pretense or representation obtains the signature of a person to a written instrument or obtains from another person any chattel, money, valuable security, or other property, real or personal, with intent to cheat and defraud a person of that property is guilty" of a crime.

**13.16 NON-INDEMNIFICATION:**

Any term or condition is void to the extent it requires the State to indemnify anyone. It is unlawful for a person charged with disbursements of state funds appropriated by the General Assembly to exceed the amounts and purposes stated in the appropriations. (§ 11-9-20) It is unlawful for an authorized public officer to enter into a contract for a purpose in which the sum is in excess of the amount appropriated for that purpose. It is unlawful for an authorized public officer to divert or appropriate the funds arising from any tax levied and collected for any one fiscal year to the payment of an indebtedness contracted or incurred for a previous year. (§ 11-1-40)

**3.111** *Delete Section 14.1.1 and substitute the following:*

**14.1.1** The Contractor may terminate the Contract if the Work is stopped for a period of 45 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1** Issuance of an order of a court or other public authority having jurisdiction that requires substantially all Work to be stopped; or

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- .2 An act of government, such as a declaration of national emergency that requires substantially all Work to be stopped.
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents and the Contractor has stopped work in accordance with Section 9.7

**3.112** *Insert the following at the end of Section 14.1.3:*

Any adjustment to the Contract Sum pursuant to this Section shall be made in accordance with the requirements of Article 7.

**3.113** *In Section 14.1.4, replace the word “repeatedly” with the word “persistently.”*

**3.114** *Delete Section 14.2.1 and substitute the following:*

**14.2.1** The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials, or otherwise fails to prosecute the Work, or any separable part of the Work, with the diligence, resources and skill that will ensure its completion within the time specified in the Contract Documents, including any authorized adjustments;
- .2 fails to make payment to Subcontractors for materials or labor in accordance with the Contract Documents and the respective agreements between the Contractor and the Subcontractors;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

**3.115** *In Section 14.2.2, delete the parenthetical statement “, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action,” immediately following the word “Owner” in the first line.*

**3.116** *In Section 14.2.4, replace the words “Initial Decision Maker” with the word “Architect”*

**3.117** *Add the following Section 14.2.5:*

**14.2.5** If, after termination for cause, it is determined that the Owner lacked justification to terminate under Section 14.2.1, or that the Contractor’s default was excusable, the rights and obligations of the parties shall be the same as if the termination had been issued for the convenience of the Owner under Section 14.4.

**3.118** *Delete the second sentence of Section 14.3.2 and substitute the following:*

Any adjustment to the Contract Sum made pursuant to this section shall be made in accordance with the requirements of Article 7.3.3.

**3.119** *Delete Section 14.4.1 and substitute the following:*

**14.4.1** The Owner may, at any time, terminate the Contract, in whole or in part for the Owner’s convenience and without cause. The Owner shall give written notice of the termination to the Contractor specifying the part of the Contract terminated and when termination becomes effective.

**3.120** *Delete Section 14.4.2 and substitute the following:*

**14.4.2** Upon receipt of written notice from the Owner of such termination for the Owner’s convenience, the Contractor shall

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work;

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- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders; and
- .4 complete the performance of the Work not terminated, if any.

3.121 Delete Section 14.4.3 and substitute the following:

14.4.3 In case of such termination for the Owner’s convenience, the Contractor shall be entitled to receive payment for Work executed, costs incurred by reason of such termination, and any other adjustments otherwise allowed by the Contract. Any adjustment to the Contract Sum made pursuant to this Section 14.4 shall be made in accordance with the requirements of Article 7.3.3.

3.122 Add the following Sections 14.4.4, 14.4.5, and 14.5:

14.4.4 Contractor's failure to include an appropriate termination for convenience clause in any subcontract shall not (i) affect the Owner's right to require the termination of a subcontract, or (ii) increase the obligation of the Owner beyond what it would have been if the subcontract had contained an appropriate clause.

14.4.5 Upon written consent of the Contractor, the Owner may reinstate the terminated portion of this Contract in whole or in part by amending the notice of termination if it has been determined that:

- .1 the termination was due to withdrawal of funding by the General Assembly, Governor, or Budget and Control Board or the need to divert project funds to respond to an emergency as defined by Regulation 19-445.2110(B) of the South Carolina Code of Regulations, as amended;
- .2 funding for the reinstated portion of the work has been restored;
- .3 circumstances clearly indicate a requirement for the terminated work; and
- .4 reinstatement of the terminated work is advantageous to the Owner.

**14.5 CANCELLATION AFTER AWARD BUT PRIOR TO PERFORMANCE**

Pursuant to Title 11, Chapter 35 and Regulation 19-445.2085 of the South Carolina Code of Laws and Regulations, as amended, this contract may be canceled after award but prior to performance.

3.123 Insert the following sentence after the second sentence of Section 15.1.1:

A voucher, invoice, payment application or other routine request for payment that is not in dispute when submitted is not a Claim under this definition.

3.124 Delete Section 15.1.2 and substitute the following:

**15.1.2 NOTICE OF CLAIMS**

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Architect. Such notice shall include sufficient information to advise the Architect and other party of the circumstances giving rise to the claim, the specific contractual adjustment or relief requested and the basis of such request. Claims by either party arising prior to the date final payment is due must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later except as stated for adverse weather days in Section 15.1.5.2. By failing to give written notice of a Claim within the time required by this Section, a party expressly waives its claim.

3.125 Delete Section 15.1.3 and substitute the following:

**15.1.3 CONTINUING CONTRACT PERFORMANCE**

Pending final resolution of a Claim, including any administrative review allowed under Section 15.6, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will issue Certificates for Payment in accordance with the initial decisions and determinations of the Architect.

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**3.126** *Insert the following at the end of Section 15.1.5.1:*

Claims for an increase in the Contract Time shall be based on one additional calendar day for each full calendar day that the Contractor is prevented from working.

**3.127** *Insert the following Sub-Sections at the end of Section 15.1.5.2:*

- .1 Claims for adverse weather shall be based on actual weather conditions at the job site or other place of performance of the Work, as documented in the Contractor's job site log.
- .2 For the purpose of this Contract, a total of five (5) calendar days per calendar month (non-cumulative) shall be anticipated as "adverse weather" at the job site, and such time will not be considered justification for an extension of time. If, in any month, adverse weather develops beyond the five (5) days, the Contractor shall be allowed to claim additional days to compensate for the excess weather delays only to the extent of the impact on the approved construction schedule. The remedy for this condition is for an extension of time only and is exclusive of all other rights and remedies available under the Contract Documents or imposed or available by law.
- .3 The Contractor shall submit monthly with their pay application all claims for adverse weather conditions that occurred during the previous month. The Architect shall review each monthly submittal in accordance with Section 15.5 and inform the Contractor and the Owner promptly of its evaluation. Approved days shall be included in the next Change Order issued by the Architect. Adverse weather conditions not claimed within the time limits of this Subparagraph shall be considered to be waived by the Contractor. Claims will not be allowed for adverse weather days that occur after the scheduled (original or adjusted) date of Substantial Completion.

**3.128** *Delete Section 15.1.6 and substitute the following:*

**15.1.6 CLAIMS FOR LISTED DAMAGES**

Notwithstanding any other provision of the Contract Documents, including Section 1.2.1, but subject to a duty of good faith and fair dealing, the Contractor and Owner waive Claims against each other for listed damages arising out of or relating to this Contract.

**15.1.6.1** For the Owner, listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) costs suffered by a third party unable to commence work, (vi) attorney's fees, (vii) any interest, except to the extent allowed by Section 13.6 (Interest), (viii) lost revenue and profit for lost use of the property, (ix) costs resulting from lost productivity or efficiency.

**15.1.6.2** For the Contractor, listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v) attorney's fees, (vi) any interest, except to the extent allowed by Section 13.6 (Interest); (vii) unamortized equipment costs; and, (viii) losses incurred by subcontractors for the types of damages the Contractor has waived as against the Owner. Without limitation, this mutual waiver is applicable to all damages due to either party's termination in accordance with Article 14. Nothing contained in this Section shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents. This mutual waiver is not applicable to amounts due or obligations under Section 3.18 (Indemnification).

**3.129** *Add the following Section 15.1.7:*

**15.1.7 WAIVER OF CLAIMS AGAINST THE ARCHITECT**

Notwithstanding any other provision of the Contract Documents, including Section 1.2.1, but subject to a duty of good faith and fair dealing, the Contractor waives all claims against the Architect and any other design professionals who provide design and/or project management services to the Owner, either directly or as independent contractors or subcontractors to the Architect, for listed damages arising out of or relating to this Contract. The listed damages are (i) lost revenue and profit, (ii) losses resulting from injury to business or reputation, (iii) additional or escalated overhead and administration expenses, (iv) additional financing costs, (v)

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attorney's fees, (vi) any interest; (vii) unamortized equipment costs; and, (viii) losses incurred by subcontractors for the types of damages the Contractor has waived as against the Owner. This mutual waiver is not applicable to amounts due or obligations under Section 3.18 (Indemnification).

**3.130** *Delete the language of Sections 15.2, 15.3, and 15.4, including all Sub-Sections, and substitute the word "Reserved" for the deleted language of each Section and Sub-Section.*

**3.131** *Add the following Sections 15.5 and 15.6 with their sub-sections:*

**15.5 CLAIM AND DISPUTES - DUTY OF COOPERATION, NOTICE, AND ARCHITECTS****INITIAL DECISION**

**15.5.1** Contractor and Owner are fully committed to working with each other throughout the Project to avoid or minimize claims. To further this goal, Contractor and Owner agree to communicate regularly with each other and the Architect at all times notifying one another as soon as reasonably possible of any issue that if not addressed may cause loss, delay, and/or disruption of the Work. If claims do arise, Contractor and Owner each commit to resolving such claims in an amicable, professional, and expeditious manner to avoid unnecessary losses, delays, and disruptions to the Work.

**15.5.2** Claims shall first be referred to the Architect for initial decision. An initial decision shall be required as a condition precedent to resolution pursuant to Section 15.6 of any Claim arising prior to the date of final payment, unless 30 days have passed after the Claim has been referred to the Architect with no decision having been rendered, or after all the Architect's requests for additional supporting data have been answered, whichever is later. The Architect will not address claims between the Contractor and persons or entities other than the Owner.

**15.5.3** The Architect will review Claims and within ten days of the receipt of a Claim (1) request additional supporting data from the claimant or a response with supporting data from the other party or (2) render an initial decision in accordance with Section 15.5.5.

**15.5.4** If the Architect requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Architect when the response or supporting data will be furnished or (3) advise the Architect that all supporting data has already been provided. Upon receipt of the response or supporting data, the Architect will render an initial decision in accordance with Section 15.5.5.

**15.5.5** The Architect will render an initial decision in writing; (1) stating the reasons therefor; and (2) notifying the parties of any change in the Contract Sum or Contract Time or both. The Architect will deliver the initial decision to the parties within two weeks of receipt of any response or supporting data requested pursuant to Section 16.4, or within such longer period as may be mutually agreeable to the parties. If the parties accept the initial decision, the Architect shall prepare a Change Order with appropriate supporting documentation for the review and approval of the parties and the Office of State Engineer. If either the Contractor, Owner, or both, disagree with the initial decision, the Contractor and Owner shall proceed with dispute resolution in accordance with the provisions of Section 15.6.

**15.5.6** In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

**15.6 DISPUTE RESOLUTION**

**15.6.1** If a claim is not resolved pursuant to Section 15.5 to the satisfaction of either party, both parties shall attempt to resolve the dispute at the field level through discussions between Contractor's Representative and Owner's Representative. If a dispute cannot be resolved through Contractor's Representative and Owner's Representative, then the Contractor's Senior Representative and the Owner's Senior Representative, upon the request of either party, shall meet as soon as conveniently possible, but in no case later than twenty-one days after such a request is made, to attempt to resolve such dispute. Prior to any meetings between the Senior Representatives, the parties will exchange relevant information that will assist the parties in resolving their dispute. The meetings required by this Section are a condition precedent to resolution pursuant to Section 15.6.2.

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**15.6.2** If after meeting in accordance with the provisions of Section 15.6.1, the Senior Representatives determine that the dispute cannot be resolved on terms satisfactory to both the Contractor and the Owner, then either party may submit the dispute by written request to South Carolina’s Chief Procurement Officer for Construction (CPOC). Except as otherwise provided in Article 15, all claims, claims, or controversies relating to the Contract shall be resolved exclusively by the appropriate Chief Procurement Officer in accordance with Title 11, Chapter 35, Article 17 of the South Carolina Code of Laws, or in the absence of jurisdiction, only in the Court of Common Pleas for, or in the absence of jurisdiction a federal court located in, Richland County, State of South Carolina. Contractor agrees that any act by the State regarding the Contract is not a waiver of either the State’s sovereign immunity or the State’s immunity under the Eleventh Amendment of the United State’s Constitution.

**15.6.3** If any party seeks resolution to a dispute pursuant to Section 15.6.2, the parties shall participate in non-binding mediation to resolve the claim. If the claim is governed by Title 11, Chapter 35, Article 17 of the South Carolina Code of Laws as amended and the amount in controversy is \$100,000.00 or less, the CPOC shall appoint a mediator, otherwise, the mediation shall be conducted by an impartial mediator selected by mutual agreement of the parties, or if the parties cannot so agree, a mediator designated by the American Arbitration Association (“AAA”) pursuant to its Construction Industry Mediation Rules. The mediation will be governed by and conducted pursuant to a mediation agreement negotiated by the parties or, if the parties cannot so agree, by procedures established by the mediator.

**15.6.4** Without relieving any party from the other requirements of Sections 15.5 and 15.6, either party may initiate proceedings in the appropriate forum prior to initiating or completing the procedures required by Sections 15.5 and 15.6 if such action is necessary to preserve a claim by avoiding the application of any applicable statutory period of limitation or repose.

**15.6.5 SERVICE OF PROCESS**

Contractor consents that any papers, notices, or process necessary or proper for the initiation or continuation of any claims, claims, or controversies relating to the Contract; for any court action in connection therewith; or for the entry of judgment on any award made, may be served on Contractor by certified mail (return receipt requested) addressed to Contractor at the address provided for the Contractor’s Senior Representative or by personal service or by any other manner that is permitted by law, in or outside South Carolina. Notice by certified mail is deemed duly given upon deposit in the United States mail.

**3.132** *Add the following Article 16:*

**ARTICLE 16 PROJECT-SPECIFIC REQUIREMENTS AND INFORMATION**

**16.1. Inspection Requirements:** *(Indicate the inspection services required by the Contract)*

- Special Inspections are required and are not part of the Contract Sum. *(see section 01400)*
- Building Inspections are required and are not part of the Contract Sum. *(see section 01400)*
- Building Inspections are required and are part of the Contract Sum. The inspections required for this Work are : *(Indicate which services are required and the provider)*

- Civil: \_\_\_\_\_
- Structural: \_\_\_\_\_
- Mechanical: \_\_\_\_\_
- Plumbing: \_\_\_\_\_
- Electrical: \_\_\_\_\_
- Gas: \_\_\_\_\_
- Other *(list)*: \_\_\_\_\_

Remarks: \_\_\_\_\_



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**16.1.1** Contractor shall schedule and request inspections in an orderly and efficient manner and shall notify the Owner whenever the Contractor schedules an inspection in accordance with the requirements of Section 16.1. Contractor shall be responsible for the cost of inspections scheduled and conducted without the Owner's knowledge and for any increase in the cost of inspections resulting from the inefficient scheduling of inspections.

**16.2** List Cash Allowances, if any. *(Refer to attachments as needed. If none, enter NONE)*

None

**16.3.** Requirements for Record Drawings, if any. *(Refer to attachments as needed. If none, enter NONE)*

Refer to Section 01780 - Closeout Submittals

**16.4.** Requirements for Shop Drawings and other submittals, if any, including number, procedure for submission, list of materials to be submitted, etc. *(Refer to attachments as needed. If none, enter NONE)*

Refer to Section 01300 - Administrative Requirements

**16.5.** Requirements for signage, on-site office or trailer, utilities, restrooms, etc., in addition to the Contract, if any. *(Refer to attachments as needed. If none, enter NONE)*

None

**16.6.** Requirements for Project Cleanup in addition to the Contract, if any. *(Refer to attachments as needed. If none, enter NONE)*

None

**16.7.** List all attachments that modify these General Conditions. *(If none, enter NONE)*

None

**SE-355**  
**Performance Bond**

**KNOW ALL MEN BY THESE PRESENTS**, that *(Insert full name or legal title and address of Contractor)*

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_

hereinafter referred to as “Contractor”, and *(Insert full name and address of principal place of business of Surety)*

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_

hereinafter called the “surety”, are jointly and severally held and firmly bound unto *(Insert full name and address of Agency)*

Name: University of South Carolina  
Address: 743 Greene Street  
Columbia, South Carolina 29208

hereinafter referred to as “Agency”, or its successors or assigns, the sum of \_\_\_\_\_ (\$ \_\_\_\_\_), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, Contractor has by written agreement dated \_\_\_\_\_ entered into a contract with Agency to construct

State Project Name: USC Aiken Greenhouse Repackaging Rebid  
State Project Number: H29-I337  
Brief Description of Awarded Work, as found on the SE-330, Bid Form: The project consists of the construction of an owner provided 2,100 square foot greenhouse using a greenhouse kit. The project also includes associated sitework, utilities, foundations, building base, electrical, plumbing, etc.

in accordance with Drawings and Specifications prepared by *(Insert full name and address of A/E)*

Name: GMK Associates, Inc.  
Address: 1201 Main Street, Suite 2100  
Columbia, South Carolina 29201

which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

**IN WITNESS WHEREOF**, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this \_\_\_\_\_ day of \_\_\_\_\_, 2\_\_\_\_\_, \_\_\_\_\_ BOND NUMBER \_\_\_\_\_  
*(shall be no earlier than Date of Contract)*

CONTRACTOR

SURETY

By: \_\_\_\_\_  
(Seal)

By: \_\_\_\_\_  
(Seal)

Print Name: \_\_\_\_\_

Print Name: \_\_\_\_\_

Print Title: \_\_\_\_\_

Print Title: \_\_\_\_\_  
(Attach Power of Attorney)

Witness: \_\_\_\_\_

Witness: \_\_\_\_\_

*(Additional Signatures, if any, appear on attached page)*

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**Performance Bond**

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**NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:**

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Agency for the full and faithful performance of the contract, which is incorporated herein by reference

2. If the Contractor performs the contract, the Surety and the Contractor have no obligation under this Bond, except to participate in conferences as provided in paragraph 3.1.

3. The Surety's obligation under this Bond shall arise after:

**3.1** The Agency has notified the Contractor and the Surety at the address described in paragraph 10 below, that the Agency is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If the Agency, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive the Agency's right, if any, subsequently to declare a Contractor Default; or

**3.2** The Agency has declared a Contractor Default and formally terminated the Contractor's right to complete the Contract.

4. The Surety shall, within 15 days after receipt of notice of the Agency's declaration of a Contractor Default, and at the Surety's sole expense, take one of the following actions:

**4.1** Arrange for the Contractor, with consent of the Agency, to perform and complete the Contract; or

**4.2** Undertake to perform and complete the Contract itself, through its agents or through independent contractors; or

**4.3** Obtain bids or negotiated proposals from qualified contractors acceptable to the Agency for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by the Agency and the contractor selected with the Agency's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the Bonds issued on the Contract, and pay to the Agency the amount of damages as described in paragraph 7 in excess of the Balance of the Contract Sum incurred by the Agency resulting from the Contractor Default; or

**4.4** Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and:

**4.4.1** After investigation, determine the amount for which it may be liable to the Agency and, within 60 days of waiving its rights under this paragraph, tender payment thereof to the Agency; or

**4.4.2** Deny liability in whole or in part and notify the Agency, citing the reasons therefore.

5. Provided Surety has proceeded under paragraphs 4.1, 4.2, or 4.3, the Agency shall pay the Balance of the Contract Sum to either:

**5.1** Surety in accordance with the terms of the Contract; or

**5.2** Another contractor selected pursuant to paragraph 4.3 to perform the Contract.

**5.3** The balance of the Contract Sum due either the Surety or another contractor shall be reduced by the amount of damages as described in paragraph 7.

6. If the Surety does not proceed as provided in paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond 15 days after receipt of written notice from the Agency to the Surety demanding that the Surety perform its obligations under this Bond, and the Agency shall be entitled to enforce any remedy available to the Agency.

**6.1** If the Surety proceeds as provided in paragraph 4.4, and the Agency refuses the payment tendered or the Surety has denied liability, in whole or in part, then without further notice the Agency shall be entitled to enforce any remedy available to the Agency.

**6.2** Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the Dispute Resolution process defined in the Contract Documents and the laws of the State of South Carolina.

7. After the Agency has terminated the Contractor's right to complete the Contract, and if the Surety elects to act under paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Agency shall be those of the Contractor under the Contract, and the responsibilities of the Agency to the Surety shall those of the Agency under the Contract. To a limit of the amount of this Bond, but subject to commitment by the Agency of the Balance of the Contract Sum to mitigation of costs and damages on the Contract, the Surety is obligated to the Agency without duplication for:

**7.1** The responsibilities of the Contractor for correction of defective Work and completion of the Contract; and

**7.2** Additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under paragraph 4; and

**7.3** Damages awarded pursuant to the Dispute Resolution Provisions of the Contract. Surety may join in any Dispute Resolution proceeding brought under the Contract and shall be bound by the results thereof; and

**7.4** Liquidated Damages, or if no Liquidated Damages are specified in the Contract, actual damages caused by delayed performance or non-performance of the Contractor.

**8.** The Surety shall not be liable to the Agency or others for obligations of the Contractor that are unrelated to the Contract, and the Balance of the Contract Sum shall not be reduced or set-off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Agency or its heirs, executors, administrators, or successors.

**9.** The Surety hereby waives notice of any change, including changes of time, to the contract or to related subcontracts, purchase orders and other obligations.

**10.** Notice to the Surety, the Agency or the Contractor shall be mailed or delivered to the address shown on the signature page.

**11. Definitions**

**11.1** Balance of the Contract Sum: The total amount payable by the Agency to the Contractor under the Contract after all proper adjustments have been made, including allowance to the Contractor of any amounts to be received by the Agency in settlement of insurance or other Claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Contract.

**11.2** Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform the Contract or otherwise to comply with the terms of the Contract.

**SE-357  
Labor and Material Payment Bond**

**KNOW ALL MEN BY THESE PRESENTS**, that *(Insert full name or legal title and address of Contractor)*

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_

hereinafter referred to as "Contractor", and *(Insert full name and address of principal place of business of Surety)*

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_

hereinafter called the "surety", are jointly and severally held and firmly bound unto *(Insert full name and address of Agency)*

Name: University of South Carolina  
Address: 743 Greene Street  
Columbia, South Carolina 29208

hereinafter referred to as "Agency", or its successors or assigns, the sum of \_\_\_\_\_ (\$ \_\_\_\_\_), being the sum of the Bond to which payment to be well and truly made, the Contractor and Surety bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, Contractor has by written agreement dated \_\_\_\_\_ entered into a contract with Agency to construct

Project Name: USC Aiken Greenhouse Repackaging Rebid  
Project Number: H29-I337  
Brief Description of Awarded Work, as found on the SE-330, Bid Form: The project consists of the construction of an owner provided 2,100 square foot greenhouse using a greenhouse kit. The project also includes associated sitework, utilities, foundations, building base, electrical, plumbing, etc.

in accordance with Drawings and Specifications prepared by *(Insert full name and address of A/E)*

Name: GMK Associates, Inc.  
Address: 1201 Main Street, Suite 2100  
Columbia, South Carolina 29201

which agreement is by reference made a part hereof, and is hereinafter referred to as the Contract.

**IN WITNESS WHEREOF**, Surety and Contractor, intending to be legally bound hereby, subject to the terms stated herein, do each cause this Labor and Material Payment Bond to be duly executed on its behalf by its authorized officer, agent or representative.

DATED this \_\_\_\_\_ day of \_\_\_\_\_, 2\_\_\_\_\_, BOND NUMBER \_\_\_\_\_  
*(shall be no earlier than Date of Contract)*

CONTRACTOR

SURETY

By: \_\_\_\_\_  
(Seal)

By: \_\_\_\_\_  
(Seal)

Print Name: \_\_\_\_\_

Print Name: \_\_\_\_\_

Print Title: \_\_\_\_\_

Print Title: \_\_\_\_\_  
(Attach Power of Attorney)

Witness: \_\_\_\_\_

Witness: \_\_\_\_\_

*(Additional Signatures, if any, appear on attached page)*

**SE-357****Labor and Material Payment Bond****NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT:**

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Agency to pay for all labor, materials and equipment required for use in the performance of the Contract, which is incorporated herein by reference.
2. With respect to the Agency, this obligation shall be null and void if the Contractor:
  - 2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants; and
  - 2.2 Defends, indemnifies and holds harmless the Agency from all claims, demands, liens or suits by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract.
3. With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.
4. With respect to Claimants, and subject to the provisions of Title 29, Chapter 5 and the provisions of §11-35-3030(2)(c) of the SC Code of Laws, as amended, the Surety's obligation under this Bond shall arise as follows:
  - 4.1 Every person who has furnished labor, material or rental equipment to the Contractor or its subcontractors for the work specified in the Contract, and who has not been paid in full therefore before the expiration of a period of ninety (90) days after the date on which the last of the labor was done or performed by him or material or rental equipment was furnished or supplied by him for which such claim is made, shall have the right to sue on the payment bond for the amount, or the balance thereof, unpaid at the time of institution of such suit and to prosecute such action for the sum or sums justly due him.
    - 4.2 A remote claimant shall have a right of action on the payment bond upon giving written notice by certified or registered mail to the Contractor within ninety (90) days from the date on which such person did or performed the last of the labor or furnished or supplied the last of the material or rental equipment upon which such claim is made.
  - 4.3 Every suit instituted upon a payment bond shall be brought in a court of competent jurisdiction for the county or circuit in which the construction contract was to be performed, but no such suit shall be commenced after the expiration of one year after the day on which the last of the labor was performed or material or rental equipment was supplied by the person bringing suit.
5. When the Claimant has satisfied the conditions of paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:
  - 5.1 Send an answer to the Claimant, with a copy to the Agency, within sixty (60) days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.
  - 5.2 Pay or arrange for payment of any undisputed amounts.
  - 5.3 The Surety's failure to discharge its obligations under this paragraph 5 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a claim. However, if the Surety fails to discharge its obligations under this paragraph 5, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs to recover any sums found to be due and owing to the Claimant.
6. Amounts owed by the Agency to the Contractor under the

Contract shall be used for the performance of the Contract and to satisfy claims, if any, under any Performance Bond. By the Contractor furnishing and the Agency accepting this Bond, they agree that all funds earned by the contractor in the performance of the Contract are dedicated to satisfy obligations of the Contractor and the Surety under this Bond, subject to the Agency's prior right to use the funds for the completion of the Work.

7. The Surety shall not be liable to the Agency, Claimants or others for obligations of the Contractor that are unrelated to the Contract. The Agency shall not be liable for payment of any costs or expenses of any claimant under this bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

8. The Surety hereby waives notice of any change, including changes of time, to the Contract or to related Subcontracts, purchase orders and other obligations.

9. Notice to the Surety, the Agency or the Contractor shall be mailed or delivered to the addresses shown on the signature page. Actual receipt of notice by Surety, the Agency or the contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

10. By the Contractor furnishing and the Agency accepting this Bond, they agree that this Bond has been furnished to comply with the statutory requirements of the South Carolina Code of Laws, as amended, and further, that any provision in this Bond conflicting with said statutory requirements shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory Bond and not as a common law bond.

11. Upon request of any person or entity appearing to be a potential beneficiary of this bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

12. Any dispute, suit, action or proceeding arising out of or relating to this Bond shall be governed by the laws of the State of South Carolina.

**13. DEFINITIONS**

**13.1 Claimant:** An individual or entity having a direct contract with the Contractor or with a Subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of the Contractor and the Contractor's Subcontractors, and all other items for which a mechanic's lien might otherwise be asserted.

**13.2 Remote Claimant:** A person having a direct contractual relationship with a subcontractor of the Contractor or subcontractor, but no contractual relationship expressed or implied with the Contractor.

**13.3 Contract:** The agreement between the Agency and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

## USC SUPPLEMENTAL GENERAL CONDITIONS FOR CONSTRUCTION PROJECTS

1. Contractor's employees shall take all reasonable means not to interrupt the flow of student traffic in building corridors, lobbies and stairs. All necessary and reasonable safety precautions shall be taken to prevent injury to building occupants while transporting materials and equipment through the building to the work area. Providing safe, accessible, plywood pedestrian ways around construction may be required if a suitable alternative route is not available.
2. Fraternalization between Contractor's employees and USC students, faculty or staff is strictly prohibited-zero tolerance!
3. USC will not tolerate rude, abusive or degrading behavior on the job site. Heckling and cat-calling directed toward students, faculty or staff or any other person on USC property is strictly prohibited. Any contractor whose employees violate this requirement will be assessed a fine of up to \$500 per violation.
4. Contractor's employees must adhere to the University's policy of maintaining a drug-free and smoke-free/tobacco free workplace.
5. Contractor must sign a Contractor Key Receipt/Return form before any keys are issued. Keys must be returned immediately upon the completion of the work. The Contractor will bear the cost of any re-keying necessary due to the loss of or failure to return keys.
6. A welding permit must be issued by the University Fire Marshall before any welding can begin inside a building. Project Manager will coordinate.
7. Contractor must notify the University immediately upon the discovery of suspect material such as those potentially containing asbestos or other such hazardous materials. These materials **must not** be disturbed until approved by the USC Project Manager.
8. At the beginning of the project, the USC Project Manager will establish the Contractor's lay-down area. This area will also be used for the Contractor's work vehicles. No personal vehicles will be allowed in this area, or in any areas surrounding the construction site that are not regular or authorized parking lots. Personal vehicles must be parked in the perimeter parking lots. Parking permits can be obtained at the USC Parking Office located in the Pendleton Street parking garage. The lay down area will be clearly identified to the contractor by the PM, with a sketch or drawing provided to Parking. In turn, the contractor will mark off this area with a sign containing the project name, PM name, Contractor name and contact number, and end date. Where this area is subject to foot traffic, protective barriers will be provided as specified by the PM. The area will be maintained in a neat and orderly fashion. Vehicles parked in the lay down area (or designated parking areas) will be clearly marked or display a CPC furnished placard for identification.
9. Contractor will be responsible for providing its own temporary toilet facilities, unless prior arrangements are made with the USC Project Manager.
10. Use of USC communications facilities (telephones, computers, etc.) by the Contractor is prohibited, unless prior arrangements are made with the USC Project Manager.

Updated: July 15, 2011

11. For all projects over \$100,000, including IDC 's, an SE-395, Contractor Performance Evaluation, will be completed by the USC Project Manager and reviewed with the GC at the beginning of the project and a copy given to the GC. At the end of the project the form will be completed and a Construction Performance rating will be established.
12. Contractor is responsible for removal of all debris from the site, and is required to provide the necessary dumpsters which will be emptied at least \_\_\_\_\_ times per week. Construction waste must not be placed in University dumpsters. **THE CONSTRUCTION SITE MUST BE THOROUGHLY CLEANED WITH ALL TRASH PICKED UP AND PROPERLY DISPOSED OF ON A DAILY BASIS AND THE SITE MUST BE LEFT IN A SAFE AND SANITARY CONDITION EACH DAY. THE UNIVERSITY WILL INSPECT JOB SITES REGULARLY AND WILL FINE ANY CONTRACTOR FOUND TO BE IN VIOLATION OF THIS REQUIREMENT AN AMOUNT OF UP TO \$1,000 PER VIOLATION.**
13. **Contractor must provide all O&M manuals, as-built drawings, and training of USC personnel on new equipment, controls, etc. prior to Substantial Completion. Final payment will not be made until this is completed.**
14. The contractor will comply with all regulations set forth by OSHA and SCDHEC. Contractor must also adhere to USC's internal policies and procedures (available by request). As requested, the contractor will submit all Safety Programs and Certificates of Insurance to the University for review.
15. Tree protection fencing is required to protect existing trees and other landscape features to be preserved within a construction area. The limits of this fence will be evaluated for each situation with the consultant, USC Arborist and USC Project Manager. The tree protection fence shall be 5' high chain link fence unless otherwise approved by USC Project Manager. No entry or materials storage will be allowed inside the tree protection zone. A 4" layer of mulch shall be placed over the tree protection area to maintain moisture in the root zone.
16. Where it is necessary to cross walks, tree root zones (i.e., under canopy) or lawns the following measures shall be taken: For single loads up to 9,000 lbs., a 3/4" minimum plywood base shall be placed over areas impacted. For single loads over 9,000 lbs., two layers of 3/4" plywood is required.
17. For projects requiring heavy loads to cross walks tree root zones or lawns. A construction entry road consisting of 10' X 16' oak logging mates on 12" coarse, chipped, hardwood base. Mulch and logging mats shall be supplemented throughout the project to keep matting structurally functional.
18. Any damage to existing landscaping (including lawn areas) will be remediated before final payment is made.
19. Orange safety fence to be provided by the contractor. (USC Arborist, Kevin Curtis may be contacted at 777-0033 or 315-0319)

## **CAMPUS VEHICLE EXPECTATIONS**

1. All motorized vehicles on the University campus are expected to travel and park on roadways and/or in parking stalls.
2. All motorized vehicle traffic on USC walkways must first receive the Landscape Manager=s authorization. Violators may be subject to fines and penalties.
3. All motorized vehicles that leak or drip liquids are prohibited from traveling or parking on walks or landscaped areas.
4. Contractors, vendors, and delivery personnel are required to obtain prior parking authorization before parking in a designated space. Violators may be subject to fines and/or penalties. See Item 10 below.
5. Drivers of equipment or motor vehicles that damage university hardscape or landscape will be held personally responsible for damages and restoration expense.
6. Vehicle drivers who park on landscape or drives must be able to produce written evidence of need or emergency requiring parking on same.
7. All vehicles parked on landscape, hardscape, or in the process of service delivery, must display adequate safety devices, i.e. flashing lights, cones, signage, etc.
8. All drivers of equipment and vehicles will be respectful of University landscape, equipment, structures, fixtures and signage.
9. All incidents of property damage will be reported to Parking Services or the Work Management Center.
10. Parking on campus is restricted to spaces designated by Parking Services at the beginning of the project. Once the project manager and contractor agree on how many spaces are needed, the project manager will obtain a placard for each vehicle. This placard must be hung from the mirror of the vehicle, otherwise a ticket will be issued and these tickets cannot be “fixed”. Parking spaces are restricted to work vehicles only; no personal vehicles.



University of South Carolina, Aiken  
USC Aiken Greenhouse Repackaging  
Aiken, South Carolina

USC PROJECT #H29-I337  
PROJECT #12036.02

Project Name: USC Aiken Greenhouse Repackaging Rebid

Project Number: H29-I337

University of South Carolina

**CONTRACTOR'S ONE YEAR GUARANTEE**

STATE OF \_\_\_\_\_

COUNTY OF \_\_\_\_\_

WE \_\_\_\_\_

as General Contractor on the above-named project, do hereby guarantee that all work executed under the requirements of the Contract Documents shall be free from defects due to faulty materials and /or workmanship for a period of one (1) year from date of acceptance of the work by the Owner and/or Architect/Engineer; and hereby agree to remedy defects due to faulty materials and/or workmanship, and pay for any damage resulting wherefrom, at no cost to the Owner, provided; however, that the following are excluded from this guarantee;

Defects or failures resulting from abuse by Owner.

Damage caused by fire, tornado, hail, hurricane, acts of God, wars, riots, or civil commotion.

\_\_\_\_\_  
[Name of Contracting Firm]

\*By \_\_\_\_\_

Title \_\_\_\_\_

\*Must be executed by an office of the Contracting Firm.

SWORN TO before me this \_\_\_\_\_ day of \_\_\_\_\_, 2\_\_\_\_ (seal) \_\_\_\_\_ State

My commission expires \_\_\_\_\_

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## SECTION 01100 - SUMMARY

### PART 1 GENERAL

#### 1.01 PROJECT

- A. Project Name: USC AIKEN GREENHOUSE REPACKAGING.
- B. Owner's Name: USC AIKEN.
- C. Architect's Name: GMK Associates, Inc.
- D. The Project consists of the construction of an owner provided 2,100 square foot preengineered greenhouse structure and associated infrastructure including a new water line and data conduit .
- E. Alternates:
  - 1. Alternate 1: The electrical contractor's scope of work shall consist of furnishing and installing all electrical elements as shown in Weatherhead Detail 2/E2.0 and Power Riser Diagram as shown on Sheet E2.0. This shall include and not be limited to 225A Panel "P1" and all circuit breakers, CT meter, weatherhead and all associated conduit and wire required for a complete installation.
  - 2. Alternate 2: The electrical contractor's scope of work shall consist of furnishing and installing all the electrical elements as shown in Weatherhead Detail 2/E2.0 and Power Riser Diagram as shown on Sheet E2.0. This shall include and not be limited to 225A Panel "P1" and all circuit breakers, CT meter, weatherhead and all associated conduit and wire required for a complete installation. The electrical contractor shall also furnish and install all materials and labor to upfit Greenhouse #2 and the connector greenhouse structure as well. This shall include and not be limited to all light fixture not included in the greenhouse kit, light switches, receptacles, disconnect switches, junction boxes and all associated conduit and wiring required for a complete installation per the design as indicated on the electrical drawings as shown on sheet E2.0, V1.0, V2.0 and V3.0.
  - 3. All labor and materials associated with the installation of the two 1" data conduits indicated on drawing C-101 shall be deleted from the scope or work including the trenching, asphalt patches, handholes, conduit, etc.

#### 1.02 WORK BY OWNER

- A. Owner has awarded a contract for supply of a preengineered greenhouse kit which will be delivered to the owner prior to the commencement of this contract.
- B. Owner will supply the following for installation by Contractor:
  - 1. Greenhouse kit as indicated in the attached vendor drawings.
  - 2. The equipment indicated on the shop drawings will be provided by the greenhouse manufacturer. The contractor is responsible for all wiring, rough ins, and terminations of equipment. Refer to the installation instructions of each piece of equipment for additional information.

#### 1.03 OWNER OCCUPANCY

- A. Owner intends to occupy the Project upon Substantial Completion.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

#### 1.04 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.

B. Provide access to and from site as required by law and by Owner:

**1.05 WORK SEQUENCE**

A. Coordinate construction schedule and operations with Owner.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01200 - PRICE AND PAYMENT PROCEDURES**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Coordinate the Schedule of Values and Applications for Payment with the Contractor's Construction Schedule, List of Subcontracts, and Submittal Schedule.
- D. The Contractor's Construction Schedule and Submittal Schedule are included in other sections of Division 1.
- E. See also the payment requirements in Supplementary Conditions.
- F. Change procedures.
- G. Correlation of Contractor submittals based on changes.
- H. Procedures for preparation and submittal of application for final payment.

**1.02 RELATED REQUIREMENTS**

- A. Document 00500 - Agreement: Contract Sum, retainages, payment period.

**1.03 SCHEDULE OF VALUES**

- A. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- B. Forms filled out by hand will not be accepted.
- C. Submit Schedule of Values in duplicate within 30 days after date of Owner-Contractor Agreement.
- D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization and bonds and insurance.
  - 1. Provide minimum of 1% of the Construction Cost for Project Record Drawings.
  - 2. Provide minimum of 1% of the Construction Cost for Operating and Maintenance Data.
  - 3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items.
- E. Correlate line items in the Schedule of Values with other required administrative schedules and forms, including:
  - 1. Contractor's construction schedule.
  - 2. Application for Payment form.
  - 3. List of Subcontractors.
  - 4. Schedule of allowances.
  - 5. List of principal suppliers and fabricators.
  - 6. Schedule of submittals.
- F. Sub-Schedules: Where the Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

- G. Identification: Include the following Project identification on the Schedule of Values:
  - 1. Project name and location.
  - 2. Name of the Architect.
  - 3. Contractor's name and address.
  - 4. Date of submittal.
- H. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.
- I. Include within each line item, a direct proportional amount of Contractor's overhead and profit.
- J. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
- K. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values.
- L. Revise schedule to list approved Change Orders, with each Application For Payment.

#### 1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
  - 1. List of Subcontractors.
  - 2. List of principal suppliers and fabricators.
  - 3. Schedule of Values.
  - 4. Contractor's Construction Schedule (preliminary if not final).
  - 5. Schedule of principal products.
  - 6. List of Contractor's staff assignments.
  - 7. List of Contractor's principal consultants.
  - 8. Copies of building permits.
  - 9. Copies of authorizations and licenses from governing authorities for performance of the Work.
  - 10. Initial progress report.
  - 11. Report of pre-construction meeting.
  - 12. Certificates of insurance and insurance policies.
  - 13. Performance and payment bonds (if required).
  - 14. Data needed to acquire Owner's insurance.
  - 15. Initial settlement survey and damage report, if required.
- E. For each item, provide a column for listing each of the following:
  - 1. Item Number.
  - 2. Description of work.
  - 3. Scheduled Values.
  - 4. Previous Applications.

5. Work in Place and Stored Materials under this Application.
  6. Authorized Change Orders.
  7. Total Completed and Stored to Date of Application.
  8. Percentage of Completion.
  9. Balance to Finish.
  10. Retainage.
- F. Execute certification by signature of authorized officer.
1. Incomplete applications will be returned without action.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored Products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of Work.
- I. Submit three copies of each Application for Payment.
- J. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.
- K. Include the following with the application:
1. Transmittal letter as specified for Submittals in Section 01300.
  2. Construction progress schedule, revised and current as specified in Section 01325.
  3. Partial release of liens from major Subcontractors and vendors.
- L. Waiver Delays: Submit each Application for Payment with the Contractor's waiver of mechanics lien for the period of construction covered by the application.
- M. When an application shows completion of an item, submit final or full waivers.
- N. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.
- O. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- P. Administrative actions and submittals that shall proceed or coincide with this application include:
1. Occupancy permits and similar approvals.
  2. Warranties (guarantees) and maintenance agreements.
  3. Test/adjust/balance records.
  4. Meter readings.
  5. Start-up performance reports.
  6. Change-over information related to Owner's occupancy, use, operation and maintenance.
  7. Final cleaning.
  8. Application for reduction of retainage, and consent of surety.
  9. Advice on shifting insurance coverages.
- Q. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial

Completion.

- R. Contractor is required to assemble and complete information required by SC Department of Health and Environmental Control for project close-out. Copies of these regulations and guidelines are available from SCDHEC or will be given to successful bidder upon start of work. Three copies of all information is required.

#### 1.05 MODIFICATION PROCEDURES

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to the Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Price or Contract Time, Architect will issue instructions directly to Contractor.
- C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
  - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
  - 2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 14 days.
- E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01600.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
  - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
  - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
  - 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
  - 4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- G. Substantiation of Costs: Provide full information required for evaluation.
  - 1. Provide following data:
    - a. Quantities of products, labor, and equipment.
    - b. Taxes, insurance, and bonds.
    - c. Overhead and profit.
    - d. Justification for any change in Contract Time.



- e. Credit for deletions from Contract, similarly documented.
  2. Support each claim for additional costs with additional information:
    - a. Origin and date of claim.
    - b. Dates and times work was performed, and by whom.
    - c. Time records and wage rates paid.
    - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
  3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- K. Promptly enter changes in Project Record Documents.

#### 1.06 APPLICATION FOR FINAL PAYMENT

- A. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of Work covered by the application who could lawfully be entitled to a lien.
- B. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- C. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
  1. Completion of Project closeout requirements.
  2. Completion of items specified for completion after Substantial Completion.
  3. Assurance that unsettled claims will be settled.
  4. Assurance that Work not complete and accepted will be completed without undue delay.
  5. Transmittal of required Project construction records to Owner.
  6. Certified property survey.
  7. Proof that taxes, fees and similar obligations have been paid.
  8. Removal of temporary facilities and services.
  9. Removal of surplus materials, rubbish and similar elements.
  10. Change of door locks to Owner's access.
- D. Application for Final Payment will not be considered until the following have been accomplished:
  1. All closeout procedures specified in Section 01700.

**END OF SECTION**

**SECTION 01300 - ADMINISTRATIVE REQUIREMENTS**

**PART 1 GENERAL**

**1.01 SECTION INCLUDES**

- A. Preconstruction meeting.
- B. Progress meetings.
- C. Coordination drawings.
- D. Submittals for review, information, and project closeout.
- E. Number of copies of submittals.
- F. Submittal procedures.

**1.02 RELATED REQUIREMENTS**

- A. Document 00700 - General Conditions: Dates for applications for payment.
- B. Section 01325 - Construction Progress Schedule: Form, content, and administration of schedules.
- C. Section 01700 - Execution Requirements: Additional coordination requirements.
- D. Section 01780 - Closeout Submittals: Project record documents.

**1.03 PROJECT COORDINATION**

- A. During construction, coordinate use of site and facilities through the Project Coordinator.
- B. Comply with Project Coordinator's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.
- C. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities.
- D. Coordinate field engineering and layout work under instructions of the Project Coordinator.
- E. Make the following types of submittals to Architect through the Project Coordinator:
  - 1. Requests for interpretation.
  - 2. Requests for substitution.
  - 3. Shop drawings, product data, and samples.
  - 4. Test and inspection reports.
  - 5. Manufacturer's instructions and field reports.
  - 6. Applications for payment and change order requests.
  - 7. Progress schedules.
  - 8. Coordination drawings.
  - 9. Closeout submittals.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PRECONSTRUCTION MEETING**

- A. Owner will schedule a meeting after Notice of Award.
- B. Attendance Required:
  - 1. Owner.
  - 2. Architect.
  - 3. Contractor.
- C. Agenda:
  - 1. Execution of Owner-Contractor Agreement.
  - 2. Submission of executed bonds and insurance certificates.
  - 3. Distribution of Contract Documents.
  - 4. Submission of list of Subcontractors, list of Products, schedule of values, and progress schedule.
  - 5. Designation of personnel representing the parties to Contract and Architect.
  - 6. Designation of personnel representing the parties to Contract, Owner, and Architect.
  - 7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
  - 8. Scheduling.
- D. Contractor to record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

### 3.02 PROGRESS MEETINGS

- A. Schedule and administer meetings throughout progress of the Work at maximum weekly intervals on day and time convenient for all parties involved.
- B. Make arrangements for meetings, prepare agenda with copies for participants prior to meetings, preside at meetings.
- C. Attendance Required: Job superintendent, major Subcontractors and suppliers as appropriate to agenda topics for each meeting. The Architect and Owner may attend.
- D. Agenda:
  - 1. Review minutes of previous meetings.
  - 2. Review of Work progress.
  - 3. Field observations, problems, and decisions.
  - 4. Identification of problems that impede, or will impede, planned progress.
  - 5. Review of submittals schedule and status of submittals.
  - 6. Review of status of Request for Information (RFI).
  - 7. Review of status of Architectural Supplemental Instructions (ASI).
  - 8. Review of status of proposal requests (PR).
  - 9. Review of status of Change Orders (CO).
  - 10. Review of off-site fabrication and delivery schedules.
  - 11. Maintenance of progress schedule.
  - 12. Corrective measures to regain projected schedules.
  - 13. Planned progress during succeeding work period.
  - 14. Coordination of projected progress.
  - 15. Maintenance of quality and work standards.
  - 16. Effect of proposed changes on progress schedule and coordination.
  - 17. Other business relating to Work.

- E. Record minutes and distribute copies within five days after meeting to participants, with three copies to Architect, one copy to Owner, participants, and those affected by decisions made.

### 3.03 SUBMITTALS FOR REVIEW

- A. When the following are specified in individual sections, submit them for review:
  - 1. Product data.
    - a. When product data submittals are prepared specifically for this project (in the absence of standard printed information) submit such information as shop drawings and not as product data submittals.
    - b. Content:
      - 1) Identify the particular product being submitted; submit only pertinent pages.
      - 2) Show compliance with properties specified.
      - 3) Identify which options and accessories are applicable.
      - 4) Show compliance with the specific standards referenced.
      - 5) Show compliance with specified testing agency listings; show the limitations of their labels or seals, if any.
      - 6) Identify dimensions which have been verified by field measurement.
      - 7) Show special coordination requirements for the product.
  - 2. Shop drawings.
    - a. Original drawings, prepared by Contractor, Subcontractor, supplier or distributor, which illustrate portion of the work, showing fabrication, layout, setting and erection details.
    - b. Do not reproduce the Contract Drawings for the shop drawing submittals. Electronic media of the Construction Documents are not available for the Contractor's Subcontractor's, or material suppliers use.
    - c. Identify details by reference to drawing sheet number(s) and pertinent detail number(s).
    - d. Shop drawings shall not include the phrase by others, except when relating to materials, products or equipment not included under the total Contract.
  - 3. Samples.
    - a. Provide samples that are the same as proposed product.
    - b. Where products are to match a sample prepared by other entities, prepare sample to match.
    - c. Preparation:
      - 1) Attach a description to each sample.
      - 2) Attach name of manufacturer or source to each sample.
      - 3) Where compliance with specified properties is required, attach documentation showing compliance.
      - 4) Where selection is required, the first submittal may be a single set of all options; after return of submittal with selection indicated, submit standard number of sets of selected item.
    - d. Keep final sample set(s) at the project site, available for use during progress of the work.
    - e. Contractor shall be responsible for submitting all interior and exterior materials samples that require a color and/or finish selection or is required to be part of a mock up assembly at the same time. The Contractor shall include the color, finish, material selection schedule in the shop drawing submittal schedule. The Architect will provide final color, finish, and material selections only when they

have all been submitted by the Contractor.

- B. Submit to Architect for review for the limited purpose of checking for conformance with information given and the design concept expressed in the contract documents.
- C. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01780 - CLOSEOUT SUBMITTALS.

#### 3.04 SUBMITTALS FOR INFORMATION

- A. When the following are specified in individual sections, submit them for information:
  - 1. Design data.
  - 2. Certificates.
  - 3. Test reports.
  - 4. Inspection reports.
  - 5. Manufacturer's instructions.
  - 6. Manufacturer's field reports.
  - 7. Other types indicated.
- B. Submit for Architect's knowledge as contract administrator or for Owner. No action will be taken.

#### 3.05 SUBMITTALS FOR PROJECT CLOSEOUT

- A. When the following are specified in individual sections, submit them at project closeout:
  - 1. Project record documents.
  - 2. Operation and maintenance data.
  - 3. Warranties.
  - 4. Bonds.
  - 5. Other types as indicated.
- B. Submit for Owner's benefit during and after project completion.

#### 3.06 NUMBER OF COPIES OF SUBMITTALS

- A. Documents for Review:
  - 1. Small Size Sheets, Not Larger Than 8-1/2 x 11 inches: Submit the number of copies that Contractor requires, plus two copies that will be retained by Architect.
- B. Documents for Information: Submit two copies.
- C. Documents for Project Closeout: Make one reproduction of submittal originally reviewed. Submit one extra of submittals for information.

#### 3.07 SUBMITTAL PROCEDURES

- A. Transmit each submittal with AIA Form G810, in duplicate.
  - 1. Submittals received without a transmittal form will be returned without review or action.
  - 2. Fill out a separate transmittal form for each submittal; also include the following:
    - a. Other relevant information.
    - b. Requests for additional information.
  - 3. Sequentially number the transmittal form. Revise submittals with original number and a sequential alphabetic suffix.

- B. Identify Project name and numbers, Contractor's, Subcontractor's or supplier's name and address, Architect's name and address, Manufacturer's name ; pertinent drawing and detail number, and specification section number, as appropriate on each copy.
- C. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of Products required, field dimensions, quantities, adjacent construction Work, and coordination of information is in accordance with the requirements of the Work and Contract Documents.
  - 1. Contractor's responsibility regarding errors and omissions in submittals is not relieved by Architect's review of submittals.
  - 2. Contractor's responsibility regarding deviations in submittals from requirements of Contract Documents is not relieved by Architect's review submittals, unless Architect gives written acceptance of specific deviations as approved by Owner.
  - 3. When work is directly related and involves more than one trade, shop drawings shall be coordinated by the submitting Contractor/Subcontractor with other trades prior submission and related work submitted under one cover.
    - a. After shop drawing has been submitted for review, no changes may be made to that Drawing other than changes resulting from review notes made by the Architect unless such changes are clearly identified and circled before being resubmitted. Any failure to comply with this requirement shall nullify and invalidate the Architect's review.
  - 4. Submittals without Contractor's stamp of review will not be reviewed and will be returned for resubmission.
- D. Submittals will be accepted from the Contractor only. Submittals received from other entities will be returned without review or action.
- E. Do not submit substitute items that have not been approved by means of the procedure specified elsewhere.
- F. Do not include requests for substitution (either direct or indirect) on submittals; comply with procedures for substitutions specified elsewhere.
- G. Schedule submittals to expedite the Project, and coordinate submission of related items.
  - 1. Prepare and submit, in accordance with the approved Project Construction Schedule, a separate document listing dates by which shop drawings, product data and samples must be submitted for each material, product or equipment item requiring submittal.
  - 2. The schedule shall reflect an orderly sequence so as to cause no delay in the Work.
  - 3. Coordinate submittals and activities that must be performed in sequence, so that the Architect has enough information to properly review the submittals.
  - 4. Coordinate submittals of different types for the same product or system so that the Architect has enough information to properly review each submittal.
  - 5. The dates indicated shall allow reasonable time for the review process of checking, correcting and resubmitting and reasonable time for procurement.
  - 6. No extension of time will be granted to the Contractor/Subcontractor because of failure to expeditiously submit shop drawings and samples in reasonable time to allow for review process.
  - 7. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor. Architect shall review with reasonable promptness.
- H. Identify variations from Contract Documents and Product or system limitations that may be

detrimental to successful performance of the completed Work.

- I. Provide space for Contractor and Architect review stamps. Submittals to receive Architect's action marking: Provide blank space on the label or on the submittal itself for action marking; 4 inches wide by 6 inches high.
- J. Do not commence work which requires review of any submittals until receipt of returned submittals with an acceptable action.
  - 1. Stamped Reviewed, no corrections or resubmissions required, fabrication may proceed.
  - 2. Stamped Revise and Resubmit.
    - a. If Contractor/Subcontractor complies with noted corrections, fabrication may proceed.
  - 3. If for any reason the Contractor/Subcontractor cannot comply with the noted corrections, fabrication shall not proceed and Contractor/Subcontractor shall resubmit, following procedures outlined herein before.
  - 4. Stamped Revise and Resubmit or Resubmit.
    - a. Contractor/Subcontractor shall revise and resubmit for review. Fabrication shall not proceed.
- K. When revised for resubmission, identify all changes made since previous submission.
- L. Distribute reviewed submittals as appropriate. Instruct parties to promptly report any inability to comply with requirements.
- M. Submittals not requested will not be recognized or processed.

**END OF SECTION**

## SECTION 01325 - CONSTRUCTION PROGRESS SCHEDULE

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.
- C. Reports.

#### 1.02 SUBMITTALS

- A. Within 7 days after date established in Notice to Proceed, submit preliminary schedule defining planned operations for the first 45 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 3 working days.
- C. Within 10 days after date established in Notice to Proceed, submit draft of proposed complete schedule for review.
  - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 3 days after Architect's review, submit complete schedule.
- E. Submit Daily Construction Reports every week.
- F. Submit updated schedule and Progress Reports with each Application for Payment.
- G. Submit the number of opaque reproductions that Contractor requires, plus three copies that will be retained by Architect.
- H. Submit under transmittal letter form specified in Section 01300.

#### 1.03 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with one years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

#### 1.04 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 22 x 17 inches or width required.
- C. Sheet Size: Multiples of 8-1/2 x 11 inches.
- D. Scale and Spacing: To allow for notations and revisions.

#### 1.05 COORDINATION

- A. In preparation of schedules, take into account the time allowed or required for the Architect's administrative procedures.



PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Provide sub-schedules to define critical portions of the entire schedule.
- E. Include conferences and meetings in schedule.
- F. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- G. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, Products identified under Allowances, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.
- H. Indicate delivery dates for owner-furnished products.
- I. Coordinate content with schedule of values specified in Section 01200.
- J. Provide legend for symbols and abbreviations used.
- K. Use the same terminology as that used in the Contract Documents.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.
- C. Coordinate each element on the schedule with other construction activities.
- D. Show activities in proper sequence.
- E. Include cost bar at top of chart, showing estimated and actual costs of work performed at the date of each application for payment.
- F. Use vertical lines to mark the time scale at not more than one week intervals.

3.04 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Provide construction schedule in the form of bar charts:
  - 1. Use the same items of work as shown in the schedule of values.
  - 2. Where related activities must be performed in sequence, show relationship graphically.
  - 3. Incorporate the submittal schedule specified elsewhere.
  - 4. Incorporate the quality control activities schedule specified elsewhere.
  - 5. Show dates of:
    - a. Each activity that influences the construction time.

- b. Preconstruction meeting.
  - c. Ordering dates for products requiring long lead time.
  - d. Completion of demolition.
  - e. Completion of mechanical work.
  - f. Completion of electrical work.
  - g. Instruction of the Owner's personnel in operation and maintenance of equipment and systems.
  - h. Substantial and final completion, with time frames for the Architect's completion procedures.
6. In developing the schedule take into account:
- a. Continued occupancy of areas adjacent to the work area as well as throughout the building.
  - b. Interruption of services to occupied facilities
  - c. Site limitations

### 3.05 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit progress reports required to support recommended changes.

### 3.06 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules and reports to Contractor's project site file, to Subcontractors, suppliers, Architect, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

### 3.07 REPORTS

- A. Daily Construction Logs: Every day, record the following information concerning events at the site:
  1. Approximate number of persons at the site.
  2. Visitors to the site.
  3. Modifications to the contract received; modifications implemented.
  4. Changes in occupancy.
  5. Delays; reasons for delay.
  6. Emergencies and accidents.
  7. Equipment and system start-ups and tests.
  8. Losses of material and property.
  9. Meetings held and significant decisions made there.
  10. Names of Subcontractors at site.
  11. Orders and requests of representatives of governing authorities.

12. Unusual events.
  13. Utility service disconnections and connections.
- B. Progress Reports: Prepare a narrative report describing the general state of completion of the work and describing in detail the following:
1. Actual and anticipated delays, their impact on the schedule, and corrective actions taken or proposed.
  2. Actual and potential problems.
  3. Status of change order work.
  4. Effect of delays, problems, and changes on the schedules of Subcontractors.
  5. Outstanding change proposal requests.
  6. Status of corrective work ordered by the Architect

**END OF SECTION**

## SECTION 01400 - QUALITY REQUIREMENTS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. References and standards.
- B. Mock-ups.
- C. Control of installation.
- D. Tolerances.
- E. Testing and inspection services.
- F. Manufacturers' field services.

#### 1.02 RELATED REQUIREMENTS

- A. Document 00700 - General Conditions: Inspections and approvals required by public authorities.
- B. Section 01300 - Administrative Requirements: Submittal procedures.
- C. Section 01600 - Product Requirements: Requirements for material and product quality.

#### 1.03 SUBMITTALS

- A. Testing Agency Qualifications:
  - 1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
  - 2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, or for Owner's information.
- C. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.
  - 1. Include:
    - a. Date issued.
    - b. Project title and number.
    - c. Name of inspector.
    - d. Date and time of sampling or inspection.
    - e. Identification of product and specifications section.
    - f. Location in the Project.
    - g. Type of test/inspection.
    - h. Date of test/inspection.
    - i. Results of test/inspection.
    - j. Conformance with Contract Documents.
    - k. When requested by Architect, provide interpretation of results.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in

quantities specified for Product Data.

1. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
1. Submit report within 10 days of observation to Architect for information.
  2. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.
- G. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.
1. Submit for information for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents.

#### 1.04 TESTING AND INSPECTION AGENCIES

- A. Owner will employ and pay for services of an independent testing agency to perform other specified testing.
- B. As indicated in individual specification sections, Owner or Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.
- C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- D. Contractor Employed Agency:
1. Testing agency: Comply with requirements of ASTM E329, ASTM E 548, ASTM E543, ASTM C1021, ASTM C1077, and ASTM C1093.
  2. Inspection agency: Comply with requirements of ASTM D3740, ASTM E329, and ASTM E548.
  3. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
  4. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

#### PART 2 PRODUCTS - NOT USED

#### PART 3 EXECUTION

##### 3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

### 3.02 MOCK-UPS

- A. Tests will be performed under provisions identified in this section and identified in the respective product specification sections.
- B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- C. Accepted mock-ups shall be a comparison standard for the remaining Work.
- D. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, remove mock-up and clear area when directed to do so.

### 3.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

### 3.04 TESTING AND INSPECTION

- A. See individual specification sections for testing required.
- B. Testing Agency Duties:
  - 1. Test samples of mixes submitted by Contractor.
  - 2. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
  - 3. Perform specified sampling and testing of products in accordance with specified standards.
  - 4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
  - 5. Promptly notify Architect and Contractor of observed irregularities or non-conformance of Work or products.
  - 6. Perform additional tests and inspections required by Architect.
  - 7. Submit reports of all tests/inspections specified.
- C. Limits on Testing/Inspection Agency Authority:
  - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
  - 2. Agency may not approve or accept any portion of the Work.
  - 3. Agency may not assume any duties of Contractor.

4. Agency has no authority to stop the Work.
- D. Contractor Responsibilities:
1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
  2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
  3. Provide incidental labor and facilities:
    - a. To provide access to Work to be tested/inspected.
    - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
    - c. To facilitate tests/inspections.
    - d. To provide storage and curing of test samples.
  4. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.
  5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
  6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.
- F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

### 3.05 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

### 3.06 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements.
- B. If, in the opinion of Architect, it is not practical to remove and replace the Work, Architect will direct an appropriate remedy or adjust payment.

**END OF SECTION**

## SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary sanitary facilities.
- C. Security requirements.
- D. Vehicular access and parking.
- E. Waste removal facilities and services.
- F. Campus Policy

#### 1.02 SUBMITTALS

- A. Implementation and Termination Schedule: Submit a schedule indicating implementation and termination of each temporary utility connection within 10 days of the date established for commencement of the Work.

#### 1.03 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but not limited to:
  - 1. Building Code requirements.
  - 2. Health and safety regulations.
  - 3. Utility company regulations.
  - 4. Police, Fire Department and Rescue Squad rules.
  - 5. Environmental protection regulations.
- B. Standards: Comply with NFPA Code 241, "Building Construction and Demolition Operations", ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition", and NECA Electrical Design Library, "Temporary Electrical Facilities."
- C. Electrical Service: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- D. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

#### 1.04 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility connection. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use of the permanent service.

#### 1.05 MATERIALS

- A. General: Provide new materials; if acceptable to the Architect, undamaged previously used materials in serviceable condition may be used. Provide materials suitable for the use intended.



- B. Lumber and Plywood: Comply with requirements in Division-6 Section "Wood Blocking and Curbing"
- C. Gypsum Wallboard: Provide gypsum wallboard complying with requirements of ASTM C 36 on interior walls of temporary offices.
- D. Paint: Comply with requirements of Division-9 Section "Paints and Coatings."
- E. Water: Provide potable water approved by local health authorities.

#### 1.06 EQUIPMENT

- A. General: Provide new equipment; if acceptable to the Architect, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.
- B. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light, for connection of power tools and equipment.
- C. Electrical Power Cords: Provide grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
- D. Temporary Offices: Locate office within the construction site as directed by Owner.
- E. First Aid Supplies: Comply with governing regulations. All accidents or injuries shall be reported to Owner.
- F. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, or a combination of extinguishers of NFPA recommended classes for the exposures.
- G. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.
- H. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them to interfere with progress. Do not allow hazardous dangerous or unsanitary conditions, or public nuisances to develop or persist on the site

#### 1.07 TEMPORARY UTILITIES

- A. Existing facilities may be used.

#### 1.08 TEMPORARY SANITARY FACILITIES

- A. Use of existing facilities is permitted as directed by Owner.

#### 1.09 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

- B. Construction: Framing and gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:
  - 1. STC rating of 35 in accordance with ASTM E90.
  - 2. Maximum flame spread rating of 75 in accordance with ASTM E84.
- C. Paint surfaces exposed to view from Owner-occupied areas.

#### 1.10 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.
- B. Except for use of permanent fire protection as soon as available, do not change over from use of temporary security and protection facilities to permanent facilities until Substantial Completion, or longer as requested by the Architect.
- C. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities, install and maintain temporary fire protection facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 "Standard for Portable Fire Extinguishers," and NFPA 241 "Standard for Safeguarding Construction, Alterations and Demolition Operations."
- D. Store combustible materials in containers in fire-safe locations
- E. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities for fighting fires. Prohibit smoking in the building.
- F. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- G. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to prevent unauthorized entrance, vandalism, theft and similar violations of security.
- H. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possibility that air, might be contaminated or polluted, or that other undesirable effects might result.
- I. Coordinate with Owner's security program.

#### 1.11 VEHICULAR ACCESS AND PARKING

- A. Coordinate access and haul routes with governing authorities and Owner.
- B. Designated existing on-site roads may be used for construction traffic.
- C. Existing parking areas may be used for construction parking as directed by Owner.

#### 1.12 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the

structure unless otherwise approved by the authorities having jurisdiction.

#### 1.13 CAMPUS POLICY

- A. Smoking is prohibited on the McLeod Regional Medical Center Campus. Smoking is not allowed by construction personnel.
- B. Food and canned or bottled drinks are prohibited in the areas of interior construction work. Contractor shall provide designated areas for water stations and consumption of food.
- C. Workers not complying with these requirements shall be subject to dismissal.

#### 1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Restore existing facilities used during construction to original condition.

**END OF SECTION**

## SECTION 01600 - PRODUCT REQUIREMENTS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations and procedures.
- E. Procedures for Owner-supplied products.

#### 1.02 RELATED REQUIREMENTS

- A. Document 00200 - Instructions to Bidders: Product options and substitution procedures prior to bid date.
- B. Section 01100 - Summary: Lists of products to be removed from existing building.
- C. Section 01400 - Quality Requirements: Product quality monitoring.

#### 1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; National Fire Protection Association.

#### 1.04 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
  - 1. Submit within 15 days after date of Agreement.
  - 2. For products specified only by reference standards, list applicable reference standards.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
  - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

### PART 2 PRODUCTS

#### 2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. Do not use products having any of the following characteristics:
- C. Provide interchangeable components of the same manufacture for components being replaced.

- D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
- E. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

## 2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

## PART 3 EXECUTION

### 3.01 SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify time restrictions for submitting requests for substitutions during the bidding period. Comply with requirements specified in this section.
- B. Substitutions will not be considered when a product becomes unavailable through no fault of the Contractor.
- C. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- D. A request for substitution constitutes a representation that the submitter:
  - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
  - 2. Will provide the same warranty for the substitution as for the specified product.
  - 3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
  - 4. Waives claims for additional costs or time extension that may subsequently become apparent.
  - 5. Will reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.
- E. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- F. Substitution Submittal Procedure:
  - 1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.
  - 2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
  - 3. The Architect will notify Contractor in writing of decision to accept or reject request.
- G. Substitution Request Form:
  - 1. **SUBSTITUTIONS WILL BE CONSIDERED ONLY WHEN THE ATTACHED**

FORM IS COMPLETED AND INCLUDED WITH THE SUBMITTAL WITH ALL BACK-UP DATA.

### 3.02 OWNER-SUPPLIED PRODUCTS

- A. See Section 01100 - Summary for identification of Owner-supplied products.
- B. Owner's Responsibilities:
  - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
  - 2. Arrange and pay for product delivery to site.
  - 3. On delivery, inspect products jointly with Contractor.
  - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
  - 5. Arrange for manufacturers' warranties, inspections, and service.
- C. Contractor's Responsibilities:
  - 1. Review Owner reviewed shop drawings, product data, and samples.
  - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
  - 3. Handle, store, install and finish products.
  - 4. Repair or replace items damaged after receipt.

### 3.03 TRANSPORTATION AND HANDLING

- A. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- B. Transport and handle products in accordance with manufacturer's instructions.
- C. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- D. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- E. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.
- F. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

### 3.04 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.
- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.

- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- G. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- H. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- I. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- J. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

**SECTION 01601 - SUPPLEMENT A - SUBSTITUTION REQUEST FORM**

TO:

GMK Associates, Inc.  
1201 Main Street, Suite 2100  
Columbia, South Carolina 29201  
fax: 803.255.7243

We hereby submit for your consideration the following product instead of the specified item for the above project:

DRAWING NO. \_\_\_\_\_ DRAWING  
NAME \_\_\_\_\_

SPEC. SECT.	SPEC NAME	PARAGRAPH	SPECIFIED ITEM
-------------	-----------	-----------	----------------

\_\_\_\_\_

Proposed Substitution: \_\_\_\_\_

Attached complete information on changes to Drawings and/or Specifications, which proposed substitution would require for its proper installation.

Submit with request necessary samples and substantiating data to prove equal quality and performance to that which is specified. Clearly mark manufacturer's literature to indicate equality in performance.

The undersigned certifies that the function, appearance and quality are of equal performance and assumes liability for equal performance, equal design and compatibility with adjacent materials.

Submitted By:

\_\_\_\_\_  
Signature Title

\_\_\_\_\_  
Firm

\_\_\_\_\_  
Address

\_\_\_\_\_  
Telephone Date

Signature shall be by person having authority to legally bind his firm to the above terms. Failure to provide legally binding signature will result in retraction of approval.

\_\_\_\_\_  
For use by the Architect: For use by the Owner:  
 Recommended  Recommended as noted  Approved



<input type="checkbox"/> Not Recommended	<input type="checkbox"/> Received too late	<input type="checkbox"/> Not Approved
<input type="checkbox"/> Insufficient data received		<input type="checkbox"/> Approved as noted
By: _____		By: _____
Date: _____		Date: _____

---

Fill in Blanks Below:

- A. Does the substitution affect dimensions shown on Drawings: Yes \_\_\_ No \_\_\_ If yes, clearly indicate changes. \_\_\_\_\_
- B. Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution? Yes \_\_\_ No \_\_\_ If no, fully explain: \_\_\_\_\_
- C. What affect does substitution have on other Contracts or other trades? \_\_\_\_\_
- D. What affect does substitution have on construction schedule? \_\_\_\_\_
- E. Manufacturer's warranties of the proposed and specified items are: \_\_\_ Same \_\_\_ Different (If Different, Explain on Attachment)
- F. Reason for Request: \_\_\_\_\_
- G. Itemized comparison of specified item(s) with the proposed substitution; list significant variations: \_\_\_\_\_  
 \_\_\_\_\_
- H. Accurate cost data comparing proposed substitution with product specified: \_\_\_\_\_
- I. Designation of maintenance services and sources: \_\_\_\_\_  
 \_\_\_\_\_

(Attach additional sheets if required.)

**END OF SECTION**

## SECTION 01700 - EXECUTION REQUIREMENTS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.
- C. Cutting and patching.
- D. Cleaning and protection.
- E. Starting of systems and equipment.
- F. Demonstration and instruction of Owner personnel.
- G. Closeout procedures, except payment procedures.
- H. General requirements for maintenance service.

#### 1.02 RELATED REQUIREMENTS

- A. Section 01100 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.
- B. Section 01300 - Administrative Requirements: Submittals procedures.
- C. Section 01400 - Quality Requirements: Testing and inspection procedures.
- D. Section 01500 - Temporary Facilities and Controls: Temporary interior partitions.
- E. Section 01780 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.
- F. Section 07840 - Firestopping.

#### 1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
  - 1. Structural integrity of any element of Project.
  - 2. Integrity of weather exposed or moisture resistant element.
  - 3. Efficiency, maintenance, or safety of any operational element.
  - 4. Visual qualities of sight exposed elements.
  - 5. Work of Owner or separate Contractor.
  - 6. Include in request:
    - a. Identification of Project.
    - b. Location and description of affected work.
    - c. Necessity for cutting or alteration.
    - d. Description of proposed work and products to be used.
    - e. Alternatives to cutting and patching.
    - f. Effect on work of Owner or separate Contractor.
    - g. Written permission of affected separate Contractor.
    - h. Date and time work will be executed.

- C. Project Record Documents: Accurately record actual locations of capped and active utilities.

#### 1.04 PROJECT CONDITIONS

- A. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- B. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
  - 1. Clean interior spaces prior to the start of the finish painting and continue cleaning on an as-needed basis until painting is finished.
  - 2. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.
  - 3. Handle materials in a controlled manner with as little handling as possible; do not drop or throw materials from heights.
- C. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.
- D. Rodent Control: Provide methods, means, and facilities to prevent rodents from accessing or invading premises.
- E. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

#### 1.05 PRE-CONSTRUCTION

- A. Meet with management staff of the area of construction for required infection control practices in that department and comply with the Owner's policies.

#### 1.06 COORDINATION

- A. See Section 01100 for occupancy-related requirements.
- B. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

- G. Coordinate completion and clean-up of work of separate sections.
- H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

## **PART 2 PRODUCTS**

### **2.01 PATCHING MATERIALS**

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01600.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### **3.02 PREPARATION**

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### **3.03 GENERAL INSTALLATION REQUIREMENTS**

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Building shall be enclosed, ventilated and sealed from the exterior prior to installation of interior finish materials.

- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- F. Make neat transitions between different surfaces, maintaining texture and appearance.

### 3.04 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  - 1. Verify that construction and utility arrangements are as shown.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
  - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01500 in locations indicated on drawings.
- C. Remove existing work as indicated and as required to accomplish new work.
  - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
  - 2. Remove items indicated on drawings.
  - 3. Relocate items indicated on drawings.
  - 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
  - 5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
  - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
  - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
  - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    - b. See Section 01100 for other limitations on outages and required notifications.
    - c. Provide temporary connections as required to maintain existing systems in service.
  - 4. Verify that abandoned services serve only abandoned facilities.
  - 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub

and tag with identification; patch holes left by removal using materials specified for new construction.

- E. Protect existing work to remain.
  - 1. Prevent movement of structure; provide shoring and bracing if necessary.
  - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  - 3. Repair adjacent construction and finishes damaged during removal work.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
- G. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
- H. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
- I. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.
- J. Trim existing wood doors as necessary to clear new floor finish. Refinish trim as required.
- K. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- L. Refinish existing surfaces as indicated:
- M. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
- N. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- O. Clean existing systems and equipment.
- P. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- Q. Do not begin new construction in alterations areas before demolition is complete.
- R. Comply with all other applicable requirements of this section.

### 3.05 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
  - 1. Complete the work.
  - 2. Fit products together to integrate with other work.
  - 3. Provide openings for penetration of mechanical, electrical, and other services.
  - 4. Match work that has been cut to adjacent work.
  - 5. Repair areas adjacent to cuts to required condition.

6. Repair new work damaged by subsequent work.
  7. Remove samples of installed work for testing when requested.
  8. Remove and replace defective and non-conforming work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- G. Restore work with new products in accordance with requirements of Contract Documents.
- H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07840, to full thickness of the penetrated element.
- J. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
  2. Match color, texture, and appearance.
  3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
- K. Meet with management staff of the area of construction for required infection control practices in that department and comply with the Owner's policies.

### 3.06 PROGRESS CLEANING

- A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.
- B. Contractor shall assess the amount of air borne dust and debris for construction and apprise the Owner of the need to change the air filtration filters in the air handling system at an increased frequency.
- C. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- D. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- E. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- F. Collect and remove waste materials, debris, and rubbish from site periodically and dispose off-site.
- G. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or

sanitary drains.

### 3.07 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Remove protective coverings when no longer needed; reuse or recycle plastic coverings if possible.

### 3.08 SYSTEM STARTUP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect and owner seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. Submit a written report that equipment or system has been properly installed and is functioning correctly.

### 3.09 DEMONSTRATION AND INSTRUCTION

- A. See Section 01820 - Demonstration and Training.
- B. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.
- C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.
- D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- E. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.

### 3.10 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 15950.



### 3.11 FINAL CLEANING

- A. Employ skilled workmen for final cleaning.
- B. Materials:
  - 1. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
  - 2. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
  - 3. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.
  - 4. Sweeping compounds used in cleaning operations shall leave no residue on concrete floor surfaces that may effect installation of finish flooring materials.
- C. Execute final cleaning prior to final project assessment.
  - 1. Clean areas to be occupied by Owner prior to final completion before Owner occupancy.
- D. Use cleaning materials that are nonhazardous.
- E. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.
- F. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- G. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior surfaces.
- H. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- I. Dust cabinetwork and remove markings.
- J. Prior to final completion, or Owner occupancy, the Contractor shall conduct an inspection of sight-exposed interior surfaces, and all work areas, to verify that the entire Work is clean.
- K. Tunnels and closed off spaces shall be cleaned of packing boxes, wood frame members and other waste materials used in the construction.
- L. The entire system of piping and equipment shall be cleaned internally. The Contractor installing those items shall open all dirt pockets and strainers, completely blowing down as required and clean strainer screens of all accumulated debris.
- M. Tanks, fixtures and pumps shall be drained and proved free of sludge and accumulated matter.
- N. Temporary labels, stickers, etc., shall be removed from fixtures and equipment. (Do not remove permanent name plates, equipment model numbers, ratings, etc.)
- O. Heating and air conditioning equipment, tanks, pumps and traps shall be thoroughly cleaned and new filters or filter media installed.
- P. Before being placed in service, domestic water distribution systems, including those for cold water, drinking water and the hot water system shall be chlorinated. The method to be used

shall be at the option of the Contractor installing the systems, and one of the methods set forth in the AWWA Standard specifications, latest edition, including all amendments thereto. The treatment shall consist of a solution of not less than 50 parts per million of available chlorine. The chlorinating material shall be either liquid chlorine or sodium hypochloride. After sterilization the system shall be flushed with clear water until the chlorine residual is not greater than 0.2 per million.

- Q. Clean filters of operating equipment.
- R. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

### 3.12 CLOSEOUT PROCEDURES

- A. Contract requirements shall be met when construction activities have successfully produced, in this order, these three terminal activities:
  - 1. Substantial Completion.
  - 2. Final Completion.
  - 3. Final Payment.
- B. Make submittals that are required by governing or other authorities.
  - 1. Provide copies to Architect and Owner.
- C. Substantial Completion:
  - 1. The date of Substantial Completion of the Work or designated portion thereof is the date certified by the Architect when construction is sufficiently complete, in accordance with the Contract Documents, so the Owner may occupy the Work or designated portion thereof for the use for which it is intended.
  - 2. When the Contractor considers the Work is substantially complete, he shall submit to the Architect:
    - a. A written notice that the Work, or designated portion thereof, is substantially complete.
    - b. A list of items to be completed or corrected, (herein after referred to as Punch List).
    - c. Request Substantial Completion Observation at a mutually agreeable date.
  - 3. Within a reasonable time after receipt of such notice, the Architect, the Contractor, and at his option, the Owner, will make an observation to determine the status of completion.
  - 4. Should the Architect determine that the Work is not substantially complete:
    - a. The Architect will promptly notify the Contractor in writing, giving the reasons thereof.
    - b. The Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Architect.
    - c. The Architect will re-observe the Work and the cost of the Architect's time and reimbursable expenses will be charged to the Contractor.
  - 5. When the Architect concurs that the Work is substantially complete, he will:
    - a. Prepare a Certificate of Substantial Completion on AIA Form G704, accompanied by the Contractor's Punch List of items to be completed or corrected, as verified and amended by the Architect. (Note: Contract responsibilities are not altered by inclusion or omission of required work from the Punch List.)
    - b. Submit the Certificate to the Owner and the Contractor for their written acceptance

- of the responsibilities assigned to them in the Certificate.
6. The Contractor shall complete or correct all items identified on the Punch List and required by the Contract requirements within time limits established by the Certificate.
  7. Owner will occupy portions of the building as specified in Section 01100.
  8. Correct items of work listed in executed Certificates of Substantial Completion and comply with requirements for access to Owner-occupied areas.
- D. Final Completion:
1. To attain final completion the Contractor shall complete activities pertaining to Substantial Completion, and complete work on punch list items. Only then shall he issue written request to the Architect for Final Observation.
  2. When the Contractor considers the Work is complete, he shall submit written certification that:
    - a. Contract Documents have been reviewed.
    - b. Work has been inspected for compliance with Contract Documents.
    - c. Work has been completed in accordance with Contract Documents.
    - d. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
    - e. Work is completed and ready for final observation.
  3. The Architect, the Contractor and the Owner will make an observation to verify the status of completion with reasonable promptness after receipt of such certification.
  4. Should the Architect consider that the Work is incomplete or defective:
    - a. The Architect will promptly notify the Contractor in writing, listing the incomplete or defective work.
    - b. The Contractor shall take immediate steps to remedy the stated deficiencies, and send a second written certification to the Architect that the Work is complete.
    - c. The Architect will reinspect the Work.
  5. When the Architect finds that the Work is acceptable under the Contract Documents, he shall request the Contractor to make closeout submittals.
- E. The Contractor's Closeout Submittals to the Architect:
1. Evidence of compliance with requirements of governing authorities:
    - a. Certificate of Occupancy
    - b. Certificates of Inspection
    - c. Mechanical
    - d. Electrical
  2. Project Record Documents: To requirements of Section 01780.
  3. Operating and Maintenance Data, Instructions to the Owner's Personnel: To requirements of Section 01780.
  4. Warranties and Bonds: To requirements of individual sections.
  5. Spare Parts and Maintenance Materials: To requirements of individual sections.
  6. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.
- F. Final Adjustment of Accounts:
1. Submit a final statement of accounting to the Architect.
  2. Statement shall reflect all adjustments to the Contract Sum:
    - a. The original Contract Sum.
    - b. Additions and deductions resulting from:
      - 1) Previous Change Orders.

- 2) Deductions for uncorrected Work.
  - 3) Deductions for reinspection payments.
  - 4) Other adjustments.
  - c. Total contract sum, as adjusted.
  - d. Previous payments
  - e. Sum remaining due.
3. Architect will prepare a final Change Order, reflecting adjustments to the Contract Sum which were not previously made by Change Orders.
- G. Final Application for Payment:
1. The Contractor shall submit the final Application and Certificate for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

### 3.13 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION**

## SECTION 01780 - CLOSEOUT SUBMITTALS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

#### 1.02 RELATED REQUIREMENTS

- A. Section 01300 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01700 - Execution Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

#### 1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Architect prior to claim for final Application for Payment.
- B. Operation and Maintenance Data:
  - 1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.
  - 2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
  - 3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
  - 4. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
  - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 15 days after acceptance.
  - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
  - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
  - 4. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.
  - 5. Refer to individual Sections of Divisions-2 through -16 for specific content

- requirements, and particular requirements for submittal of special warranties.
6. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
  7. Bind warranties and bonds in two (or more) duplicate heavy-duty, commercial quality, durable 3-hole punch tab binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
  8. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
  9. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS," the Project title or name, and the name of the Contractor.
  10. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
  1. Drawings.
  2. Specifications.
  3. Addenda.
  4. Change Orders and other modifications to the Contract.
  5. Reviewed shop drawings, product data, and samples.
  6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.
- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
  1. Manufacturer's name and product model and number.
  2. Product substitutions or alternates utilized.
  3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
  1. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
  2. Field changes of dimension and detail.
  3. Details not on original Contract drawings.

### 3.02 OPERATION AND MAINTENANCE DATA

- A. For Each Product or System: List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- E. Manuals:
  - 1. Purpose:
    - a. Operation and maintenance manuals will be used for training of, and use by, Owner's personnel in operation and maintenance of mechanical and electrical systems and equipment. A separate manual or chapter within a manual shall be prepared for each class of equipment or system.
    - b. For additional requirements refer to various specification sections.
- F. Instructions of Owner's Personnel
  - 1. Fully instruct Owner's designated operating and maintenance personnel in operating, adjustments and maintenance of all mechanical and electrical systems and equipment as required by respective and pertinent sections, after all final inspection, tests and repairs have been completed.
  - 2. Operating and maintenance manuals shall constitute the basis of instructions. Contents of manual shall be reviewed in full detail, explaining all aspects of operations and maintenance.
  - 3. Prepare and include additional data when need for such data becomes apparent during instruction and training and sessions.
  - 4. Training sessions shall be jointly arranged with Owner during Contractor's normal week and daily hours. The Owner shall have the responsibility of scheduling its shift work personnel accordingly.
  - 5. Owner and Contractor shall coordinate and cooperate to keep training sessions to a reasonable minimum.

### 3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
  - 1. Product data, with catalog number, size, composition, and color and texture designations.
  - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

- D. Additional information as specified in individual product specification sections.
- E. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

### 3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
  - 1. Description of unit or system, and component parts.
  - 2. Identify function, normal operating characteristics, and limiting conditions.
  - 3. Include performance curves, with engineering data and tests.
  - 4. Complete nomenclature and model number of replaceable parts.
- B. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- C. Include color coded wiring diagrams as installed.
- D. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- E. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.
- I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Provide control diagrams by controls manufacturer as installed.
- K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- N. Include test and balancing reports.
- O. Safety instructions.
- P. Additional Requirements: As specified in individual product specification sections.

### 3.05 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- B. Prepare data in the form of an instructional manual.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable



plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

- D. Cover: Identify each binder on the front and the spine with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Provide heavy duty paper tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- G. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- H. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- I. Contents: Prepare a Table of Contents for each volume, with each product or system description identified, in three parts as follows:
  - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect, Contractor, Subcontractors, and major equipment suppliers.
  - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
    - a. Significant design criteria.
    - b. List of equipment.
    - c. Parts list for each component.
    - d. Operating instructions.
    - e. Maintenance instructions for equipment and systems.
    - f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
  - 3. Part 3: Project documents and certificates, including the following:
    - a. Shop drawings and product data.
    - b. Air and water balance reports.
    - c. Certificates.
- J. Provide a listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.
- K. Table of Contents: Provide title of Project; names, addresses, and telephone numbers of Architect, Consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.

### 3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.

- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder on the front and the spine with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- I. See all provisions under "3.5 WARRANTY:" in General Conditions.
- J. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- K. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, guarantee the corrected work with a new warranty equal to the original.
- L. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.
- M. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, right and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
- N. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- O. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

**END OF SECTION**

**SECTION 01820 - DEMONSTRATION AND TRAINING**

**PART 1 GENERAL**

**1.01 SUMMARY**

**1.02 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures; except:
1. Make all submittals specified in this section, and elsewhere where indicated for commissioning purposes, directly to the Commissioning Authority.
  2. Submit one copy to the Commissioning Authority, not to be returned.
  3. Make commissioning submittals on time schedule specified by Commissioning Authority.
  4. Submittals indicated as "Draft" are intended for the use of the Commissioning Authority in preparation of overall Training Plan; submit in editable electronic format, Microsoft Word 2003 preferred.

**1.03 QUALITY ASSURANCE**

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
  2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**END OF SECTION**

# D I V I S I O N 3

Applicable Portions Of The Conditions  
Of The Contract And Division 1 General  
Requirements Apply To The Work Of  
This Division.

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**SECTION 310523 - CEMENT CONCRETE PAVEMENT**

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
  1. Driveways and roadways.
  2. Parking lots.
  3. Curbs and gutters.
  4. Walkways.

1.03 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Design Mixes: For each concrete pavement mix. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Samples: 10-lb sample of exposed aggregate.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
- E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
  1. Cementitious materials and aggregates.
  2. Steel reinforcement and reinforcement accessories.
  3. Fiber reinforcement.
  4. Admixtures.
  5. Curing compounds.
  6. Applied finish materials.
  7. Bonding agent or adhesive.
  8. Joint fillers.
- F. Minutes of preinstallation conference.

1.04 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
  - 1. Manufacturer must be certified according to the National Ready Mix Concrete Association's Plant Certification Program.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- E. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.
- F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixes.
- G. Mockups: Cast mockups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.
  - 1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
  - 2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
  - 3. Obtain Architect's approval of mockups before starting construction.
  - 4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
  - 5. Demolish and remove approved mockups from the site when directed by Architect.
  - 6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
  - 1. Before submitting design mixes, review concrete pavement mix design and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with concrete pavement to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency responsible for concrete design mixes.
    - c. Ready-mix concrete producer.
    - d. Concrete subcontractor.

1.05 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

## PART 2 - PRODUCTS

### 2.01 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
  - 1. Use flexible or curved forms for curves of a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

### 2.02 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.
- C. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed.
- D. Steel Bar Mats: ASTM A 184/A 184M; with ASTM A 615/A 615M, Grade 60, deformed bars; assembled with clips.
- E. Plain Steel Wire: ASTM A 82, as drawn.
- F. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- G. Tie Bars: ASTM A 615/A 615M, Grade 60, deformed.
- H. Hook Bolts: ASTM A 307, Grade A, internally and externally threaded. Design hook-bolt joint assembly to hold coupling against pavement form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.
- I. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
  - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

### 2.03 CONCRETE MATERIALS

- A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.
- B. Portland Cement: ASTM C 150, Type I or II.
  - 1. Fly Ash: ASTM C 618, Class F or C.
  - 2. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- C. Blended Hydraulic Cement: ASTM C 595M, Type IS, portland blast-furnace slag cement.
- D. Aggregate: ASTM C 33, uniformly graded, from a single source, with coarse aggregate as follows:
  - 1. Class: 1N.
  - 2. Maximum Aggregate Size: 3/4 inch nominal.
  - 3. Do not use fine or coarse aggregates containing substances that cause spalling.
- E. Water: ASTM C 94.

#### 2.04 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.
- B. Air-Entraining Admixture: ASTM C 260.
- C. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.

#### 2.05 FIBER REINFORCEMENT

- A. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.
- B. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Fibrillated Fibers:
    - a. Fibrasol F; Axim Concrete Technologies.
    - b. Fibermesh; Fibermesh, Div. of Synthetic Technologies.
    - c. Forta CR; Forta Corporation.
    - d. Grace Fibers; W. R. Grace & Co., Construction Products Div.

#### 2.06 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.



- D. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- E. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.
- F. Products: Subject to compliance with requirements, provide one of the following:
  - 1. Evaporation Retarder:
    - a. Finishing Aid Concentrate; Burke Group, LLC (The).
    - b. Aquafilm; Conspec Marketing & Manufacturing Co., Inc.
    - c. Sure Film; Dayton Superior Corporation.
    - d. Eucobar; Euclid Chemical Co.
    - e. Lambco Skin; Lambert Corporation.
    - f. E-Con; L&M Construction Chemicals, Inc.
    - g. Finishing Aid; Symons Corporation.
  - 2. Clear Solvent-Borne Liquid-Membrane-Forming Curing Compound:
    - a. Res-X Cure All Resin; Burke Group, LLC (The).
    - b. RX Cure; Conspec Marketing & Manufacturing Co., Inc.
    - c. Day-Chem Rez Cure; Dayton Superior Corporation.
    - d. Kurez DR; Euclid Chemical Co.
    - e. #64 Resin Cure; Lambert Corporation.
    - f. L&M Cure DR; L&M Construction Chemicals, Inc.
    - g. Resi-Chem C309; Symons Corporation.

#### 2.07 RELATED MATERIAL

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class and grade to suit requirements, and as follows:
  - 1. Type II, non-load bearing, for bonding freshly mixed concrete to hardened concrete.
  - 2. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
  - 3. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

#### 2.08 CONCRETE MIXES

- A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
  - 1. Do not use Owner's field quality-control testing agency as the independent testing agency.

- C. Proportion mixes to provide concrete with the following properties:
  - 1. Compressive Strength (28 Days): 3000 psi.
  - 2. Maximum Water-Cementitious Materials Ratio: 0.50.
- D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.
- E. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
  - 1. Fly Ash: 25 percent.
  - 2. Combined Fly Ash and Pozzolan: 25 percent.
  - 3. Ground Granulated Blast-Furnace Slag: 50 percent.
  - 4. Combined Fly Ash or Pozzolan, and Ground Granulated Blast-Furnace Slag: 50 percent portland cement minimum, with fly ash or pozzolan not exceeding 25 percent.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 2.5 to 4.5 percent.
- G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus or minus 1.5 percent:
  - 1. Air Content: 5.5 percent for 1-1/2-inch maximum aggregate.
  - 2. Air Content: 6.0 percent for 1-inch maximum aggregate.
  - 3. Air Content: 6.0 percent for 3/4-inch maximum aggregate.
- H. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd..

## 2.09 CONCRETE MIXING

- A. Ready-Mixed Concrete: Comply with requirements and with ASTM C 94 and ASTM C 1116.
  - 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Comply with requirements and measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
  - 1. For mixers of 1 cu. yd. or smaller capacity, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
  - 2. For mixers of capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
  - 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.

### 3.02 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

### 3.03 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.
- E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

### 3.03 JOINTS

- A. General: Construct construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
  - 1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at isolation joints.
  - 1. Provide preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
  3. Provide tie bars at sides of pavement strips where indicated.
  4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
  5. Use epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
  2. Extend joint fillers full width and depth of joint.
  3. Terminate joint filler less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
  4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
  5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
  6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
- D. Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the following radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
    - a. Radius: 1/4 inch.
  2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
- F. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the following radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.
1. Radius: 1/4 inch.

### 3.04 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.
- D. Comply with requirements and with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery, at Project site, or during placement.
- F. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- G. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
  - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- H. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
  - 1. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.
- I. Screed pavement surfaces with a straightedge and strike off. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.
- J. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- K. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- L. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
  - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.

2. Do not use frozen materials or materials containing ice or snow.
  3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.
- M. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
  2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
  3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

### 3.05 CONCRETE FINISHING

- A. General: Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
1. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

### 3.06 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.
- D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    - a. Water.

- b. Continuous water-fog spray.
- c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

### 3.07 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
  1. Elevation: 1/4 inch.
  2. Thickness: Plus 3/8 inch, minus 1/4 inch.
  3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/4 inch.
  4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
  5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
  6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
  7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
  8. Joint Spacing: 3 inches.
  9. Contraction Joint Depth: Plus 1/4 inch, no minus.
  10. Joint Width: Plus 1/8 inch, no minus.

### 3.08 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing shall be performed according to the following requirements:
  1. Sampling Fresh Concrete: Representative samples of fresh concrete shall be obtained according to ASTM C 172, except modified for slump to comply with ASTM C 94.
  2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but not less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
  3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.
  4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of compressive-strength specimens.
  5. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.

6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd.. One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
  7. When frequency of testing will provide fewer than five compressive-strength tests for a given class of concrete, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
  8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.
  9. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.
- C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
- D. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as the sole basis for approval or rejection.
- E. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

### 3.09 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.
- B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

**END OF SECTION**



## SECTION 312000 - EARTH MOVING

### PART 1 - GENERAL

#### 1.01 SUMMARY

##### A. Section Includes:

1. Preparing subgrades for slabs-on-grade, walks, pavements and turf and grasses.
2. Excavating and backfilling for buildings and structures.
3. Excavating and backfilling for utility trenches.

#### 1.02 DEFINITIONS

##### A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

##### B. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

##### C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

##### D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions and beyond the additional excavation referenced on pages 6 & 7 of the subsurface exploration report as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

##### E. Fill: Soil materials used to raise existing grades.

##### F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

##### G. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

- H. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### 1.03 QUALITY ASSURANCE

- A. Preexcavation Conference: Conduct conference at Project site.

#### 1.04 PROJECT CONDITIONS

- A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.

### PART 2 - PRODUCTS

#### 2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- C. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

#### 2.02 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.02 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.03 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.2 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.3 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
  1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.
- D. Trenches in Tree- and Plant-Protection Zones:
  1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
  2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.

#### 3.4 SUBGRADE INSPECTION

- A. Proof-roll subgrade below the building slabs and pavements with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

#### 3.5 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
  1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

#### 3.6 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

**3.7 UTILITY TRENCH BACKFILL**

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil.
- D. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
  - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

**3.8 SOIL FILL**

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  - 1. Under grass and planted areas, use satisfactory soil material.
  - 2. Under walks and pavements, use satisfactory soil material.
  - 3. Under steps and ramps, use engineered fill.
  - 4. Under building slabs, use engineered fill.
  - 5. Under footings and foundations, use engineered fill.

**3.9 SOIL MOISTURE CONTROL**

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

**3.10 COMPACTION OF SOIL BACKFILLS AND FILLS**

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
  - 3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
  - 4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.
  - 5. Compact over-excavation in the building pad area per pages 6 & 7 of the subsurface exploration report.

**3.11 GRADING**

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
  - 2. Walks: Plus or minus 1 inch.
  - 3. Pavements: Plus or minus 1/2 inch.

**3.12 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.13 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.14 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

**END OF SECTION**

**SECTION 312500 – EROSION AND SEDIMENTATION CONTROL**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Erosion control materials and methods.
- B. Related Sections:
  - 1. 31 1000 – Site Clearing
  - 2. 31 2000 – Earth Moving

**1.03 DEFINITIONS**

- A. Soil disturbing activities include but are not limited to: Clearing and grubbing, excavation for utilities and foundations, roadway and parking lot construction, construction or modification of site drainage, grading, and preparation for final seeding.

**1.04 PERFORMANCE REQUIREMENTS**

- A. Regulatory Requirements: Comply with provisions of the following:
  - 1. Aiken County.
  - 2. City of Aiken.
  - 3. South Carolina Department of Health and Environmental Control.



PART 2 - PRODUCTS

2.01 SILT FENCES.

Synthetic Filter Fabric for silt fences. Provide pervious sheet of polypropylene, nylon, or polyethylene fabric conforming to the following physical and hydraulic characteristics: <u>Physical Properties (Min.)</u>	<u>Requirement</u>	<u>Test Method</u>
Grab Tensile, lbs.	W120/F100	ASTM-D-4632
Grab Elongation, %	15	ASTM-D-4632
Mullen Burst, psi	275	ASTM-D-3786
Puncture, lbs.	65	ASTM-D-4833
Trapezoidal Tear, lbs.	50	ASTM-D-4533
UV Resistance, %	80	ASTM-D-4355
AOS, US Sieve #	30/40	ASTM-D-4751
Permittivity gal/min-sq. ft.	90	ASTM-D-4491

- A. Filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0 to 120 F.
- B. Support Posts: 4 foot – steel picket.
- C. Utilize standard strength synthetic filter fabric for sediment barriers. The filter fabric shall be purchased in a continuous roll cut to the length of the barrier to avoid the use of joints.

2.02 STRAW MATERIALS

- A. Erosion Control Matting: Approximately 70% straw, 30% coconut fiber between two layers of photo degradable polypropylene netting.

2.03 GRASS

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: State-certified seed of grass species, as follows:
  1. Brown top millet: March 1 through August 14.
  2. Rye Grain and Annual Rye Grass: August 15 through February 28.

## PART 3 - EXECUTION

### 3.01 PREPARATION

- A. Place all erosion and sediment control measures prior to any soil disturbance activity.
- B. Conform to the requirements of the appropriate regulatory agency for the State.

### 3.02 INSTALLATION, GENERAL

- A. Prior to construction, install silt fence along the downhill construction limits in accordance with the erosion control standard detail to prevent silt intrusion upon adjacent land.
- B. Install sediment and erosion control measures on the down slope toe of all top soil stock piles.

### 3.03 DUST CONTROL

- A. In areas subject to surface and air movement of dust, where on-site or off-site damage is likely to occur, one or more of the following preventive measures shall be taken for dust control:
- B. Minimize the period of soil exposure through the use of temporary ground cover and other temporary stabilization practices.
- C. Sprinkle the site with water until surface is wet. Repeat as needed.

### 3.04 INSTALLATION OF SILT FENCES

- A. Provide silt fences at the following general locations:
  - 1. Immediately upstream of the point(s) of runoff discharge from a site before flow becomes concentrated.
  - 2. Below disturbed areas where runoff may occur in the form of overland flow.
  - 3. Along the down slope toe of all top soil stock piles.
  - 4. Around all storm structures.
- B. Construction of Fence:
  - 1. Space support posts at a maximum 6 feet on center. Drive securely into the ground a minimum of 24 inches.
  - 2. Staple or wire the filter fabric to the fence post, extending 6 inches of the fabric on the ground. Do not staple filter fabric to trees.
  - 3. Splice filter fabric only at a support post, overlapping fabric a minimum of 6 inches, and seal.
  - 4. Do not exceed 36 inches in height.
- C. Maintenance.
  - 1. Inspect silt fences and filter barriers immediately after each rainfall and at least daily during prolonged rainfall.
  - 2. Inspect Silt fences for depth of sediment,
    - a. Remove Sediment deposits after each storm event and when deposits reach approximately 1/3 the height of the barrier or when the sediments limit or prevent the flow of water through the fabric hydraulic.

- b. Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, prepared, and seeded.
3. Inspect silt fences for tears in the fabric, and the attachment of the fabric to the fence posts. Inspect post for continued firm embedment. Repair any deficiencies immediately.
4. Replace filter fabric promptly if it shows signs of decomposition or deterioration that limits its effectiveness.

### **3.05 INSTALLATION OF EROSION CONTROL MATTING**

- A. Provide erosion control matting on all slopes over six feet high. Install, secure and maintain matting according to manufacturer's written instructions.
- B. Maintain matting until an acceptable vegetative cover is in place.

### **3.06 TEMPORARY GRASSING**

- A. Provide temporary seeding on exposed surfaces that will not be brought to final grading or permanent cover treatment within 21 days of the exposure to reduce erosion and sedimentation by stabilizing exposed soils.
- B. Check seeded areas regularly for bare spots, washouts, and healthy growth to assure that a good stand of grass is being maintained. Reseed areas that fail to establish vegetation cover as soon as such areas are identified.

**END OF SECTION**

**SECTION 321216 - PLANT-MIX ASPHALT PAVING**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS**

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

**1.02 SUMMARY**

- A. This Section includes the following:
  - 1. Hot-mix asphalt paving.
- B. Related Sections include the following:
  - 1. Division 2 Section "Earthwork" for aggregate subbase and base courses and for aggregate pavement shoulders.
  - 2. Division 2 Section "Pavement Joint Sealants" for joint sealants and fillers at paving terminations.

**1.03 DEFINITIONS**

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. SCDOT: South Carolina Department of Transportation.

**1.04 SYSTEM DESCRIPTION**

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of state or local DOT.
  - 1. Standard Specification: SCDOT standard specifications – latest edition.
  - 2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

**1.05 SUBMITTALS**

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- C. Job-Mix Designs: For each job mix proposed for the Work.
- D. Qualification Data: For manufacturer.
- E. Material Test Reports: For each paving material.
- F. Material Certificates: For each paving material, signed by manufacturers.

**1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: A qualified manufacturer.
  - 1. Manufacturer shall be a paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated, as documented according to ASTM E 548.

- C. Regulatory Requirements: Comply with
- D. SCDOT for asphalt paving work.
- E. Asphalt-Paving Publication: Comply with AIMS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."
- G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
  - 1. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
  - 2. Review condition of subgrade and preparatory work.
  - 3. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
  - 4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

#### 1.08 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
  - 1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.
  - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.

### PART 2 - PRODUCTS

#### 2.01 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or properly cured, crushed blast-furnace slag.
- C. Fine Aggregate: ASTM D 1073 sharp-edged natural sand or sand prepared from stone, gravel, properly cured blast-furnace slag, or combinations thereof.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.
- D. Mineral Filler: ASTM D 242 rock or slag dust, hydraulic cement, or other inert material.

#### 2.02 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO MP 1, PG 64-22
- B. Prime Coat: ASTM D 2027, medium-curing cutback asphalt, MC-30 or MC-70 MC-250.
- C. Prime Coat: Asphalt emulsion prime complying with SCDOT requirements.

- D. Tack Coat: ASTM D 977 or AASHTO M 140, emulsified asphalt or ASTM D 2397 or AASHTO M 208, cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.
- E. Water: Potable.

#### 2.03 AUXILIARY MATERIALS

- A. Sand: ASTM D 1073 Grade Nos. 2 or 3.
- B. Joint Sealant: ASTM D 3405 or AASHTO M 301, hot-applied, single-component, polymer-modified bituminous sealant.

#### 2.04 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and designed according to procedures in AIMS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types."
  - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
  - 2. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:
    - a. Binder Course: 1 inch.

### PART 3 - EXECUTION

#### 3.01 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.

#### 3.02 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..
  - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
  - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

#### 3.03 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
  - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

- B. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd.. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum.
  - 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
  - 2. Protect primed substrate from damage until ready to receive paving.

### 3.04 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
  - 1. Place hot-mix asphalt binder course in number of lifts and thicknesses indicated.
  - 2. Spread mix at minimum temperature of 250 deg F.
  - 3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
  - 4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
  - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.05 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
  - 1. Clean contact surfaces and apply tack coat to joints.
  - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
  - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
  - 4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."
  - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
  - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.06 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
  - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
  - 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.07 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  - 1. Binder Course: Plus 1/4 inch, no minus.
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
  - 1. Binder Course: 1/4 inch.
  - 2. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

### 3.08 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
  - 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.
  - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.



2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
  - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
  - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

### 3.09 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
  1. Do not allow excavated materials to accumulate on-site.

**END OF SECTION**

## SECTION 329200 - TURF AND GRASSES

### PART 1 - GENERAL

#### 1.01 SUMMARY

A. Section Includes:

1. Seeding.

#### 1.02 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- I. Surface Soil: Whatever soil is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certification of grass seed.
  - 1. Certification of each seed mixture for turfgrass sod.
- C. Product certificates.

1.04 QUALITY ASSURANCE

- A. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  - 1. Pesticide Applicator: State licensed, commercial.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

1.06 MAINTENANCE SERVICE

- A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
  - 1. Seeded Turf: 60 days from date of Substantial Completion.
    - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

**PART 2 - PRODUCTS**

2.01 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: State-certified seed of grass species as follows:
  - 1. Full Sun: rye grass and bermuda.

2.02 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
  - 1. Class: T, with a minimum of 99 percent passing through No. 8 sieve and a minimum of 75 percent passing through No. 60 sieve.
  - 2. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through No. 60 sieve.
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through No. 6 sieve and a maximum of 10 percent passing through No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through No. 50 sieve.
- G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.
- H. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.
- I. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.03 FERTILIZERS

- A. Bonemeal: Commercial, raw or steamed, finely ground; a minimum of **4** percent nitrogen and **10** percent phosphoric acid.
- B. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
- C. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
  - 1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
- D. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.

2.04 MULCHES

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

2.05 PESTICIDES

- A. General: Pesticide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.01 TURF AREA PREPARATION

- A. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
  1. Apply fertilizer directly to subgrade before loosening.
  2. Thoroughly blend planting soil off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
- B. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- D. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.02 SEEDING

- A. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate as indicated on plans.

- C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate as indicated on plans to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
  - 1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

### 3.03 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
- B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain height appropriate for species without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings.
- C. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

### 3.04 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
  - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
  - 2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

**END OF SECTION**

## SECTION 331100 - WATER DISTRIBUTION SYSTEM

### PART 1 GENERAL

#### 1.1 SCOPE

- A. The Contractor shall furnish all labor, equipment, and materials and perform all operations necessary to construct a complete, functioning, NFPA, SCDHEC and City of Aiken approved water distribution system.
- B. All materials and work performed shall be in accordance with plans, specifications, applicable codes and standards, and of first-class workmanship.

#### 1.2 SAFETY PROVISIONS

- A. It shall be the responsibility of the Contractor to protect persons from injury and to avoid property damage.
- B. Contractor shall provide and maintain adequate barricades, construction signs, torches, red lanterns and guards during the progress of the construction work and until it is safe for traffic to drive over the trenches in the roadway.
- C. Contractor shall perform all construction in a safe manner, specifically, the rules and regulations of the Occupational Safety and Health Administration (OSHA) and the Manual of Uniform Traffic Control Devices (MUTCD).

#### 1.3 REFERENCES

- A. The City of Aiken Minimum Engineering and Construction Standards.
- B. Manual of Uniform Traffic Control Devices (MUTCD)
- C. NSF 61, "Drinking Water System Components – Health Effects"
- D. ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings
- E. ASTM B88, Standard Specification for Seamless Copper Water Tube
- F. ASTM D1248, Standard Specification for Polyethylene Plastics Extrusion Materials For Wire and Cable
- G. ASTM D1599, Standard Test Method for Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
- H. ASTM D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- I. ASTM D2241, Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
- J. ASTM D2737, Standard Specification for Polyethylene (PE) Plastic Tubing
- K. ANSI/AWWA C110, American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids - International Restrictions
- L. ANSI/AWWA C500, AWWA Standard for Metal-Seated Gate Valves for Water Supply Service - International Restrictions
- M. ANSI/AWWA C600, Standard for Installation of Ductile-Iron Water Mains and their Appurtances - International Restrictions

- N. ANSI/AWWA C651, Disinfecting Water Mains - International Restrictions
- O. ANSI/AWWA C800, Underground Service Line Valves and Fittings - International Restrictions
- P. ANSI/AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution - International Restrictions
- Q. NFPA24, Installation of Private Fire Service Mains and their appurtenances.

#### 1.4 EXISTING UTILITIES

- A. Contractor shall provide necessary temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, and other obstructions encountered in the progress of the work at his own expense.
- B. Where existing utility structures such as conduits, ducts, pipe branch connections to main sewers, or main drains obstruct the grade or alignment of the pipe, the Contractor shall permanently support, relocate, remove, or reconstruct, the existing structure with the cooperation of the their owners.
  - 1. Do not deviate from the required line or grade except, as directed, in writing by the Architect.
- C. The Contractor shall obtain a PUPS Certification number and an existing utility field location at least 48 hours prior to beginning any excavation.
- D. Prior to beginning construction, the Contractor shall verify the size, location, elevation, and material of all existing utilities within the area of construction by use of record drawings, electronic locating devices, ground penetrating radar, potholing, or other suitable techniques.
- E. Existing utility locations shown on these plans are approximate and identified as either "to remain" or "to be removed".
  - 1. The Architect assumes no responsibility for the accuracy of existing utilities shown or for any existing utilities not shown.
- F. The Contractor is responsible for repairing any damage done during construction to any and all existing utilities.
- G. If upon excavation, an existing utility is found to be in conflict with the proposed construction or to be of a size or material different from that shown on the plans; the Contractor shall immediately notify the Architect.
- H. Provide water services to each building from the underground water main system, and not from adjacent buildings.

#### 1.5 SHOP DRAWINGS AND SUBMITTALS

- A. The Contractor shall provide the Architect a copy of all manufacturers' literature and data for materials installed under this section.
  - 1. The Architect shall review and stamp the submittals, "Approved" prior to installation by the Contractor.
- B. Prior to final approval and acceptance of work, the Architect and other Regulatory Agencies shall review and accept the Contractors "As-Built" documentation.
  - 1. The Contractor shall provide complete and accurate "As-Built" information relative to manholes, valves, services, fittings, length of pipe, and the like, with the horizontal and vertical information verified by an independent Registered Surveyor to the Architect and other regulatory Agencies.



## 1.6 APPLICABLE CODES

- A. General: All construction and materials shall conform to the City of Aiken and SCDHEC requirements and all local and national codes where applicable.
- B. Survey Data: All elevations on the plans or referenced in the specifications are based on National Geodetic Vertical Datum of 1929 (NGVD).
- C. Portable water shall comply with the City of Aiken and SCDHEC Minimum Engineering and Construction Standards, Water and Sewer Systems,” and/or the construction standards of any municipality having, jurisdiction.

## 1.7 RELATED DOCUMENTS

- A. The provisions of the General Conditions, Supplementary Conditions, and the Sections included under, Division 1, General Requirements, are included as part of this section.
- B. Section 312000 – Earth Moving

## PART 2 PRODUCTS

### 2.1 PIPE

- A. OFF-SITE
  - 1. For water main construction within the public right-of-way and utility easements refer to city, county, or state utility standards and specifications for water main construction within their right-of-way.
- B. ON-SITE
  - 1. The water main shall be either polyvinyl chloride (PVC) pipe or ductile iron pipe (DIP) and shall have push on rubber gasket joints.
  - 2. Pressure pipe (4" and larger) PVC pipe shall be pressure pipe with iron o.d. class 200 (SDR 14) for fire mains, conforming to AWWA C900.
  - 3. Ductile iron pipe (4" and larger) shall be cement-mortar lined and seal coated, class 200 for fire mains, mechanical, or push-on joints.
  - 4. Pressure pipe (under 4") Polyvinyl chloride (PVC) pressure pipe, schedule 80 conforming to ASTM D-1785 or SDR 21 conforming to ASTM D2241 with cement-solvent welded joints.
  - 5. Miscellaneous: ¾" threaded tie-rods shall be cadmium plated and painted with a coal tar base paint following installation.

### 2.2 FITTINGS

- A. Fittings for ductile iron and PVC pipes (4" and larger) shall have a pressure rating of 250 psi; use mechanical joints and conform to the latest revision of ANSI/AWWA C110.
- B. Mechanical joint fittings shall conform to the latest revision of ANSI/AWWA C110.
- C. Flanged fittings shall conform to ANSI Specifications for Class 125.
- D. Brass fittings shall conform to ANSI/AWWA C800, with all exposed threads covered with a protective plastic coating.
- E. Fittings for PVC pipe shall be cast iron mechanical joint type having a pressure rating of 250 psi and conforming to ANSI/AWWA C110.

### 2.3 VALVES

- A. Gate valves 2½" or less in size shall be standard 125 pound, non-rising stem, bronze, double-disc, screwed type, equipped with hand wheel.
- B. Gate valves over 2½" shall be resilient seat gate valves with iron body, non-rising stem, fully coated disc with rubber seat ring manufactured in accordance with ANSI/AWWA C500.

### 2.4 VALVE BOXES

- A. Valve boxes shall be of standard extension design manufactured with top cover marked "water."
- B. The top section shall be adjustable for elevation and shall be set to allow equal movement above and below grade.
- C. Provide valve box appropriate in size for the required valve.
- D. Center the base of valve box over the valve and rest firmly on compacted backfill and the entire assembly shall be plumb.
- E. Valve boxes shall be like Figure H-10364, as manufactured by Mueller Company, or an approved equal.

### 2.5 HYDRANTS

- A. Hydrants shall have a minimum 6" mechanical joint base pipe connection, 5¼" main valve opening, two 2½" hose nozzles, and one 4½" pumper nozzle. Confirm with the City of Aiken.
  - 1. Threads shall be National Standard.
  - 2. Hydrants shall be cast iron body, fully bronze mounted, suitable for a working pressure of 150 pounds, and shall be in accordance with the latest specification of the ANSI/AWWA C-502.
  - 3. They shall be of the O-ring seal type.
  - 4. Operation nut shall open counter-clockwise and be of the pentagonal shape, measuring 1½" from point to opposite flat.
- B. Provide hydrants with a breakaway feature that breaks cleanly upon impact.
  - 1. This shall consist of a two-part breakable safety flange with a breakable stem coupling.
  - 2. The upper and lower barrels shall be fluted and ribbed above and below the safety flange or have an extra strength lower barrel.
- C. Paint hydrants with one coat of zinc chromate primer and two finish coats of an approved paint of Architect approved color.
  - 1. Hydrants shall be Number A-423, Traffic type, as manufactured by Mueller Company, or an approved equal.

### 2.6 SERVICE CONNECTION AND METER

- A. The Contractor shall install in coordination with the City of Aiken water system complete with dual backflow preventer, valves and vault, at the locations shown on the drawings, and in accordance with the specifications as shown on the drawings.
- B. Contractor shall submit shop drawings for meter, valves, and backflow preventer.
- C. Contractor is responsible for all costs associated with providing and installing water meters, vaults, backflow preventers, valves, and connections in accordance with the applicable local utility.

## 2.7 SERVICE METERS

- A. Service water meters shall be as specified by the City of Aiken.
- B. The meter shall be of the straight reading type, recording flow in gallons, and shall be of the sealed register type.
- C. Meters shall conform to applicable specifications of ANSI/AWWA and shall be as manufactured by Neptune Meter Company, or an approved equal.

## 2.8 METER BOXES

- A. Meter boxes shall be precast concrete with a two-piece reinforced concrete cover including a round concrete reading lid. All meter boxes must also meet local utility company requirements.
  - 1. Meter boxes for larger meters shall be of suitable size for the enclosed meter.
- B. Contractor shall submit shop drawings for meter boxes larger than ¾".

## 2.9 BACKFLOW PREVENTERS

- A. Backflow preventers shall conform to AWWA Standard C506.
  - 1. The backflow preventer shall be provided as an assembly from one manufacturer. The assembly shall include two isolation valves, two check valves, and all other fittings or accessories needed to satisfy referenced design standards.
- B. Paint backflow preventers with one coat of zinc chromate primer and two finish coats of an approved paint of Architect approved color.
- C. Provide chain and padlock then chain and lock valves on all backflow preventers together.

## 2.10 PRESSURE GAGES

- A. Pressure Gages: Pressure gages for line pressure measurement shall conform to Federal Specifications GG-G-76, Class 1, Style A, Type 1, 3½" diameter with phenolic case, or as indicated on the drawings.

## 2.11 CHECK VALVES

- A. Check valves shall be SCDHEC and the City of Aiken approved AWWA standard for 200-psi working pressure, swing type, iron body, or bronze mounted, leather faced disc, suitable for vertical or horizontal position.
- B. Valves shall be Mueller Figure A-2600 or approved equal.
- C. Where designated on the plans, check valves shall be spring loaded, double half disc wafer check valve, manufactured by TRW Mission, or approved equal.
- D. Spring shall be of sufficient tension so valve will close without appreciable slam.

## 2.12 WATER SERVICES

- A. Polyethylene Tubing – Material shall comply with ASTM D1248 and the following:
  - 1. Polyethylene extrusion compound for extruding the polyethylene tubing shall comply with applicable requirements for PE-3406 or 3408 ultra high molecular weight polyethylene plastic material
  - 2. Tubing shall have a working pressure rating of 160 psi at 73.4°F.

3. Tubing must be capable of maintaining pressure of 340 psi at 73.4°F for 1,000 hours when tested in accordance with ASTM D1599.
  4. Tubing surfaces shall be free from bumps and irregularities. Materials must be completely homogeneous and uniform in appearance.
  5. Tubing dimensions and tolerances shall correspond with the valves listed in ASTM D2737 with a standard dimension ratio (SDR) of 9.
  6. Provide label on tubing with brand name and manufacturer, NSF Seal, size, type of plastic material, and ASTM applicable designation with which the tubing complies.
- B. Copper tubing shall be type “K” and conform to AWWA Specification 75-CR and ASTM B88 with a working pressure rating of 160 psi at 73.4°F.
- C. Other service materials may be considered for specific installations, upon submissions of specification and approval by the Architect.
- D. Joints:
1. Joints for polyethylene or copper tubing shall be of the compression type utilizing a totally confined grip seal and coupling nut.
    - a. Provide stainless steel tube stiffener insert for P.E. tubing service.
  2. Other type joints may be considered for specific installations, upon submissions of specifications and approval by the Architect.

#### 2.13 METER VALVES

- A. Meter valves shall be of bronze construction in accordance with ASTM B62.
- B. Meter valves shall be closed bottom design and resilient “o” ring sealed against external leakage at the top.
- C. Provide a shut-off with a resilient pressure actuated seal so positioned in the plug as to completely enclose the flow way in the closed position.
- D. The inlet side of all meter valves shall have a compression type fitting as detailed in Section C Part 1.
- E. Meter valves for meter size 1” and under shall be equipped with a meter-coupling nut on the outlet sides.
- F. Meter valves for 1½” and 2” meters shall have flanged connections on the outlet sides.
- G. Provide meter valves over 2” on individual basis for the particular installation.

#### 2.14 CURB STOPS

- A. Curb stops shall be of the inverted key type with tee-head shut off.
- B. Curb stops shall be made of brass alloy in accordance with ASTM B62.

#### 2.15 CORPORATION STOPS

- A. Provide corporation stops manufactured of brass alloy in accordance with ASTM B62.
- B. Inlet thread shall be taper thread in all sizes in accordance with ANSI/AWWA C800.
- C. Outlet connections shall have a compression type fitting as detailed in Section C Part 1.

#### 2.16 TAPPING SLEEVES

- A. Ductile iron tapping sleeves shall be of the mechanical joint type having a flat-faced ductile iron flange, recessed for a tapping valve with all end and side gaskets totally confined.

- B. The contractor shall determine the outside diameter of the existing main before ordering the sleeve.

### **PART 3 EXECUTION**

#### **3.1 UNLOADING MATERIAL**

- A. The Contractor shall exercise care in unloading and handling pipe, valves, fittings, and all other material.
- B. Do not drop pipe from trucks or allow pipe to roll against other pipe.

#### **3.2 EXCAVATION**

- A. All excavation to conform to Section 312000.

#### **3.3 SEPARATION OF WATER AND SEWER MAINS**

- A. See design plans for water and sewer separation statement and requirements.

#### **3.4 WATER METER**

- A. Domestic water service; provide a water meter (max. 3") and dual backflow preventer assembly. (Meter bypass with gate valve), (gate valve, meter, gate valve), (bypass reconnection), and (gate valve, backflow preventer, gate valve).
  - 1. All service pipes for 3" water meter shall be 4" ductile iron pipe with 4" gate valves with flanged fittings for above ground use, and mechanical fittings with retainer glands for underground use.
- B. Fire line system; provide a double detector check valve assembly and a fire department connection.
  - 1. Provide gate valve, (¾" meter bypass with a gate valve and check valve).
- C. Locate both assemblies adjacent to property line, and provide either 6' high chain link fence around the assembly or chain lock the valves as indicated on the plans.

#### **3.5 INSTALLATION OF PIPE**

- A. Obtain permission of the Health Department, Water Department, and the Fire Department having jurisdiction, before installing water mains.
- B. All installation of pipe shall conform to AWWA C600.
  - 1. Do not roll or push pipe into the trench from the bank.
  - 2. Contractor shall thoroughly inspect all pipes before lowering into the trench, to insure its sound condition and eliminate the possibility of leakage or bursting under test pressure.
  - 3. Do not use pipes, valves, fittings or any other materials showing defects.
  - 4. Remove all such defective materials from the construction site immediately.
  - 5. Before lowering pipe into the trench, swab or brush it to insure that no dirt or foreign matter is in the finished line.
- C. Lay pipe on a flat bottom trench and backfill tamped to 6" above the top of the pipe.
  - 1. Pipe installation shall conform to "Type B Method" as adopted by Committee A21 of the American Standards Association.

2. Provide a firm even bearing throughout the length of each section of pipe.
3. Pipe shall not bear on any un-yielding structures, nor shall it support any other structures.
4. Plug or cap all dead ends, anchor and hold in place with concrete backing as required.
5. Except while work is in progress, plug all pipe openings to prevent entrance of water or any foreign matter.
6. Remove material deemed unstable for providing adequate support for pipe and replace with a suitable material.
7. Provide an adequate backfill material on the pipe to prevent floating, remove and relay any pipe that floats as directed by the Architect.
8. Water/sewer line separation shall be in accordance with Section R.61-58.4D(12) of the "State Primary Drinking Water Regulations". The distancing requirements outlined by this Section must be explicitly stated in your specifications. Also, the outline of the procedure when these minimum distances cannot be maintained must be submitted.

#### Separation of Water Mains and Sewers

- (a) Parallel installation – Water mains and hydrant drains shall be laid at least ten (10) feet horizontally from any existing or proposed sewer. The distance shall be measured edge to edge. In cases where it is not practical to maintain a ten foot separation, the Department may allow deviation on a case-by-case basis, if supported by data from the design engineer. Such deviation may allow installation of the water main closer to a sewer, provided that the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least eighteen (18) inches above the top of the sewer.
- (b) Crossings – Water mains crossing sewers shall be laid to provide a minimum vertical separation of eighteen (18) inches between the outside of the water main and the outside of the sewer. This shall be the case whether the water main is either above or below the sewer line. Whenever possible, the water main shall be located above the sewer line. Where a new water main crosses a new sewer line, a full length of pipe shall be used for both the water main and sewer line and the crossing shall be arranged so that the joints of each of each line will be as far as possible from the point of crossing and each other. Where a new water main crosses an existing sewer line, one full length of water pipe shall be located so both joints will be as far from the sewer line as possible. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer line to prevent damage to the water main.
- (c) Special Conditions – When it is impossible to obtain the distances specified in R.61-58.4(D)(12)(a) and (b) the Department may allow an alternative design. Any alternative design shall:
  - (i) maximize the distances between the water main and sewer line and the joints of each:
  - (ii) use materials which meet requirements R.61-58.4(D)(1) for the sewer line; and,

- (iii) allow enough distance between all piping to make repairs to one of the lines without damaging the other.(at least 18” horizontal separation)
  - (iv) Sewer Manholes: No water pipe shall pass through or come in contact with any part of a sewer manhole. Water lines may come in contact with storm sewers or catch basins if there is no other practical alternative, provided that ductile iron is used, no joints of the water line are within the storm sewer or catch basin and the joints are located as far as possible from the storm sewer or catch basin.
  - (v) Force Mains: There shall be at least a 10 foot horizontal separation between water mains and sanitary sewer force mains. There shall be an 18 inch vertical separation at crossing as required in R.61-58.4(D)(12)(a) and (b).
  - (vi) Drain-fields and Spray-fields: Potable water lines shall not be laid less than 25 feet horizontally from any portion of a waste-water tile-field or spray-field, or shall be otherwise protected by an acceptable method approved by the Department.
- D. Use one of the three following methods to connect new systems to existing mains:
- 1. Method A that involves a reduced size temporary connection between the existing main and the new main.
  - 2. Method B that involves a direct connection between the new and existing mains using two gate valves separated by a sleeve with a vent pipe.
  - 3. Method C that involves a tap with one gate valve requiring disinfection of the new system prior to conducting the pressure test.
- E. The water utility company shall approve and witness the connection method.

### 3.6 JOINTS

- A. All joints shall be suitable for the type of pipe being jointed and shall be made in accordance with manufacturer’s recommendations.
- B. Mechanical Joints:
- 1. Mechanical joints shall be of the stuffing box type.
  - 2. Place the gland, followed by the rubber gasket over the plain end of the pipe inserted into the socket.
  - 3. Then push the gasket into position to evenly seat in the socket.
  - 4. Move the gland into position against the face of the socket, insert bolts and make finger tight.
  - 5. Using a ratchet wrench suitable to the pipe size, tighten bolts alternately bottom then top, etc., until the joint is complete.
- C. Compression Joints:
- 1. Compression joints shall be a rubber seal joint, made pressure tight by a molded rubber gasket and lubricant to facilitate assembly.
  - 2. Make the joint tight by inserting the plain end into the bell after lubrication.
  - 3. The compression joint shall be similar and equal to “Altite” b as manufactured by Alabama Pipe Company.
  - 4. Follow the manufacturer recommendations in making up the joints.

- D. Flanged Joints:
  - 1. Use rubber gaskets to make flanged joints, with bolts having rough square heads and hexagonal nuts made to American Standard rough dimensions that are chamfered and trimmed.
  - 2. Bolts shall be the recommended size for the diameter of pipe being joined and be tightened to evenly distribute the stress in the bolts and bring the pipe in alignment.

### 3.7 INSTALLATION OF FITTINGS

- A. Applicable portions of these specifications shall apply to installation of fittings.
- B. Provide reaction or thrust blocking at bends and tees, and where changes in pipe diameter occur at reducers or in fittings.
- C. Refer to details for concrete strength and dimensions.
- D. Provide restrained joints for all fittings in the public right-of-way.

### 3.8 INSTALLATION OF FIRE HYDRANTS

- A. Applicable portions of these specifications shall apply to installation of fire hydrants.
- B. All hydrants shall stand plumb and burial line shall be set at finished grade.
- C. Place sufficient concrete thrust blocking as shown on the plans or as directed by the Architect.

### 3.9 INSTALLATION OF VALVES

- A. Applicable portions of these specifications shall apply to installation of valves.
  - 1. All valves shall stand plumb unless otherwise shown on the plans or directed by the Architect.
  - 2. The operation of installing tapping sleeves and an experienced contractor who has been engaged in this type of work not less than one-year with a representative list of successful installations shall install the valves.
- B. Provide appropriate shut-off in a valve box approximately 5' from the building on domestic water line to each building.

### 3.10 PRESSURE TESTS

- A. After adequately backfilling the pipe and at least seven days after placing the last concrete thrust blocking, pressure test all laid pipe for two hours at 200 psi minimum, in accordance with ANSI/AWWA C600-93.
- B. The pressure test shall not vary more than  $\pm 1$  psi during the test.
- C. Remove all air from the pipe prior to pressure tests.
- D. The Contractor shall provide such means of venting the pipe as are required.
- E. The Contractor shall replace any material or installation proving defective.
- F. A representative of the City/County and the Architect shall witness the pressure test.

### 3.11 LEAKAGE TESTS

- A. Bring the main up to test pressure, and hold at this pressure.
  - 1. Carefully measure make-up water by use of a displacement meter or by pumping the water from a vessel of known volume.



2. Walk the length of the pipeline and inspect all joints for leakage and movement of pipe.
  3. Repair all visible leaks.
  4. Should any section of pipeline disclose joint leakage greater than that permitted, the Contractor shall, at his own expense, locate and repair the defective joints until leakage is within the permitted allowance.
- B. All pipe, etc. shall be tested under a constant pressure of 200 psi (fire main at 200 psi) for a minimum test of two hours and shall not exceed the leakage requirements as per ANSI/AWWA specifications of C600-93 leakage formula:

$$Q = \frac{SD(P)^{1/2}}{\text{Ductile Iron}} \quad \text{PVC}$$

$$L = [SD(P)^{1/2}] \div 133,200$$

$$L = [ND(P)^{1/2}] \div 7,400$$

$L$  = allowable leakage (gals./hr.)

$L$  = allowable leakage (gals./hr.)

$S$  = length of the pipeline tested (feet)

$N$  = # of joints in pipeline being

tested

$D$  = diameter of pipe (inches)

$D$  = diameter of pipe (inches)

$P$  = average test pressure (psig)

$P$  = average test pressure (psig)

$P$  = average test pressure in pounds per square inch

### 3.12 BACKFILL

- A. Backfill shall be in compliance with Section 31200 Earth Moving.
- B. On completion of pressure and leakage tests, the exposed joints shall be backfilled to a depth of 12" above the top of the pipe.
  1. Backfill shall be carefully compacted until 12" of cover exists over the pipe.
  2. Place the remainder of the backfill and compacted thoroughly by puddling and tamping.
  3. When directed, the contractor may backfill the trench neatly rounded to a sufficient height allowing for settlement to grade after consolidation.

### 3.13 STERILIZATION OF COMPLETED PIPELINE

- A. Before final acceptance of completed pipeline, all requirements of the City of Aiken and SCDHEC shall be satisfied.
  1. Forward satisfactory bacteriological test results from these agencies to the Architect.
- B. Prior to chlorination of mains, remove all dirt and foreign matter by high velocity flushing through fire hydrants or other approved blow-offs.
  1. Disinfection of all new mains shall be conducted in accordance with AWWA C651 (including Section 4.8). Before being placed in service, all new mains and repaired portions of, or existing mains must be thoroughly flushed then chlorinated with not less than fifty (50) ppm of available chlorine. Water from existing distribution system or other source of supply should be controlled so as to flow slowly into the newly laid pipeline during the application of chlorine. The solution must be retained in the pipeline for not less than twenty-four (24) hours. At the end of this 24-hour period, the treated water in all portions of the main must have a residual of not less than ten (10) ppm free chlorine. Then the system must be flushed with potable water and the sampling program started. The number of sampling sites depends on the

amount of new construction but must include all dead-end lines and be representative of the water in the newly constructed mains and shall be collected a minimum of every 1,200 linear feet. Prior to sampling, the chlorine residual must be reduced to normal system residual levels or be non-detectable in those systems not chlorinating. At each site, a minimum of two (2) satisfactory bacteriological samples for total coliform analysis taken at least 24 hours apart shall be obtained and shall be collected a minimum of every 1,200 linear feet. Also at each site, chlorine residual at time of sampling must be measured and reported. If the membrane filter method of coliform analysis is used, non-coliform growth must also be reported. If the non-coliform growth is greater than eighty (80) colonies per one hundred (100) milliliters, the sample result is invalid and must be repeated. All samples shall be analyzed by a State approved laboratory with results being submitted with the registered professional engineer's letter of certification. Samples must show that the water line is completely free of coliform bacteria.

### 3.14 RESTORATION OF SURFACES AND/OR STRUCTURES

- A. The Contractor shall restore and/or replace paving, curbing, sidewalks, fences, sod, survey points, or other disturbed surfaces or structures to a condition equal to that before the work was begun and to satisfaction of the Architect, and shall furnish all labor and materials incidental thereto.
- B. Restoration of surfaces and/or structures shall comply with all requirements of the applicable governing agencies including City, Town, County, and State.

### 3.15 CLEANING UP

- A. The Contractor shall remove surplus pipeline material, tools, temporary structures, etc., and as directed by the Architect, shall dispose of all dirt, rubbish, and excess earth.
- B. The construction site shall be left clean, to the satisfaction of the Architect

### 3.16 INSPECTIONS

- A. The Contractor shall notify the City, Architect, and the Owner 24 hours prior to beginning construction to arrange the required inspection of the water system.

### 3.17 PROJECT RECORD DOCUMENTS

- A. The Contractor shall maintain accurate and complete records of work items completed.
- B. Prior to the placement of any asphalt or concrete pavement, the Contractor shall submit to the Architect, "as-built" plans showing water improvements.
  - 1. Paving operations shall not commence until the Architect has reviewed the "as-built."
- C. All "as-built" information submitted to the Architect shall be sufficiently accurate, clear and legible to satisfy the Architect that the information provides a true representation of the improvements constructed.
- D. Upon completion of construction, the Contractor shall submit to the Architect five complete sets of "as-built" construction drawings and one set of mylars.
  - 1. Clearly mark these drawings "as-built" show all construction changes and dimensioned locations and elevations of all improvements and signed by the Contractor.

2. A Professional Land Surveyor registered in the State of Florida shall sign and seal the "As-Built drawings.
- E. "As-built" information on the water system shall include vertical and horizontal locations of all valves, fittings, fire hydrants, water services, and connection points.
  1. They shall show the associated pipe size and material type, and must also show the sample points and the sample point numbers must conform to the numbers used on the bacteriological test results.

### **3.18 FIRE PROTECTION SYSTEM.**

- A. Fire line extension from the main to the building, will be installed by a licensed fire sprinkler contractor. Test fire sprinkler pipe to 200 psi.
- B. All firefighting equipment (fire department connection, hydrants, double detector check valve, and gate valves) to be more than 40' away from the building.
  1. Maintain 7' clearance around each fire hydrant.
- C. Provide flow and pressure test reports according to NFPA 24.
- D. Verify the fire protection water systems and hydrant locations are approved by the fire fighting authority having, jurisdiction.

END OF SECTION 331100

# D I V I S I O N 4

Applicable Portions Of The Conditions  
Of The Contract And Division 1 General  
Requirements Apply To The Work Of  
This Division.

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## SECTION 04810 - UNIT MASONRY ASSEMBLIES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Concrete Block.
- B. Mortar and Grout.
- C. Reinforcement and Anchorage.
- D. Accessories.

#### 1.02 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Shop drawings including complete details for all reinforcing required by contract documents and Building Code Requirements for Masonry Structures.
- D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

#### 1.03 QUALITY ASSURANCE

- A. Comply with provisions of ACI 530/ASCE 5/TMS 402 and ACI 530.1/ASCE 6/TMS 602, except where exceeded by requirements of the contract documents.

#### 1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.
- B. Store masonry accessories to prevent corrosion, dirt accumulation, and other deterioration.

#### 1.05 ENVIRONMENTAL REQUIREMENTS

- A. Maintain materials and surrounding air temperature to minimum 50 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

### PART 2 PRODUCTS

#### 2.01 CONCRETE MASONRY UNITS

- A. Manufacturers:
  - 1. Metromont Materials Corporation..
  - 2. E. Dillon & Company.
  - 3. Oldcastle.
- B. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 x 8 inches and nominal depths as indicated on the drawings for specific locations.

2. Special Shapes: Provide non-standard blocks configured for corners.
3. Load-Bearing Units: ASTM C90, normal weight.
  - a. Hollow block, as indicated.
  - b. Type II - Nonmoisture-controlled; lightweight.
  - c. Pattern: Standard texture and color - All interior block masonry.
4. Non-Loadbearing Units: ASTM C129.
  - a. Hollow block, as indicated.
  - b. Type I: Moisture-controlled; lightweight.

## 2.02 MORTAR AND GROUT MATERIALS

- A. Masonry Cement: ASTM C91, Type S.
- B. Portland Cement: ASTM C150, Type I.
  1. Not more than 0.60 percent alkali.
  2. Hydrated Lime: ASTM C207, Type S.
  3. Mortar Aggregate: ASTM C144.
  4. Grout Aggregate: ASTM C404.
- C. Water: Clean and potable.

## 2.03 REINFORCEMENT AND ANCHORAGE

- A. Manufacturers of Joint Reinforcement and Anchors:
  1. Dur-O-Wal: [www.dur-o-wal.com](http://www.dur-o-wal.com).
  2. Hohmann & Barnard, Inc: [www.h-b.com](http://www.h-b.com).
  3. Masonry Reinforcing Corporation of America: [www.wirebond.com](http://www.wirebond.com).
  4. Substitutions: See Section 01600 - Product Requirements.
- B. Reinforcing Steel: ASTM A615/A615M Grade 40 (280) deformed billet bars; galvanized.
- C. Single Wythe Joint Reinforcement: Ladder type; ASTM A 82/A 82M steel wire, hot dip galvanized after fabrication to ASTM A 153/A 153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.
- D. Strap Anchors: Rigid bent steel shapes configured as required for specific situations, 2 in width, 1/4 in thick, lengths as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face, corrugated for embedment in masonry joint, hot dip galvanized to ASTM A 153/A 153M, Class B.

## 2.04 ACCESSORIES

- A. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.  
Provide cleaning solution and methods as recommended by the masonry manufacturer.

## 2.05 MORTAR AND GROUT MIXES

- A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
  1. All masonry: Type S.
- B. Grout: ASTM C476. Consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.
- C. Mixing: Use mechanical batch mixer and comply with referenced standards.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

#### 3.02 PREPARATION

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

#### 3.03 COURSING

- A. Establish lines, levels, and coursing indicated. Protect from displacement.
- B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.
- C. Concrete Masonry Units:
  - 1. Bond: Running.
  - 2. Coursing: One unit and one mortar joint to equal 8 inches.
  - 3. Mortar Joints: Concave.

#### 3.04 PLACING AND BONDING

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- C. Remove excess mortar and mortar smears as work progresses.
- D. Interlock intersections and external corners.
- E. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- F. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- G. Cut mortar joints flush where wall tile is scheduled, cement parging is required, resilient base is scheduled, or bitumen dampproofing is applied.

#### 3.05 REINFORCEMENT AND ANCHORAGE - GENERAL

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.

- E. Reinforce joint corners and intersections with strap anchors 16 inches on center.
- F. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

### 3.06 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

- A. Install horizontal joint reinforcement 8 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Lap joint reinforcement ends minimum 6 inches.
- E. Reinforce joint corners and intersections with strap anchors 16 inches on center.

### 3.07 REINFORCED COMPONENTS

- A. Reinforce walls as indicated on drawings.
- B. Lap splices as indicated on drawings.
- C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.
- D. Place and consolidate grout fill without displacing reinforcing.
- E. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

### 3.08 BUILT-IN WORK

- A. As work progresses, install built-in metal door frames and fabricated metal frames and other items to be built into the work and furnished under other sections.
- B. Install built-in items plumb, level, and true to line.
- C. Bed anchors of metal door frames in adjacent mortar joints. Fill frame voids solid with grout.
  - 1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

### 3.09 TOLERANCES

- A. Maximum Variation from Alignment of Columns: 1/4 inch.
- B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- D. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.



- F. Maximum Variation of Joint Thickness: 1/8 inch in 3 ft.
- G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

### 3.10 CUTTING AND FITTING

- A. Cut and fit for pipes, conduit, sleeves, and grounds. Coordinate with other sections of work to provide correct size, shape, and location.
- B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

### 3.11 FIELD QUALITY CONTROL

- A. An independent testing agency will perform field quality control tests, as specified in Section 01400.
- B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67 requirements, sampling 5 randomly chosen units for each 50,000 installed.
- C. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140 for conformance to requirements of this specification.
- D. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

### 3.12 CLEANING

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

### 3.13 PROTECTION

- A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

**END OF SECTION**

# D I V I S I O N 10

Applicable Portions Of The Conditions  
Of The Contract And Division 1 General  
Requirements Apply To The Work Of  
This Division.

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**SECTION 10523 - FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fire extinguishers.
- B. Accessories.

1.02 REFERENCE STANDARDS

- A. NFPA 10 - Standard for Portable Fire Extinguishers.
- B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc..

1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate cabinet physical dimensions.
- C. Product Data: Provide extinguisher operational features, color and finish, and anchorage details.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.04 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Fire Extinguisher Cabinets and Accessories:
  - 1. JL Industries, Inc: [www.jlindustries.com](http://www.jlindustries.com).
  - 2. Larsen's Manufacturing Co: [www.larsensmfg.com](http://www.larsensmfg.com).
  - 3. Potter-Roemer: [www.potterroemer.com](http://www.potterroemer.com).
  - 4. Johnson-Lee, Division of W.F. Lee Corp..
  - 5. Watrous, Inc.
  - 6. Substitutions: See Section 01600 - Product Requirements.

2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
- B. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
  - 1. Class 2A-10 B:C.
  - 2. Size 10.
  - 3. Finish: Baked enamel, red color.

**2.03 ACCESSORIES**

- A. Extinguisher Brackets: Formed steel, chrome-plated.
- B. Graphic Identification: FIRE EXTINGUISHER.

**PART 3 EXECUTION**

**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

**3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Secure rigidly in place.
- C. Place extinguishers and accessories on wall brackets.

**3.03 IDENTIFICATION**

- A. Identify existence of fire extinguisher in cabinet with lettering spelling FIRE EXTINGUISHER applied to door. Provide lettering to comply with requirements indicated for letter style, color, size, spacing and location or, if not otherwise indicated, as selected by Architect from manufacturer's standard arrangements.

**3.04 SCHEDULES**

- A. Refer to drawings for locations.

**END OF SECTION**

# D I V I S I O N 13

Applicable Portions Of The Conditions  
Of The Contract And Division 1 General  
Requirements Apply To The Work Of  
This Division.

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**Section 13120 PRE-ENGINEERED STRUCTURES**

**PART 1 -GENERAL**

**1.01 DESCRIPTION**

- A. The following is a description of the kit the owner shall provide to the general contractor for erection. The kit shall include the structure, grow tables, grow lights and miscellaneous environmental control equipment. The contractor is responsible for providing skilled labor to erect the greenhouse structure, install all necessary infrastructure, equipment and control wiring. The contractor is also responsible for ensuring that all equipment functions and can be controlled as designed.
- B. The owner shall furnish the greenhouse structures and included equipment listed herein, of the size and dimensions indicated on the drawings. Finished size of greenhouses may vary slightly, as approved by Architect, to accommodate manufacturer's standard dimensions, but shall not be less than the area indicated.
- C. The owner shall furnish materials and equipment necessary for the greenhouse system described in this section and contract drawings.

**1.02 REFERENCE STANDARDS**

- A. Comply with National Greenhouse Manufacturer's Associated Standards, 1998 Edition.
- B. Aluminum Association's design manual "Specifications for Aluminum Structures."

**1.03 OWNER SUBMITTALS**

- A. Product Data: Provide data on profiles, component dimensions, fasteners.
- B. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation; framing anchor bolt settings, glazing details, placement of all components for heating, cooling and ventilation sizes, and locations from datum, foundation loads; provide professional seal and signature.
- C. Manufacturer's Instructions: Indicate preparation requirements, anchor bolt placement.
- D. Erection Drawings: Indicate members by label, assembly sequence, and temporary erection bracing.

**1.04 CONTRACTOR SUBMITTALS**

- A. Qualifications: Installer must have 5 years documented experience in installing greenhouse structures similar in nature to the kit being furnished by the owner.

**1.05 DESIGN CRITERIA**

- A. Design members to withstand dead load, applicable snow load, and design loads due to pressure and suction of wind calculated in accordance with applicable code.
- B. Submit structural calculations for greenhouse signed and sealed by a Professional Engineer for review by the University of South Carolina's representative and Architect.
- C. Structural Performance: As a minimum, conform to the requirements and recommendations of

both the “Standard for Design Loads in Greenhouse Structures” and its “Commentary” published by the National Greenhouse Manufacturers Association, 1998 Edition (NGMA Standards). Aluminum members shall be designed in accordance with the Aluminum Association’s design manual “Specifications for Aluminum Structures.”

#### 1.06 QUALITY ASSURANCE

- A. Standards: Comply with National Greenhouse Manufacturer’s Associated standards, 1998 Edition.
- B. The greenhouse kit manufacturer will provide two days of onsite training and supervision for installation of the greenhouse kit at the contractor’s discretion. Additional supervision can be provided at the cost of the contractor to assist in the installation of the greenhouse.
  - 1. Manufacturer: Gothic Arch Greenhouses; Buzz Sierke – phone: 800-531-4769, email: [bsierke@gothicarchgreenhouses.net](mailto:bsierke@gothicarchgreenhouses.net)

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Owner shall provide access to stored greenhouse kit. The contractor shall move the kit from storage location on the campus of USC Aiken to the site for installation
- B. Protect materials during delivery, storage and handling to comply with manufacturer’s directions and as required to prevent damage or deterioration.
- B. Coordinate day and time of move with the University of South Carolina’s representative.

#### 1.08 DESIGN LOADS

- A. Design structure to carry the following loads:
  - 1. Dead Load: Structure and equipment
  - 2. Snow Load: 32 lbs/ sq ft
  - 3. Wind Load: positive and negative wind loading of 25.5 lbs/ sq ft
  - 4. Deflection: Maximum deflection is not to exceed 1/120 of the total unit span per 2006 International Building Code Table 1604.3 for Greenhouses.

#### 1.09 PERFORMANCE REQUIREMENTS

- A. Prior to the start of installation by the construction contractor, greenhouse supplier shall supply engineer sealed set of drawings and specification showing compliance with these instructions and all applicable codes. Engineer must be currently licensed to practice in South Carolina. A copy of their license should be included in their shop drawings.
- B. All metal pieces and screens shall be of galvanized steel or coated in inhibit corrosion. Painted metal is not acceptable.
- C. All door hardware shall be furnished with removable cores with beat locks seven pin cylinder.
- D. Motorized shutters shall have continues hinges along their full pivot edge.
- E. As an attachment to bid provide a listing for each component listed below the information in the bid submittal column.

- F. Provide owner with 3 copies of operating and maintenance manuals after final completion.

## PART 2 -PRODUCTS

### 2.01 MANUFACTURER

- A. Greenhouse: Polycarbonate Greenhouse Enclosure
1. Gothic Arch Greenhouse Inc.; Product Cross Country- Traditional Series:  
[www.gothicarchgreenhouses.com](http://www.gothicarchgreenhouses.com)
  2. Contact: Buzz Sierke for technical assistance, phone: 800-531-4769, email:  
[bsierke@gothicarchgreenhouses.net](mailto:bsierke@gothicarchgreenhouses.net)

### 2.02 ALUMINUM STRUCTURE

- A. Framework to be standard extruded aluminum frame, pre-cut and pre- drilled consisting of curved eave roof, or straight eave roof, and two gable ends.
- B. Aluminum
1. Alloy and Temper of all framework members shall be of 6063-T5. Structural support members shall be as recommended for strength, corrosion resistance and application of required finish; ASTM B 221 for extrusions; ASTM B 209 for sheet/Plate
- C. Finish
1. All aluminum framing members and trim shall be manufacturer's standard semi-gloss baked-on enamel finish meeting specification AAMA 2603 for kynar painted finishes.
  2. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AMMA 2603 spec and with coating and resin manufacturers' written instructions.
  3. Finish: Arctic White, Rideau Brown, or Hartford Green
- D. Bay Spacing
1. Manufacturer's standard 2' 0 1/2" o.c. (24 1/2" ), standard.

### 2.03 GLAZING

- A. Clear twin wall 6mm thick extruded polycarbonate panels.
- B. Polycarbonate to be co-extruded with a UV inhibitor and include a non-prorated.
- C. 10 year warranty against diminishing light transmission and damage due to hail.

### 2.04 WALL GLAZING

- A. Clear Twin Wall 6mm thick Extruded Polycarbonate. Where indicated on drawing
1. R Value: 1.5 or greater
  2. Visible light Transmittance: 80% or greater.

### 2.05 ROOF GLAZING

- A. Clear Twin Wall 6mm thick Extruded Polycarbonate. Where indicated on drawing.
1. R Value: 1.5 or greater
  2. Visible light Transmittance: 80% or greater.

### 2.06 GLAZING GASKETS

- A. P.V.C. (Poly Vinyl Chloride) 15lb density double-sided adhesive tape



## 2.07 FASTENERS

- A. Non-magnetic stainless steel; or other materials warranted by the manufacturer to be non-corrosive and compatible with aluminum components.

## 2.08 GLAZING BARS

- A. The vertical and horizontal extrusions shall have internal and external weep/condensation channels to direct moisture, which could collect on the interior of the glazing, to the exterior of the greenhouse.
- B. The sill member shall be sloped and weep channeled to the exterior to force moisture, which may be collected, to exit to the exterior.
- C. The moisture shall weep/exit through small weep hole covers located periodically along the length of the sill member at the center of each bay.
- D. Provide continuous glazing cap assembly system to secure glass units to the glazing bars.

## 2.09 DOORS AND FRAMES

- A. Provide heavy duty, tubular frame members fabricated with mechanical joints. Fabricate doors to facilitate replacement of glass or panels, without disassembly of stiles and rails. Provide snap-on extruded aluminum glazing stops, with exterior stops anchored for non-removal. Glaze door lights with 1/4" tempered clear float glass glazed with captive plastic gaskets. Hardware preparation shall specifically allow installation of BHMA standard locksets, incorporating BHMA standard backsets and installation of lock cylinders specified under other sections.
- B. Doors to be pre-hung in aluminum jambs with integral weather-strip and stops with 6" x 1/2" thresholds.
- C. Doors, hinges, locksets, closers and panic devices to be supplied by the greenhouse contractor.
- D. All door hardware shall be furnished with removable cores which will accept a Best Locks seven pin cylinder.

## 2.10 ENVIRONMENTAL CONTROLS

- A. Provide pricing for environmental controls as described below. Bids should include all required equipment for a functional system whether listed below or required per an individual manufacturer's standard practice.
- B. Design Conditions- Provide heating and cooling to meet the design conditions as stated below.
  - 1. East Greenhouse.
    - a. Temperature control to maintain temperatures between 65 and 90 degrees Fahrenheit.
  - 2. West Greenhouse.
    - b. Temperature control to maintain temperatures between 50 and 90 degrees Fahrenheit.
- C. Automated Roof Vents (14).
  - 1. Provide 20" x 49" roof vents.
  - 2. Roof vents shall be manufacture's standard.
  - 3. Bayliss MK 7 Triplespring auto vent opener or University of South Carolina approved equal.
- D. Exhaust Ventilation Fans (4).
  - 1. Provide shutter-style fans, by Canarm Ltd.: 2157 Parkdale Ave; Brockville, ON K6V 5V6 or University of South Carolina approved equal.

2. Shutters shall be aluminum and painted to match greenhouse.
  3. Fans shall have aluminum blades and powder coated guard.
  4. Motor shall be heavy-duty, total enclosed, maintenance free, energy efficient style with direct drive, variable speed.
  5. Fans shall be controlled by thermostat.
- E. Motorized Intake Shutters (4).
1. Provide 23" x 24" motorized intake shutter(s), Series 3200 by Canarm Ltd.: 2157 Parkdale Ave; Brockville, ON K6V 5V6 or University of South Carolina approved equal.
  2. Shutters shall be aluminum and painted to match greenhouse.
  3. Shutter motors shall be 120 volt and controlled by thermostat.
- F. Evaporative Coolers (4)
1. Provide 36" x 33-1/3" x 27-1/4" Cabinet-Enclosed style Evaporative Cooler(s), by PMI, 3655 East Roeser Rd., Phoenix, AZ 85040 or University of South Carolina approved equal.
- G. Gas Fired Unit Heaters (2)
1. Provide 35.5" x 20.5" x 22" – Propeller Driven – 100K btu Nat'l Gas-Fired Unit Heater by Modine Mfg. Co., 1500 DeKoven Av., Racine, WI. 53403 or University of South Carolina approved equal.
- H. Thermostat control shall be provided to control motorized intake shutters, evaporative coolers, exhaust ventilation fans and roof vents.
1. The contractor is responsible for the interconnectivity and functionality of all pieces of equipment.
  2. The contractor shall provide all required feeders, control wiring, disconnects, contactors, interconnections, panels and conduit.
  3. It is the contractor's responsibility to review the provided control wiring schematic and ensure that the equipment performs as designed based on the performance requirements described in this specification.

#### 2.11 BENCH SYSTEM (20)

- A. Benches shall have leg supports made from 1½" square galvanized tubing spaced on 6'0" intervals. The bench tops will consist of extruded aluminum perimeter sides (1" / 3" tall ) with 1" square 18 ga. Cross pieces on 2'-0" centers. Covering will be hot dipped ¾", #13 expanded metal.
- B. Stationary Benches: Legs and top support rails shall be inset a minimum of 3" on each side and 6" on the ends to facilitate easier movement down aisles.

#### 2.12 GROW LIGHTS (15)

- A. Manufacturer's standard grow light to meet the minimum requirements as specified below.
- B. 400 watt high pressure sodium lights wired back to a switch with a timer/controls.
- C. Lights should be spaced @ 5' O.C. above benches. Refer to drawings for number and locations.

### PART 3 -EXECUTION

#### 3.01 PREPARATION

- A. Examine areas and conditions under which greenhouse work is to be installed. Notify contractor in writing of conditions detrimental to proper and timely installation of work.

- B. Coordinate and furnish anchorages, setting diagrams, templates and directions for installation of anchorages.
- C. Ensure that all necessary parts of the greenhouse kit have been provided by manufacturer.

### 3.02 ERECTION

- A. Erect greenhouse and related components in accordance with manufacturer's written instructions and final shop and erection drawings and as directed by the manufacturer.
- B. Erector shall be an experienced crew at installing greenhouse kit buildings.

### 3.03 INSTALLATION OF EQUIPMENT

- A. General: Install equipment in accordance with manufacturer's installation instructions and recognized industry practices to insure intended function.
- B. Equipment will be installed in place by the Greenhouse Contractor. All mechanical, electrical and plumbing connection will be performed by electrical, plumbing or mechanical contractor.
- C. The Control Contractor will be responsible for equipment startup, control wiring and calibration.

**END OF SECTION**

# Gas Fired Unit Heater



6-460.8

April, 2007

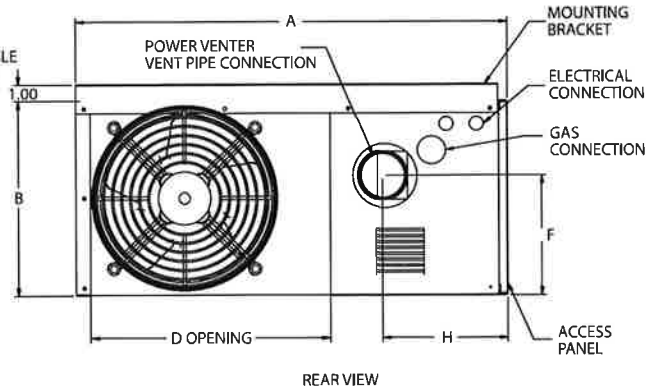
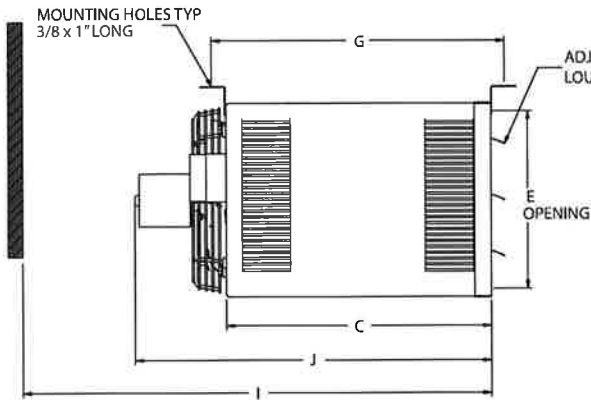


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# SUBMITTAL DATA

## power vented gas-fired unit heaters

### model HD



### Performance

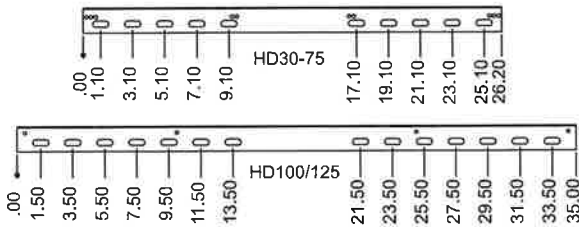
Models	HD30	HD45	HD60	HD75	HD100	HD125
Btu/Hr Input	30,000	45,000	60,000	75,000	100,000	125,000
Btu/Hr Output	24,000	36,000	48,000	60,000	80,000	100,000
Entering Airflow (CFM)	505	720	990	1,160	1,490	1,980
Outlet Velocity	523	749	653	769	565	747
Air Temp. Rise (°F)	44	46	45	48	50	47
Mounting Height (Max ft.)	10	10	12	14	12	16
Heat Throw (ft.)	25	27	36	38	42	56
Motor Data	Horsepower	1/15	1/15	1/12	1/12	1/8
	RPM	1,550	1,550	1,625	1,625	1,050
	Type	S.P.	S.P.	P.S.C.	P.S.C.	S.P.
	Amps	2.4	2.4	1.2	1.2	2.7
Unit Total Amps	3.7	3.7	2.5	2.5	4.7	4.2
Vent Connector Size (in.)	3	3	3	3	4	4

### Dimensions (inches)

Models	HD30	HD45	HD60	HD75	HD100/125
A	26.8	26.8	26.8	26.8	35.5
B	12.2	12.2	18.0	18.0	20.5
C	16.5	16.5	16.5	16.5	22.0
D	14.9	14.9	14.9	14.9	22.5
E	10.1	10.1	15.9	15.9	18.4
F	7.5	7.5	10.7	10.7	14.0
G	18.5	18.5	18.5	18.5	24.0
H	7.6	7.6	7.8	7.8	8.4
Gas Connection	1/2	1/2	1/2	1/2	1/2
I	34.5	34.5	34.5	34.5	43.0
J	22	22	25	25	31.0
Fan Diameter	10	10	14	14	18.0
Approx. Shipping Weight (lbs.)	55	60	80	85	125

### Mounting

1" - angle, mounting brackets are slotted to accommodate joists on 16" or 24" centerlines.



### Clearances

Unit Side	Clearance To Combustible Materials	Recommended Service Clearance
Top and Bottom	1"	1"
Access Side	18"	18"
Non-Access Side	1"	1"
Rear	18"	18"
Vent Connector	4"	4"

### Control Options

Control Description	Control Code No.	Service Voltage	Thermostat Voltage	Type of Gas	Model Size
<b>Single-Stage, Direct Spark Ignition, 100% Shut-Off with Continuous Retry</b> - Utilizes a single-stage combination gas control with ignition control. Gas is lit with a direct spark igniter on call for heat.	11	115V	24V	natural	30-125
	21	115V	24V	propane	30-125
<b>Two-Stage, Direct Spark Ignition, 100% Shut-Off with Continuous Retry</b> - Utilizes a two-stage combination gas control with built-in ignition control. Firing rate is 100% and 50% of full rated input. Gas is lit with a direct spark igniter on call for heat. ©	12	115V	24V	natural	75-125
	22	115V	24V	propane	75-125

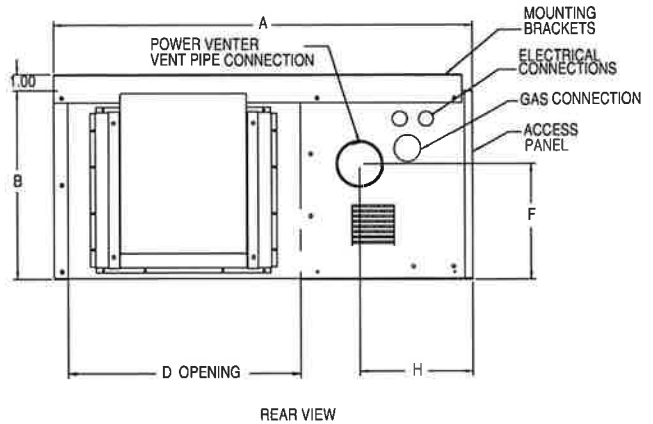
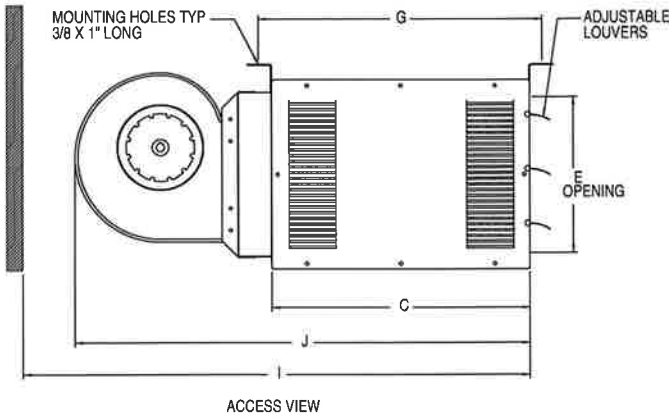


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# SUBMITTAL DATA

## power vented blower gas-fired unit heaters

### model HDB



### Performance

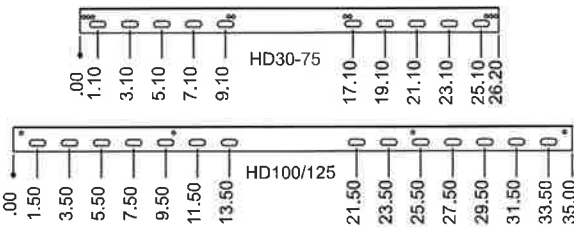
Models	HDB60	HDB75	HDB100	HDB125	
Btu/Hr Input	60,000	75,000	100,000	125,000	
Btu/Hr Output	48,000	60,000	80,000	100,000	
Air Flow CFM Range	635-1100	795-1390	1060-1850	1240-2050	
Static Pressure (max)	0.7	0.7	0.8	0.8	
Air Temp. Rise (°F)	40-70	40-70	40-70	45-75	
Motor Speeds	3	3	3	3	
Motor Data	Horsepower	1/4	1/3	1/2	1/2
	RPM	Max 1,100	Max 1,100	Max 1,100	Max 1,100
	Type	P.S.C.	P.S.C.	P.S.C.	P.S.C.
	Amps	5.4	7.1	9.5	9.5
Unit Total Amps	6.4	8.1	11.5	11.5	
Vent Connector Size (in.)	3	3	4	4	

### Dimensions (inches)

Models	HDB 60	HDB 75	HDB100/125
A	26.8	26.8	35.5
B	18.0	18.0	20.5
C	16.5	16.5	22.0
D	14.9	14.9	22.5
E	15.9	15.9	18.4
F	10.7	10.7	14.0
G	18.5	18.5	24.0
H	7.8	7.8	8.4
Gas Connection	1/2	1/2	1/2
I	35.5	35.5	44.5
J	32.5	32.5	41.5
Blower	9 - 7	9 - 7	10 - 10
Approx. Shipping Weight (lbs.)	92	97	151

### Mounting

1" - angle, mounting brackets are slotted to accommodate joists on 16" or 24" centerlines.



### Clearances

Unit Side	Clearance To Combustible Materials	Recommended Service Clearance
Top and Bottom	1"	1"
Access Side	1"	18"
Non-Access Side	1"	1"
Rear	18"	18"
Vent Connector	4"	4"

### Control Options

Control Description	Control Code No.	Service Voltage	Thermostat Voltage	Type of Gas	Model Size
<b>Single-Stage, Direct Spark Ignition, 100% Shut-Off with Continuous Retry</b> - Utilizes a single-stage combination gas control with ignition control. Gas is lit with a direct spark igniter on call for heat.	11	115V	24V	natural	30-125
	21	115V	24V	propane	30-125
<b>Two-Stage, Direct Spark Ignition, 100% Shut-Off with Continuous Retry</b> - Utilizes a two-stage combination gas control with built-in ignition control. Firing rate is 100% and 50% of full rated input. Gas is lit with a direct spark igniter on call for heat. ®	12	115V	24V	natural	75-125
	22	115V	24V	propane	75-125

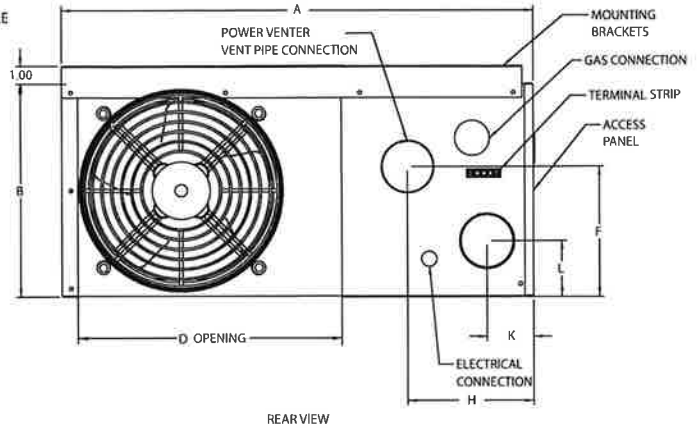
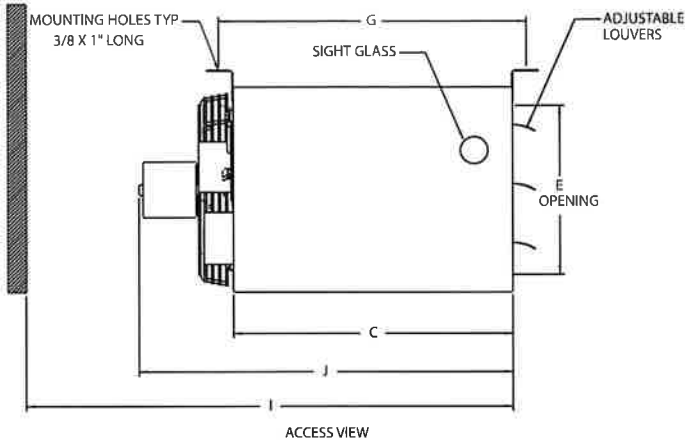


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# SUBMITTAL DATA

## separated combustion gas-fired unit heaters

### model HDS



### Performance

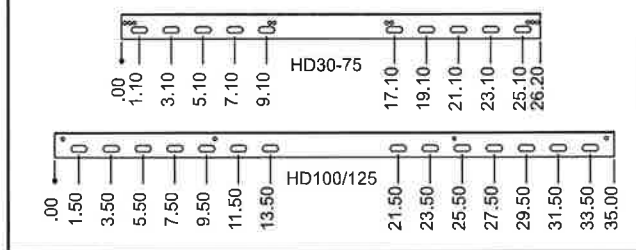
Models	HDS30	HDS45	HDS60	HDS75	HDS100	HDS125
Btu/Hr Input	30,000	45,000	60,000	75,000	100,000	125,000
Btu/Hr Output	24,000	36,000	48,000	60,000	80,000	100,000
Entering Airflow (CFM)	505	720	990	1,160	1,490	1,980
Outlet Velocity	523	749	653	769	565	747
Air Temp. Rise (°F)	44	46	45	48	50	47
Mounting Height (Max ft.)	10	10	12	14	12	16
Heat Throw (ft.)	25	27	36	38	42	56
Motor Data	Horsepower	1/15	1/15	1/12	1/12	1/12
	RPM	1,550	1,550	1,625	1,625	1,050
	Type	S.P.	S.P.	P.S.C.	P.S.C.	S.P.
	Amps	2.4	2.4	1.2	1.2	2.7
Unit Total Amps	3.7	3.7	2.5	2.5	4.7	4.2
Vent Connector Size (in.)	3	3	4	4	4	4

### Dimensions (inches)

Models	HDS30	HDS45	HDS60	HDS75	HDS100/125
A	26.8	26.8	26.8	26.8	35.5
B	12.2	12.2	18.0	18.0	20.5
C	16.5	16.5	16.5	16.5	22.0
D	14.9	14.9	14.9	14.9	22.5
E	10.1	10.1	15.9	15.9	18.4
F	7.25	7.25	10.75	10.75	14.0
G	18.5	18.5	18.5	18.5	24.0
H	7.6	7.6	7.835	7.835	8.4
Gas Connection	1/2	1/2	1/2	1/2	1/2
I	34.5	34.5	34.5	34.5	43.0
J	22	22	25	25	31.0
K	2.74	2.74	3.15	3.15	3.87
L	3.19	3.19	5.55	5.55	10.73
Fan Diameter	10	10	14	14	18.0
Approx. Shipping Weight (lbs.)	55	60	80	85	125

### Mounting

1" - angle, mounting brackets are slotted to accommodate joists on 16" or 24" centerlines.



### Clearances

Unit Side	Clearance To Combustible Materials	Recommended Service Clearance
Top and Bottom	1"	1"
Access Side	1"	18"
Non-Access Side	1"	1"
Rear	18"	18"
Vent Connector	4"	4"

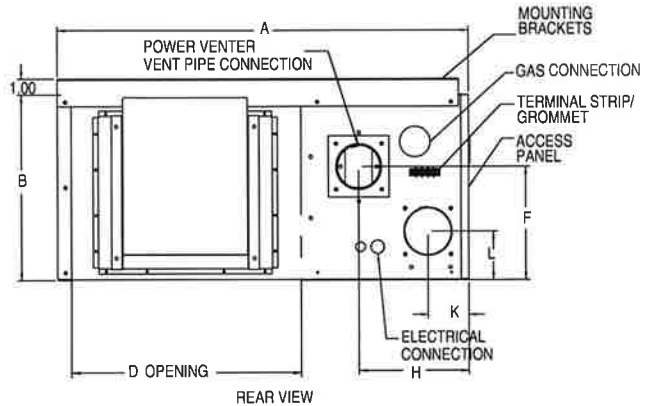
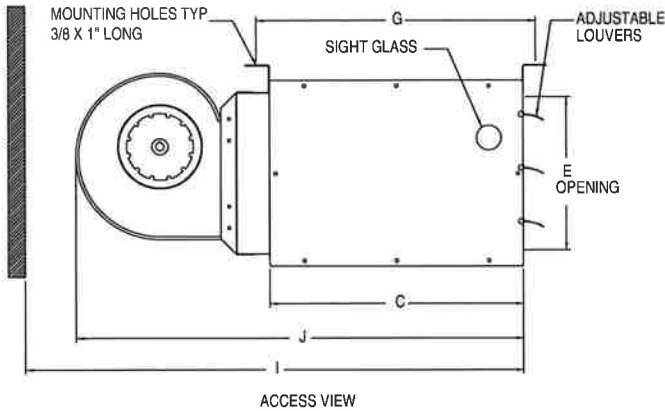
### Control Options

Control Description	Control Code No.	Service Voltage	Thermostat Voltage	Type of Gas	Model Size
<b>Single-Stage, Direct Spark Ignition, 100% Shut-Off with Continuous Retry</b> - Utilizes a single-stage combination gas control with ignition control. Gas is lit with a direct spark igniter on call for heat.	11	115V	24V	natural	30-125
	21	115V	24V	propane	30-125
<b>Two-Stage, Direct Spark Ignition, 100% Shut-Off with Continuous Retry</b> - Utilizes a two-stage combination gas control with built-in ignition control. Firing rate is 100% and 50% of full rated input. Gas is lit with a direct spark igniter on call for heat. ®	12	115V	24V	natural	75-125
	22	115V	24V	propane	75-125



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# SUBMITTAL DATA separated combustion blower gas-fired unit heaters — model HDC



## Performance

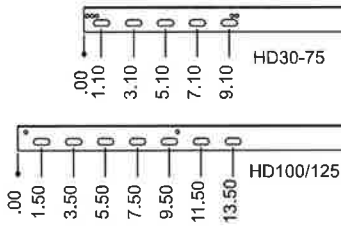
Models	HDC60	HDC75	HDC100	HDC125	
Btu/Hr Input	60,000	75,000	100,000	125,000	
Btu/Hr Output	48,000	60,000	80,000	100,000	
Air Flow CFM Range	635-1100	795-1390	1060-1850	1240-2050	
Static Pressure (max)	0.7	0.7	0.8	0.8	
Air Temp. Rise (°F)	40-70	40-70	40-70	45-75	
Motor Speeds	3	3	3	3	
Motor Data	Horsepower	1/4	1/3	1/2	1/2
	RPM	Max 1,100	Max 1,100	Max 1,100	Max 1,100
	Type	P.S.C.	P.S.C.	P.S.C.	P.S.C.
	Amps	5.4	7.1	9.5	9.5
Unit Total Amps	6.4	8.1	11.5	11.5	
Vent Connector Size (in.)	4	4	4	4	

## Dimensions (inches)

Models	HDC 60	HDC 75	HDC100/125
A	26.8	26.8	35.5
B	18.0	18.0	20.5
C	16.5	16.5	22.0
D	14.9	14.9	22.5
E	15.9	15.9	18.4
F	10.8	10.8	14.0
G	18.5	18.5	24.0
H	7.8	7.8	8.4
Gas Connection	1/2	1/2	1/2
I	35.5	35.5	44.5
J	32.5	32.5	41.5
K	3.15	3.15	3.87
L	5.55	5.55	10.73
Blower	9 - 7	9 - 7	10 - 10
Approx. Shipping Weight (lbs.)	92	97	125

## Mounting

1" - angle, mounting brackets are slotted to accommodate joists on 16" or 24" centerlines.



## Clearances

Unit Side	Clearance To Combustible Materials	Recommended Service Clearance
Top and Bottom	1"	1"
Access Side	1"	18"
Non-Access Side	1"	1"
Rear	18"	18"
Vent Connector	4"	4"

## Control Options

Control Description	Control Code No.	Service Voltage	Thermostat Voltage	Type of Gas	Model Size
<b>Single-Stage, Direct Spark Ignition, 100% Shut-Off with Continuous Retry</b> - Utilizes a single-stage combination gas control with ignition control. Gas is lit with a direct spark igniter on call for heat.	11	115V	24V	natural	30-125
	21	115V	24V	propane	30-125
<b>Two-Stage, Direct Spark Ignition, 100% Shut-Off with Continuous Retry</b> - Utilizes a two-stage combination gas control with built-in ignition control. Firing rate is 100% and 50% of full rated input. Gas is lit with a direct spark igniter on call for heat. ®	12	115V	24V	natural	75-125
	22	115V	24V	propane	75-125





# WIRING DIAGRAMS

gas-fired, power vented and separated combustion unit heaters  
for models HD/HDB, HDS/HDC, PTS/BTS, PTC



## WARNING

1. Fuel supply shall be shut-off and the electrical power disconnected before proceeding with the installation. Failure to do so could result in fire, explosion, electrical shock, or the unit starting suddenly resulting in injury.
2. All units must be wired strictly in accordance with wiring diagram furnished with the unit. Failure to wire this unit according to this wiring diagram could result in a hazard to persons and property. For deviations, contact the factory.
3. All wiring must be done with a wiring material having a temperature rating of at least 105°C.

## IMPORTANT

1. The use of this manual is specifically intended for a qualified installation and service agency. All installation and service of these kits must be performed by a qualified installation and service agency.
2. These instructions must also be used in conjunction with the Installation and Service manual originally shipped with the appliance being converted, in addition to any other accompanying component supplier literature which supersedes these instructions.

### Diagram Selection

Diagrams are provided for both single and three-phase circuits, and are readily identified in the selection table on page 2. The selection table enables easy selection of the correct wiring diagram after the electrical components of the unit heater have been determined.

**NOTE:** As indicated in every diagram, all wiring must comply with the National Electrical Code and all local codes. All components must agree with their respective power source.

### Abbreviations and Symbols

To facilitate interpretation and enable simplification the abbreviations and symbols have been selected as recommended by ANSI (American National Standards Institute) and NEMA (National Electrical Manufacturers Association) standards.

XFMR or TR	Transformer
H1, H2, etc.	Transformer Primary Terminals
X1, X2, etc.	Transformer Secondary Terminals
V	Volts
Hz	Hertz
∅	Phase
RC	Relay Contactor Coil
G	Ground
H	Hot
SW	Switch
HI	High
LO	Low
C	Common
"J" Box	Junction Box
S/W	Summer/Winter Switch
O.L.C.	Overload Contacts
SPDT	Single Pole Double Throw Switch
DPDT	Double Pole Double Throw Switch
VA	Volt-Ampere
L1, L2, L3	Load Terminals (Connect to Supply Voltage)
T1, T2, T3	Motor or Motor Starter Terminals
<b>Wire Color Coding</b>	
BK	Black
BR	Brown
BL	Blue
R	Red
W	White
GY	Gray
Y	Yellow

THIS MANUAL IS THE PROPERTY OF THE OWNER.  
PLEASE BE SURE TO LEAVE IT WITH THE OWNER WHEN YOU LEAVE THE JOB.

Modine Manufacturing Company has a continuous product improvement program, and therefore reserves the right to change design and specifications without notice.

# WIRING DIAGRAM SELECTION

Select the correct wiring diagram as follows:

1. Determine the 12 digit unit heater model number. Example: PTS350SS0122
2. Breakdown the model number into the following parts (using the above example):
  - a. Model: PTS
  - b. Size: 350
  - c. Power Code: 01
  - d. Control Code: 22
3. Review the model number breakdown against Table 2.1 to select the correct wiring diagram.  
For the example in Step 2 above, the correct wiring diagram is located on page 6.
4. Review Table 2.2 to determine if any additional wiring diagrams are necessary based on accessories included.

**Table 2.1 – Unit Heater Wiring Diagram Page Location Index**

Type	Model	Size	Power Code	Supply Voltage	Control Code	Gas Controls	Wiring Diagram	Page	
Propeller	HD/HDS	30-125	01 ①	115V/1ph	11 or 21	Single Stage	5H079963B1	3	
					12 or 22	Two Stage	5H079963B2	4	
	PTS	150-350	01 ①	115V/1ph	11 or 21	Single Stage	5H079963B1	3	
					12 or 22	Two Stage	5H079963B2	4	
		400	01 ①	115V/1ph	11 or 21	Single Stage	5H079963B3	5	
					12 or 22	Two Stage	5H079963B4	6	
	PTC	135-215	01 ①	115V/1ph	11 or 21	Single Stage	5H080716B1	11	
		260-310	01 ①	115V/1ph	11 or 21	Single Stage	5H080716B2	12	
Blower	HDB/HDC	60-125	01 ②	115V/1ph	11 or 21	Single Stage	5H079963B1	3	
					12 or 22	Two Stage	5H079963B2	4	
	BTS	150	01 ②	115V/1ph	11 or 21	Single Stage	5H079963B1	3	
					12 or 22	Two Stage	5H079963B2	4	
		150-400	02, 13, 24,35 ②	115/230V/1ph	11 or 21	Single Stage	5H080273B1	7	
					12 or 22	Two Stage	5H080273B2	8	
					208/230/460/575V/3ph	11 or 21	Single Stage	5H080274B1	9
						12 or 22	Two Stage	5H080274B2	10

① All propeller models (HD/HDS/PTS/PTC) are Power Code 01 for 115V/60Hz/1ph supply voltage only. To operate the unit on a supply voltage other than 115V/1ph, an accessory step down transformer is required. Refer to the latest revision of Literature #6-567 for instructions on properly wiring the unit heater and transformer.

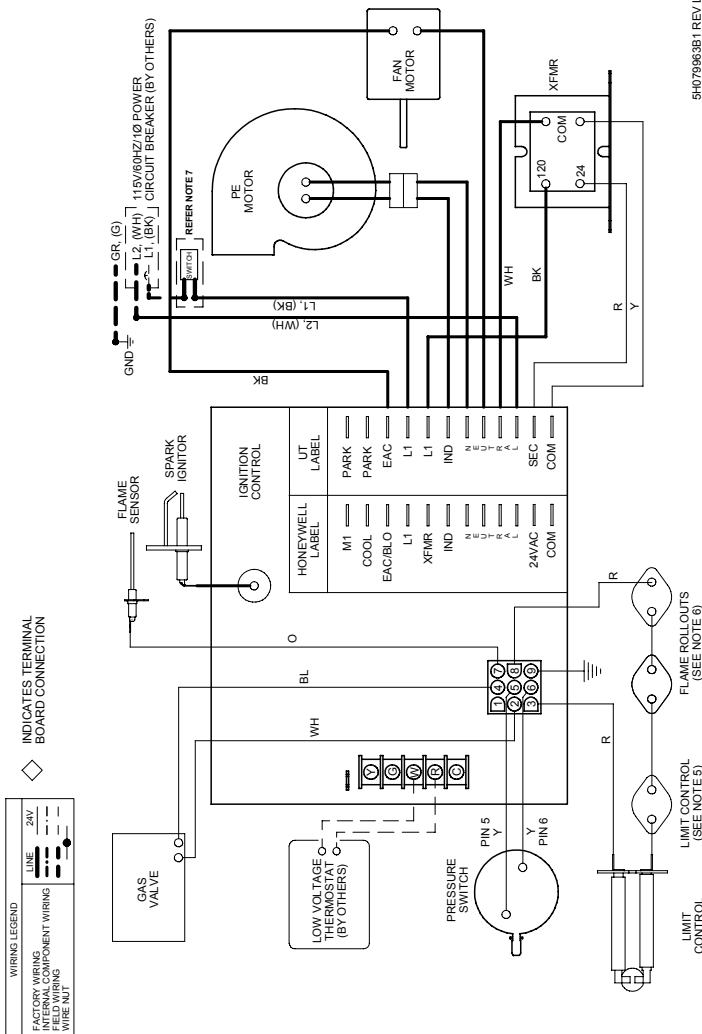
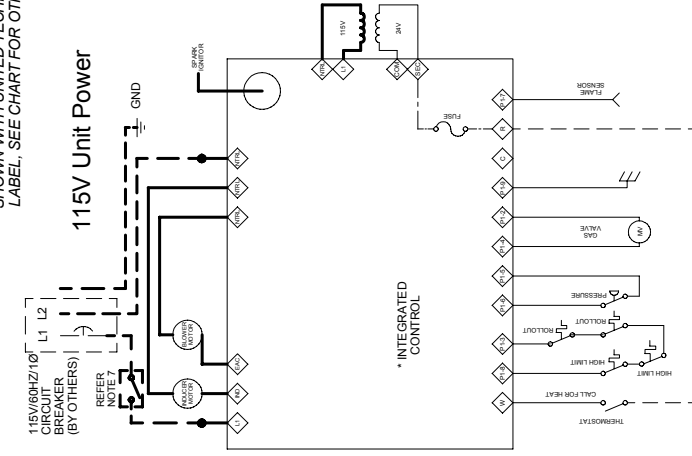
② All blower models (HDB/HDC/BTS) that are operated with a supply voltage other than 115V/1ph, an accessory step down transformer is required. Refer to the latest revision of Literature #6-567 for instructions on properly wiring the unit heater and transformer.

**Table 2.2 – Accessory Wiring Diagram Page Location Index**

Model	Accessory	Page
All	Thermostat <b>with</b> Fan On/Auto Subbase Switching	13
All	Thermostat <b>without</b> Fan On/Auto Subbase Switching <b>and</b> Summer/Winter Switch	13
All	Wiring Multiple Single Stage Unit Heaters to a Single Thermostat	14
PTC	Terminal Board Jumper Removal for Accessory Wiring	14

# WIRING DIAGRAMS – MODELS HD/HDB, HDS/HDC, PTS/BTS

\*SHOWN WITH UNITED TECHNOLOGIES LABEL. SEE CHART FOR OTHER LABELS



5H079963B1 REV L

SINGLE STAGE, DIRECT SPARK IGNITION,  
100% SHUT-OFF, MULTIPLE RETRY W/ AUTO RESET FROM LOCKOUT

NOTES TO INSTALLER:

1. ALL WIRING MUST COMPLY WITH NATIONAL ELECTRIC CODE AND ALL LOCAL CODES.
2. ALL COMPONENTS MUST AGREE WITH THEIR RESPECTIVE POWER SOURCE.
3. VERIFY THE POWER SOURCE AND THE UNIT POLARITY.
4. USE TYPE 105°C REPLACEMENT WIRE 300V OR GREATER.
5. USED ON PROPELLER MODELS 100 AND LARGER.
6. TWO SWITCHES: 30-75, ONE SWITCH: 100-125 NOT USED ON 150-400 UNITS.
7. OPTIONAL UNIT DISCONNECT SWITCH.

FOR BLOWER MOTORS.

WH-NEUTRAL  
BK-HI  
BL-MED  
RED-LO

ATTACH WIRES NOT USED TO "PARK" TERMINALS

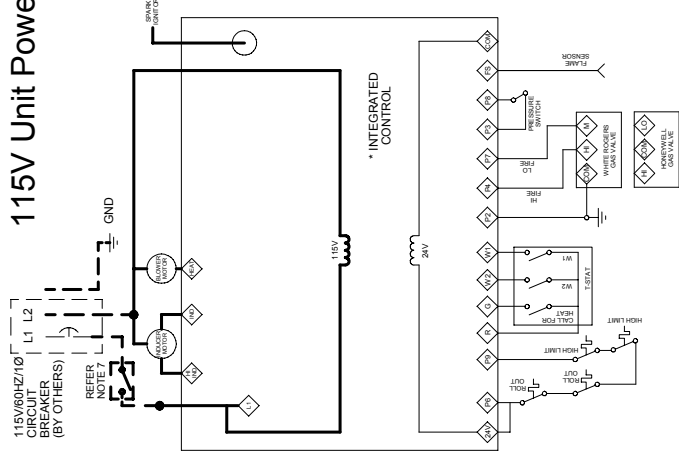
CAUTION:  
FAILURE TO WIRE THIS UNIT ACCORDING TO THIS WIRING DIAGRAM MAY RESULT IN INJURY TO THE INSTALLER OR USER. FOR DEVIATIONS CONTACT THE FACTORY.

## 5H079963B1

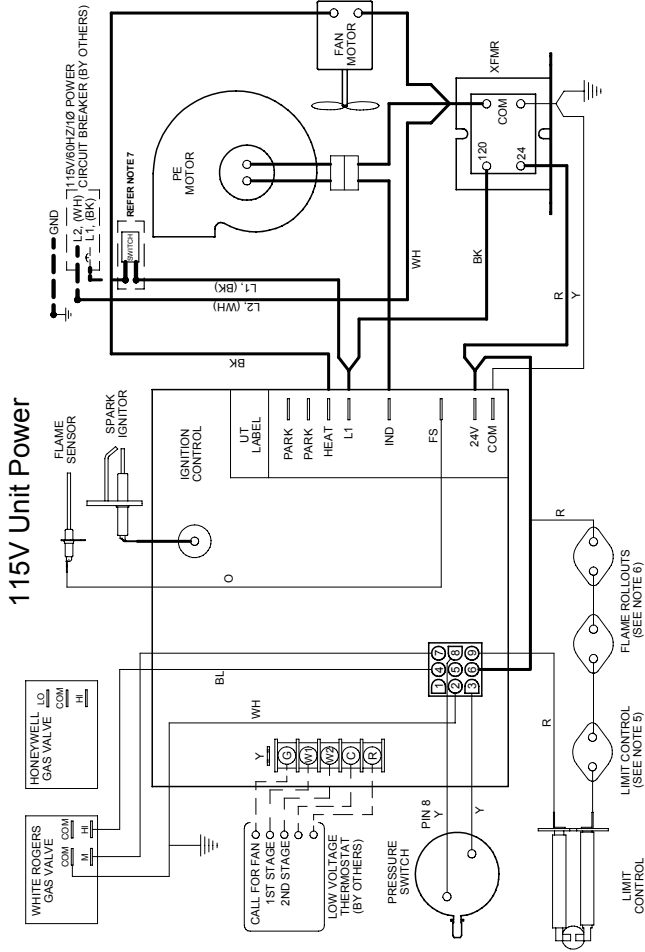
WIRING DIAGRAM, SINGLE STAGE

# WIRING DIAGRAMS – MODELS HD/HDB, HDS/HDC, PTS/BTS

## 115V Unit Power



## 115V Unit Power



100% SHUT-OFF, MULTIPLE RETRY W/ AUTO RESET FROM LOCKOUT

TWO STAGE, DIRECT SPARK IGNITION.

**MOTOR LEAD COLOR FOR DIRECT DRIVE BLOWER MOTORS ONLY.**  
 WH-NEUTRAL  
 BK-HI  
 BL-MED  
 RED-LO  
 ATTACH WIRES NOT USED TO "PARK" TERMINALS ARE FACTORY WIRED FOR HIGH SPEED OPERATION.

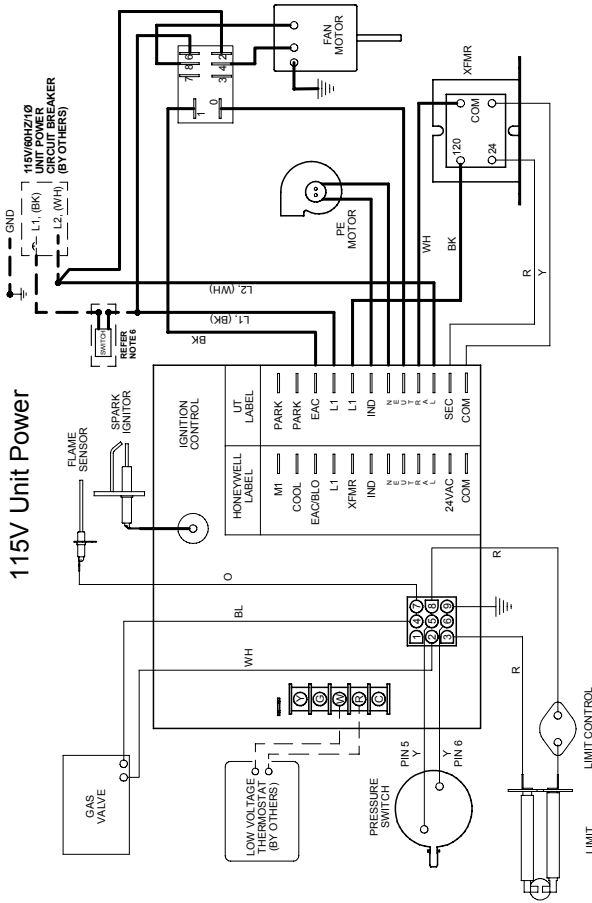
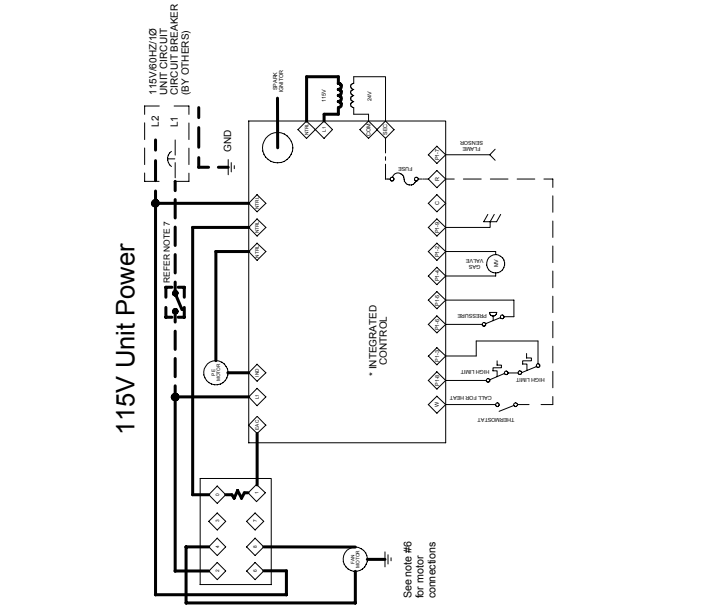
- NOTES TO INSTALLER:**
1. ALL WIRING MUST COMPLY WITH NATIONAL ELECTRIC CODE AND ALL LOCAL CODES.
  2. ALL COMPONENTS MUST AGREE WITH THEIR RESPECTIVE POWER SOURCE.
  3. VERIFY THE POWER SOURCE AND THE UNIT POLARITY.
  4. USE TYPE 105°C REPLACEMENT WIRE 300V OR GREATER
  5. USED ON PROPELLER MODELS 100 AND LARGER.
  6. TWO SWITCHES: 30-75, ONE SWITCH: 100-125 NOT USED ON 150-400 UNITS.
  7. OPTIONAL UNIT DISCONNECT SWITCH.

**CAUTION:**  
 FAILURE TO WIRE THIS UNIT ACCORDING TO THIS WIRING DIAGRAM MAY RESULT IN INJURY TO THE INSTALLER OR USER. FOR DEVIATIONS CONTACT THE FACTORY.

## 5H079963B2

WIRING DIAGRAM, TWO STAGE

# WIRING DIAGRAMS – MODELS HD/HDB, HDS/HDC, PTS/BTS



SINGLE STAGE, DIRECT SPARK IGNITION,  
100% SHUT-OFF, MULTIPLE RETRY W/ AUTO RESET FROM LOCKOUT

**NOTES TO INSTALLER:**

1. ALL WIRING MUST COMPLY WITH NATIONAL ELECTRIC CODE AND ALL LOCAL CODES.
2. ALL COMPONENTS MUST AGREE WITH THEIR RESPECTIVE POWER SOURCE.
3. VERIFY THE POWER SOURCE AND THE UNIT POLARITY.
4. USE TYPE 105°C REPLACEMENT WIRE 300V OR GREATER.
5. USED ON PROPPELLER MODELS 100 AND LARGER.
6. OPTIONAL UNIT DISCONNECT SWITCH.

**FOR BLOWER MOTORS,**

- WH-NEUTRAL
- BK-HI
- BL-MED
- RED-LO

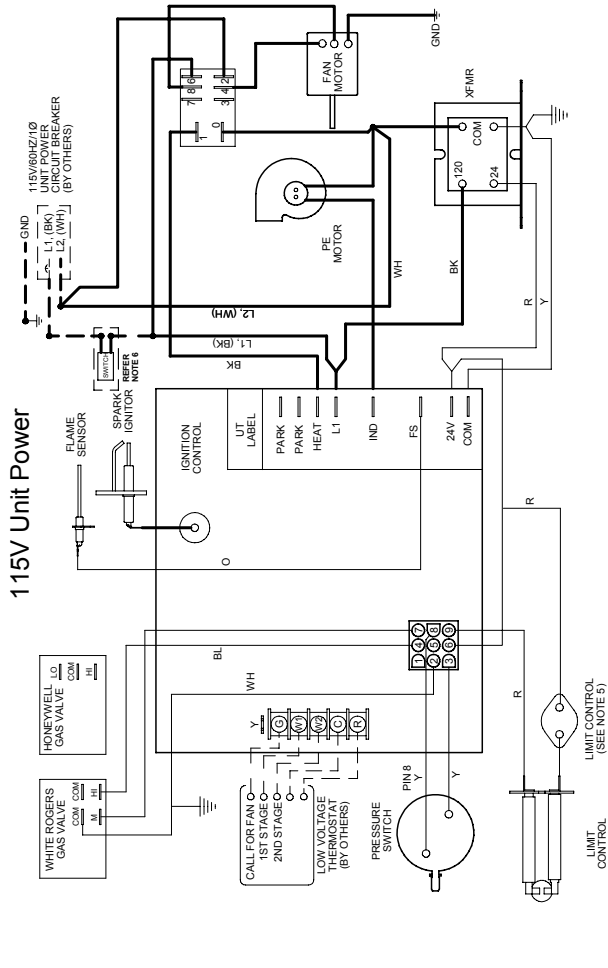
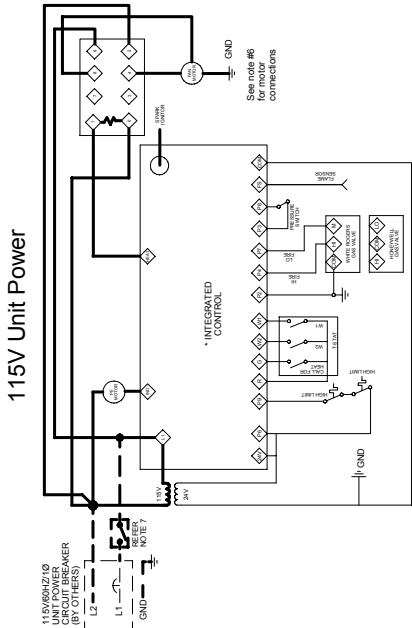
ATTACH WIRES NOT USED TO "PARK" TERMINALS

**CAUTION:**  
FAILURE TO WIRE THIS UNIT ACCORDING TO THIS WIRING DIAGRAM MAY RESULT IN INJURY TO THE INSTALLER OR USER. FOR DEVIATIONS CONTACT THE FACTORY.

**5H079963B3**

WIRING DIAGRAM, SINGLE STAGE, RELAY

# WIRING DIAGRAMS – MODELS HD/HDB, HDS/HDC, PTS/BTS



100% SHUT-OFF, MULTIPLE RETRY W/ AUTO RESET FROM LOCKOUT

### NOTES TO INSTALLER:

1. ALL WIRING MUST COMPLY WITH NATIONAL ELECTRIC CODE AND ALL LOCAL CODES.
2. ALL COMPONENTS MUST AGREE WITH THEIR RESPECTIVE POWER SOURCE.
3. VERIFY THE POWER SOURCE AND THE UNIT POLARITY.
4. USE TYPE 105°C REPLACEMENT WIRE 300V OR GREATER.
5. USED ON PROPELLER MODELS 100 AND LARGER.
6. OPTIONAL UNIT DISCONNECT SWITCH.

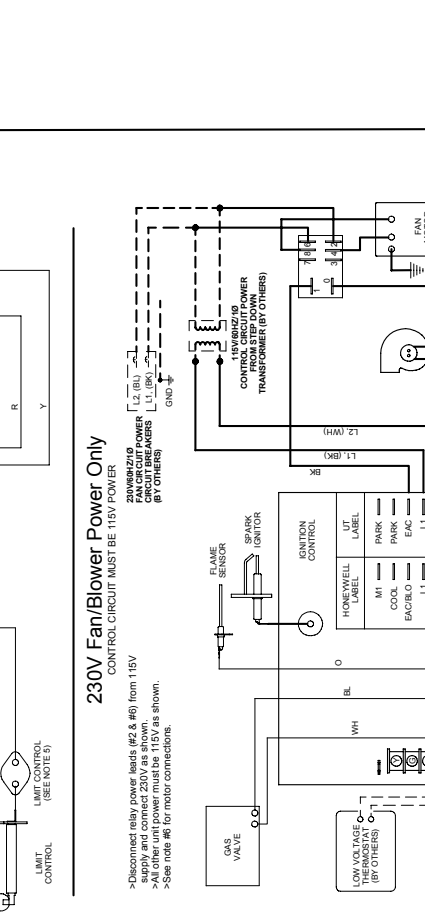
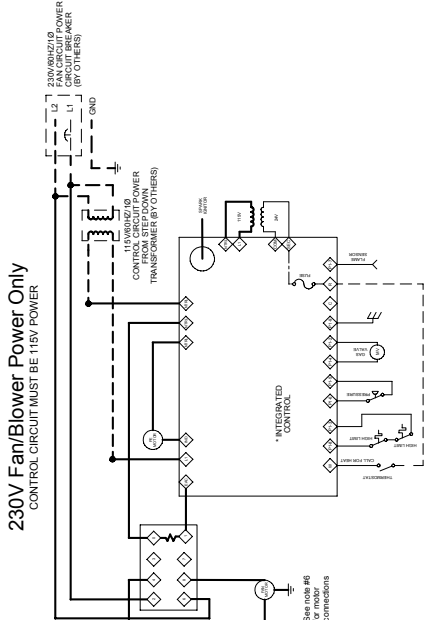
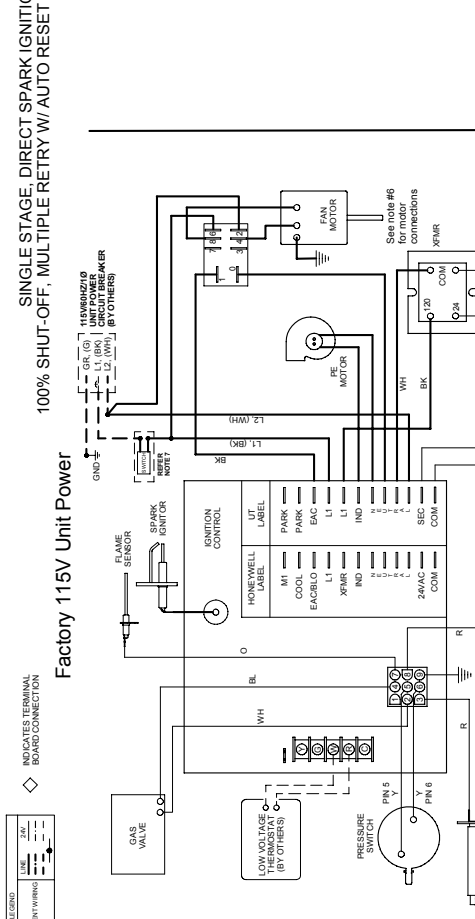
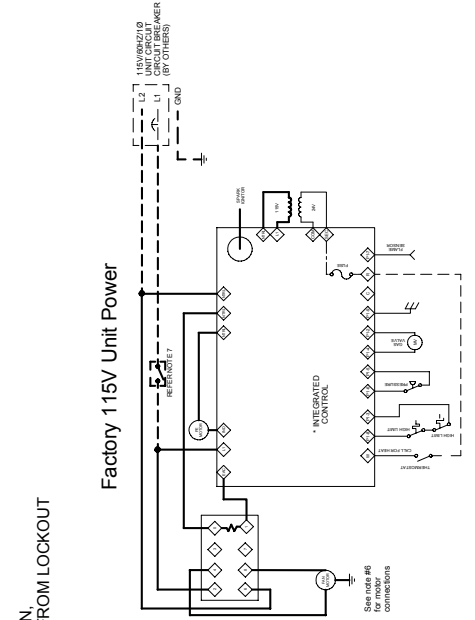
CAUTION: FAILURE TO WIRE THIS UNIT ACCORDING TO THIS WIRING DIAGRAM MAY RESULT IN INJURY TO THE INSTALLER OR USER. FOR DEVIATIONS CONTACT THE FACTORY.

## 5H079963B4

WIRING DIAGRAM, TWO STAGE, RELAY

# WIRING DIAGRAMS – MODELS HD/HDB, HDS/HDC, PTS/BTS

SINGLE STAGE DIRECT SPARK IGNITION.  
100% SHUT-OFF, MULTIPLE RETRY W/ AUTO RESET FROM LOCKOUT



\*SHOWN WITH UNITED TECHNOLOGIES LABEL. SEE CHART FOR OTHER LABELS

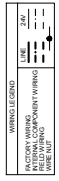
### NOTES TO INSTALLER:

1. ALL WIRING MUST COMPLY WITH NATIONAL ELECTRIC CODE AND ALL LOCAL CODES.
2. ALL COMPONENTS MUST AGREE WITH THEIR RESPECTIVE POWER SOURCE.
3. VERIFY THE POWER SOURCE AND THE UNIT POLARITY.
4. USE TYPE 105°C REPLACEMENT WIRE 300V OR GREATER.
5. USED ON PROPELLER MODELS 100 AND LARGER.
6. UNIT IS SHIPPED WIRED FOR 115V. WHEN WIRING FOR 230V, CONFIRM HAS DATA #6841 AND MOTOR WIRE LABELS FOR 230V.
7. OPTIONAL UNIT DISCONNECT SWITCH USED ON 115V UNITS ONLY.

CAUTION:  
FAILURE TO WIRE THIS UNIT ACCORDING TO THIS WIRING DIAGRAM MAY RESULT IN DAMAGE TO THE UNIT. CONTACT THE FACTORY FOR DEVIATIONS.

5H080273B1

WIRING DIAGRAM, SINGLE STAGE, RELAY

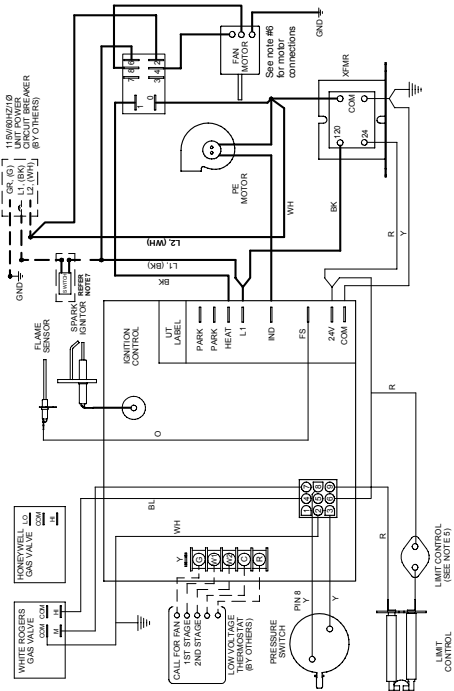


# WIRING DIAGRAMS – MODELS HD/HDB, HDS/HDC, PTS/BTS

WIRING LEGEND
LINE 24V
WIRING COMPONENTS WIRING
WIRE AND

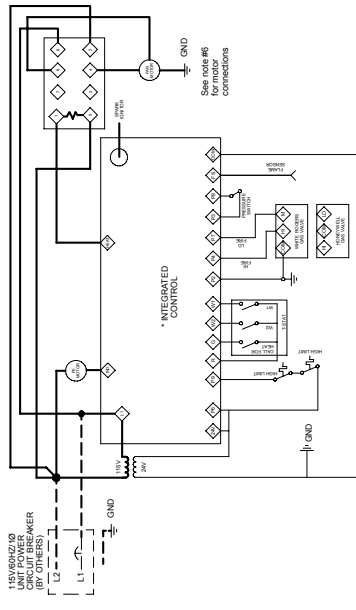
◇ INDICATES REMAINING BOARD CONNECTION

## Factory 115V Unit Power



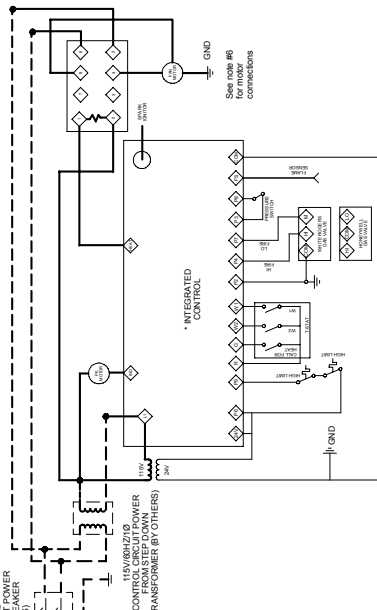
TWO STAGE, DIRECT SPARK IGNITION,  
100% SHUT-OFF, MULTIPLE RETRY W/ AUTO RESET FROM LOCKOUT

## Factory 115V Unit Power



## 230V Fan/Blower Power Only

CONTROL CIRCUIT MUST BE 115V POWER



\*SHOWN WITH UNITED TECHNOLOGIES LABEL. SEE CHART FOR OTHER LABELS

### NOTES TO INSTALLER:

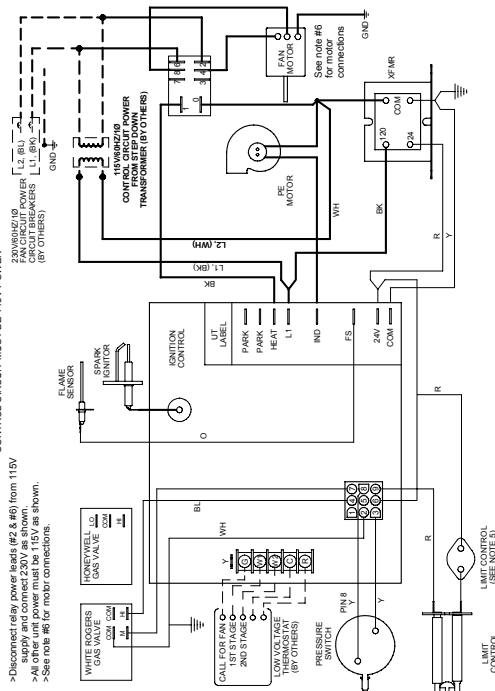
1. ALL WIRING MUST COMPLY WITH NATIONAL ELECTRIC CODE AND ALL LOCAL CODES.
2. ALL COMPONENTS MUST AGREE WITH THEIR RESPECTIVE POWER SOURCE.
3. VERIFY THE POWER SOURCE AND THE UNIT POLARITY.
4. USE TYPE 105°C REPLACEMENT WIRE 300V OR GREATER.
5. USED ON PROPELLER MODELS 100 AND LARGER.
6. UNIT IS SHIPPED WIRED FOR 115V. WHEN WIRING FOR 230V FOLLOW THIS DIAGRAM AND MOTOR WIRE LABELS FOR 230V.
7. OPTIONAL UNIT DISCONNECT SWITCH USED ON 115V UNIT'S ONLY.

## 5H080273B2

WIRING DIAGRAM, TWO STAGE, RELAY

## 230V Fan/Blower Power Only

CONTROL CIRCUIT MUST BE 115V POWER



- > Disconnect fan power leads (#2 & #6) from 115V supply and connect 230V as shown.
- > All other unit power must be 115V as shown.
- > See note #6 for motor connections.

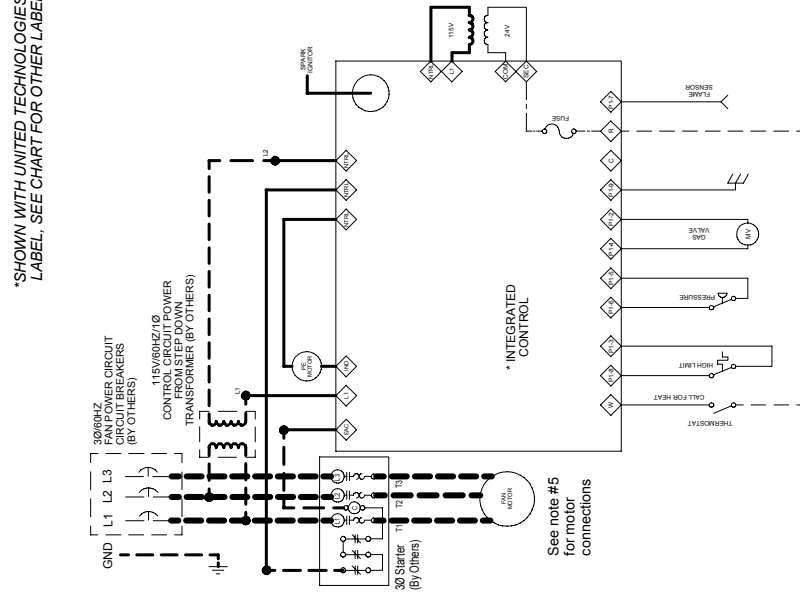
CAUTION: TO WIRE THIS UNIT ACCORDING TO THIS WIRING DIAGRAM MAY RESULT IN INJURY TO THE INSTALLER OR USER. FOR DEVIATIONS CONTACT THE FACTORY.

5H080273B2 REV. 1



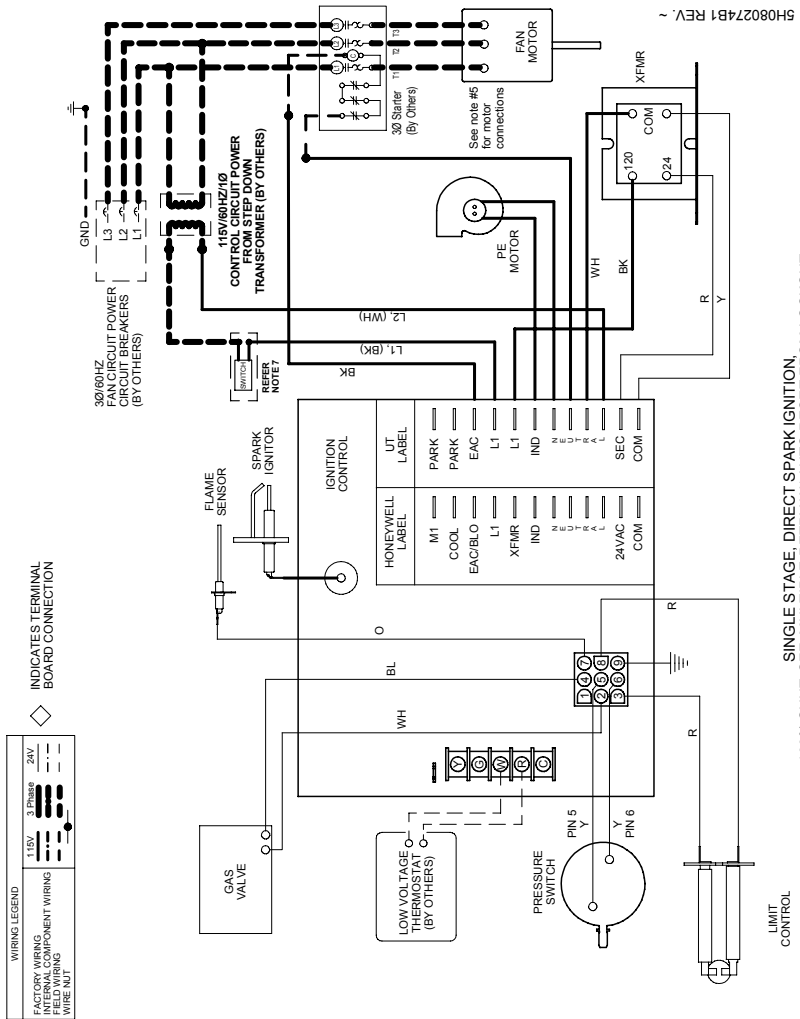
# WIRING DIAGRAMS – MODELS HD/HDB, HDS/HDC, PTS/BTS

\*SHOWN WITH UNITED TECHNOLOGIES LABEL. SEE CHART FOR OTHER LABELS



5H080274B1

WIRING DIAGRAM, SINGLE STAGE, 3 Ø



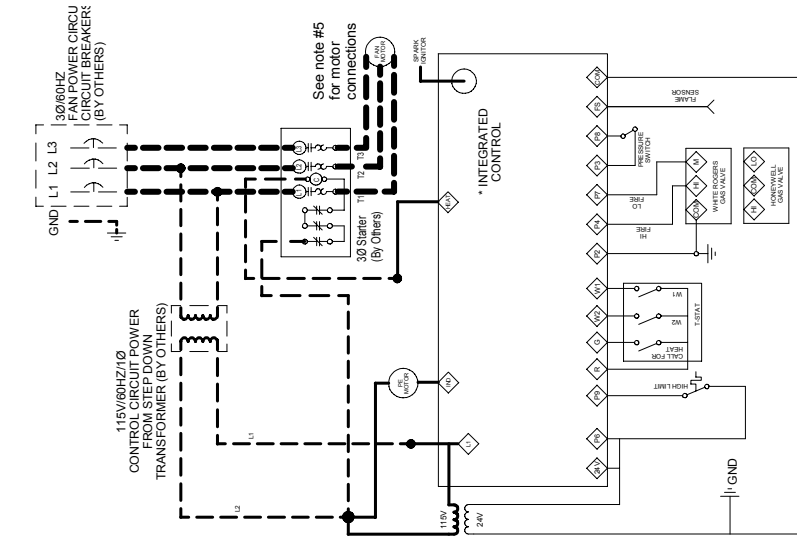
SINGLE STAGE, DIRECT SPARK IGNITION,  
100% SHUT-OFF, MULTIPLE RETRY W/ AUTO RESET FROM LOCKOUT

NOTES TO INSTALLER:

1. ALL WIRING MUST COMPLY WITH NATIONAL ELECTRIC CODE AND ALL LOCAL CODES.
2. ALL COMPONENTS MUST AGREE WITH THEIR RESPECTIVE POWER SOURCE.
3. VERIFY THE POWER SOURCE AND THE UNIT POLARITY.
4. USE TYPE 105°C REPLACEMENT WIRE 300V OR GREATER.
5. MAKE MOTOR CONNECTIONS PER THE MOTOR WIRE DIAGRAM.
6. NA
7. OPTIONAL UNIT DISCONNECT SWITCH.

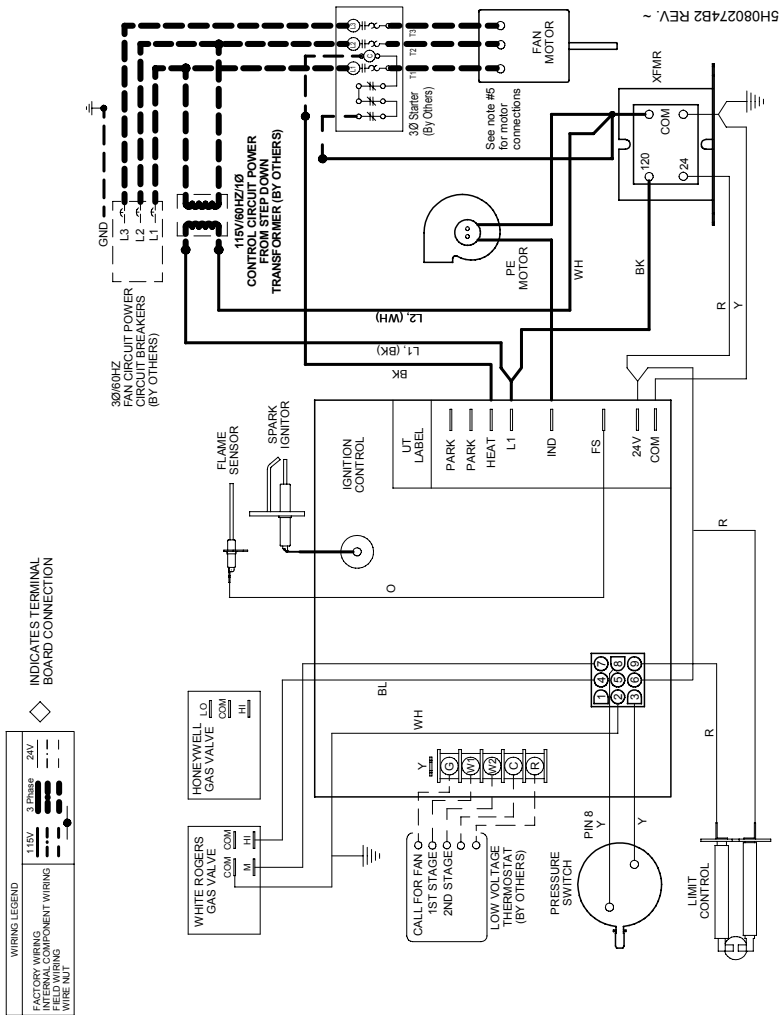
CAUTION:  
FAILURE TO WIRE THIS UNIT ACCORDING TO THIS WIRING DIAGRAM MAY RESULT IN INJURY TO THE INSTALLER OR USER. FOR DEVIATIONS CONTACT THE FACTORY.

# WIRING DIAGRAMS – MODELS HD/HDB, HDS/HDC, PTS/BTS



5H080274B2

WIRING DIAGRAM, TWO STAGE, 3 Ø



TWO STAGE, DIRECT SPARK IGNITION.  
100% SHUT-OFF, MULTIPLE RETRY W/ AUTO RESET FROM LOCKOUT

NOTES TO INSTALLER:

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2. ALL COMPONENTS MUST AGREE WITH THEIR RESPECTIVE POWER SOURCE.
3. VERIFY THE POWER SOURCE AND THE UNIT POLARITY.
4. USE TYPE 105°C REPLACEMENT WIRE 300V OR GREATER.
5. MAKE MOTOR CONNECTIONS PER THE MOTOR WIRE DIAGRAM.

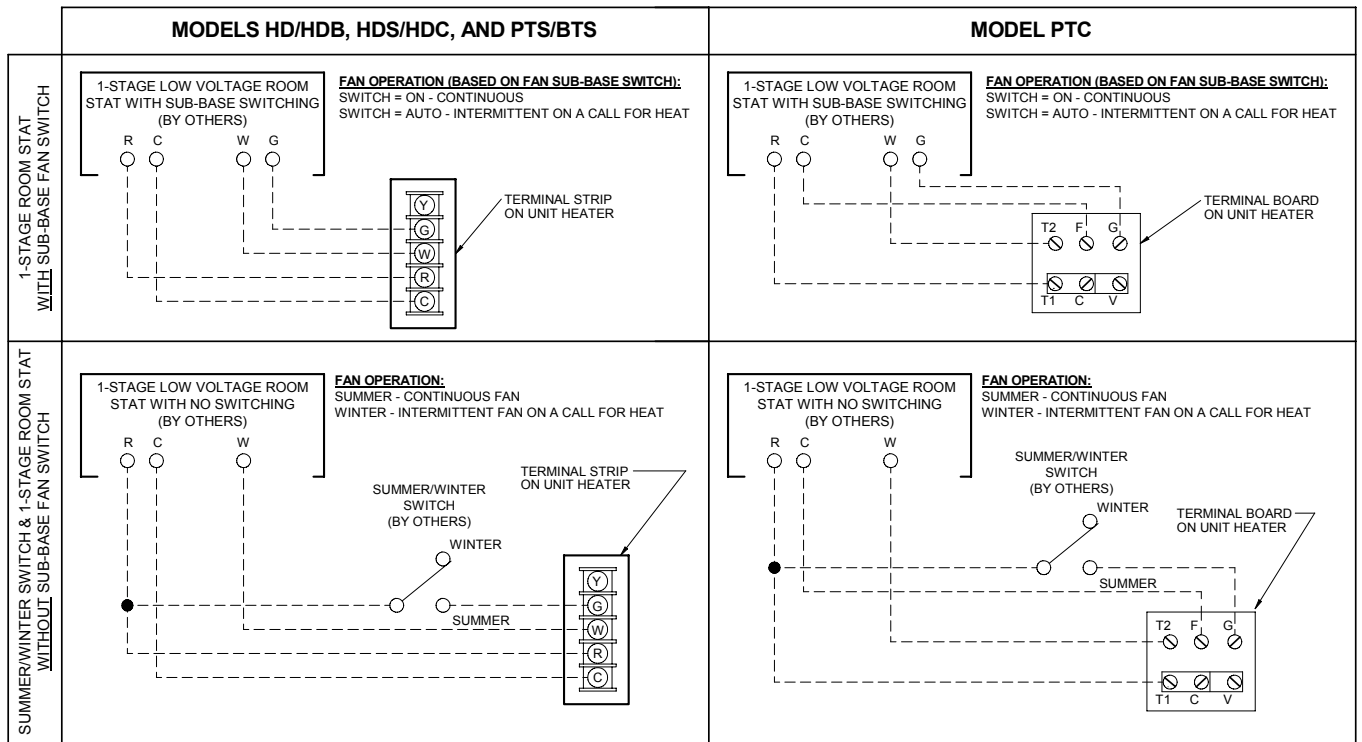
CAUTION: FAILURE TO WIRE THIS UNIT ACCORDING TO THIS WIRING DIAGRAM MAY RESULT IN INJURY TO THE INSTALLER OR USER. FOR DEVIATIONS CONTACT THE FACTORY.



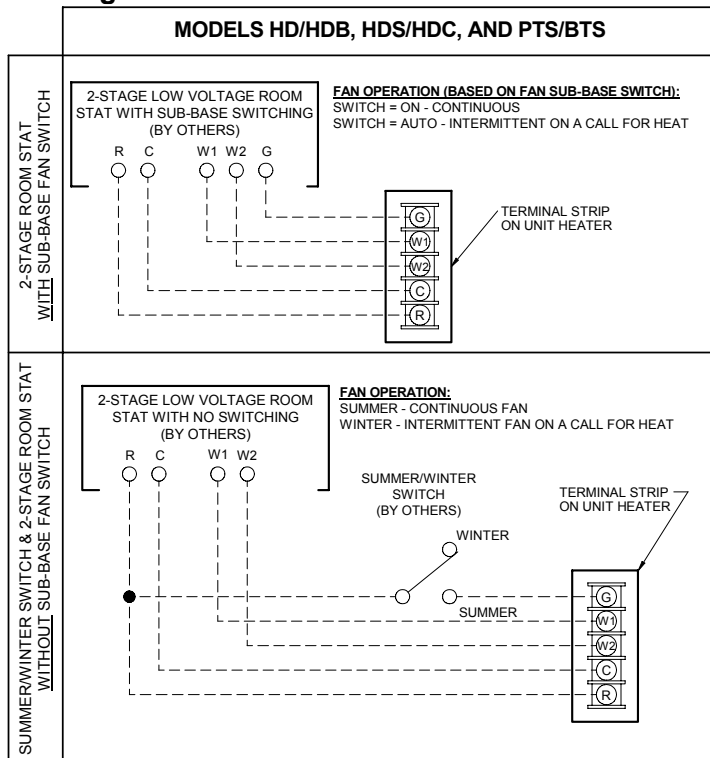


# WIRING DIAGRAMS – THERMOSTAT & SUMMER/WINTER SWITCH

## Single Stage Thermostat & Summer/Winter Switch Wiring



## Two Stage Thermostat & Summer/Winter Switch Wiring



NOTE:  
 GENERIC ROOM STAT TERMINALS SHOWN. ACTUAL STAT MAY USE DIFFERENT TERMINALS AND/OR WIRING. PLEASE CONSULT WIRING INSTRUCTIONS FOR STAT FOR PROPER WIRING.

## Notes on Thermostat and Summer/Winter Switch Wiring:

Units are equipped as standard with a controller that activates the unit fan in either of the following ways:

- On a call for heat (thermostat closure between R & W terminals (W1 for 2-stage units) on the unit heater terminal strip (T1 & T2 on the external terminal board for model PTC units). The control automatically recognizes a call for heat as requiring fan operation.
- With switch closure between R & G terminals on the unit heater terminal strip (T1 & G on the external terminal board for model PTC units). The control recognizes this as an override to the fan control based on a call for heat and starts the fan.

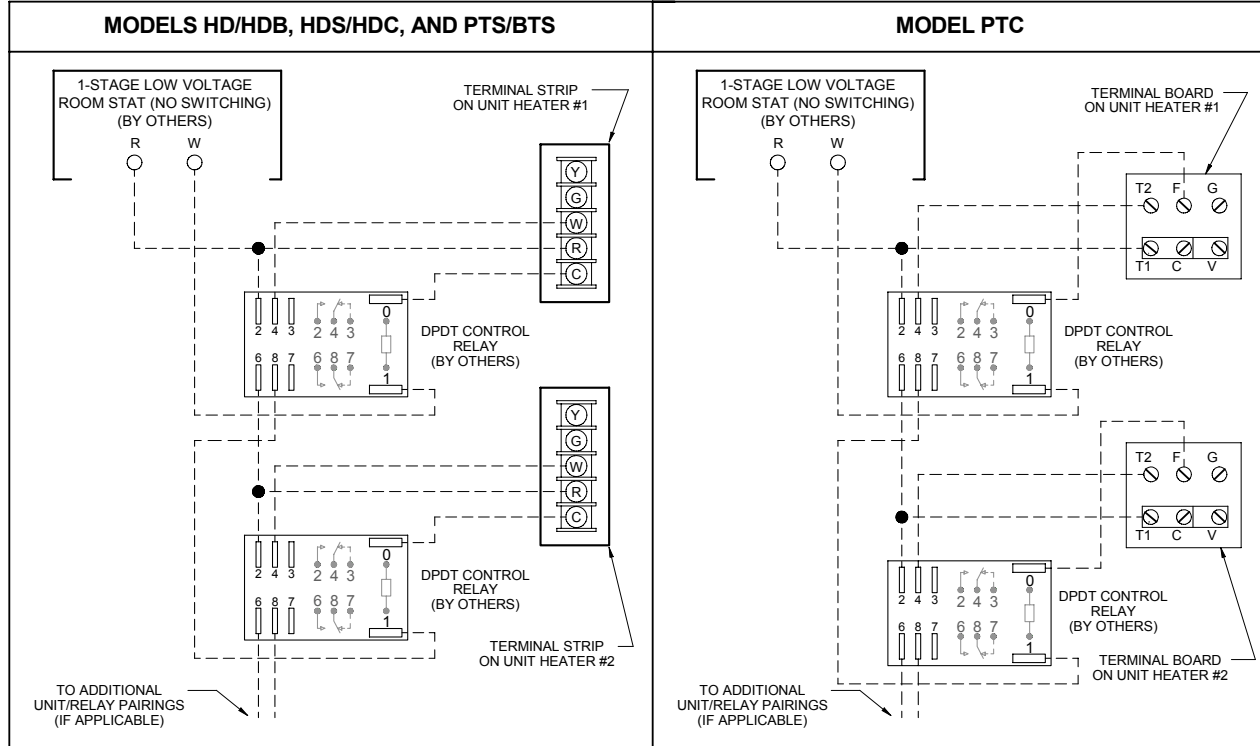
The diagrams on this page are arranged as follows:

1. Single stage thermostat with a Fan On/Auto switch for fan control.
2. Single stage thermostat without a Fan On/Auto switch and a Summer/Winter switch for fan control.
3. Two stage thermostat with a Fan On/Auto switch for fan control.
4. Two stage thermostat without a Fan On/Auto switch and a Summer/Winter switch for fan control.

**Note:** A Summer/Winter switch used on these models does NOT require a control relay as was required on previous models.

# WIRING DIAGRAMS – ACCESSORIES

## Wiring Multiple Single Stage Units to a Single Thermostat

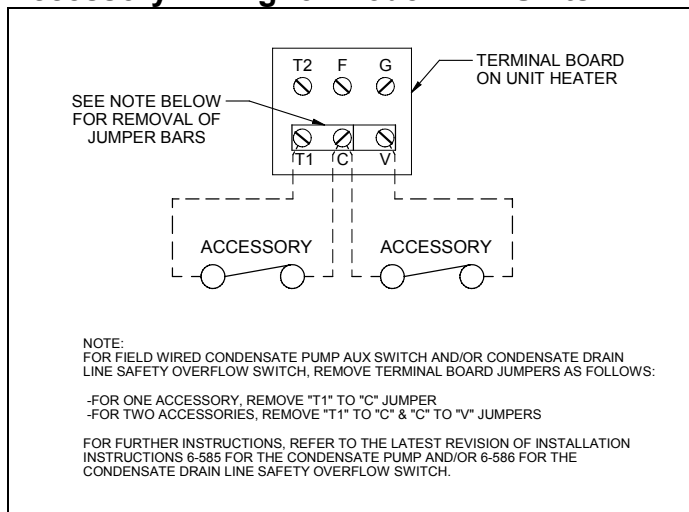


### Notes on Wiring Multiple Single Stage Units to a Single Thermostat

When two or more unit heaters are controlled by one thermostat, it is necessary to electrically isolate each unit by using relays. If relays are not used, feedback in the low voltage circuits can occur. This feedback may cause operational problems, damage the electrical components in the low voltage circuit, or cause burnout of the low voltage transformers.

The figure above shows that the thermostat, powered from the terminal strip of unit heater #1 (UH-1), energizes the relay coil of the first relay (RE-1). When the RE-1 coil is energized, the first set of normally open (NO) contacts of that DPDT relay close and activate the gas controls of UH-1. The second set of normally open (NO) contacts on RE-1 are used to energize the relay coil of the second relay RE-2, powered through the terminal strip of UH-2. The first set of NO contacts on RE-2 close and activate the gas controls of UH-2. If a third unit is to be controlled from the same thermostat, a third relay RE-3 coil is wired to the second set of contacts on RE-2. This procedure is repeated for each additional unit which is to be controlled by the thermostat. Generally, there should be a quantity of DPDT relays that is one less than the quantity of heaters to be controlled.

### Accessory Wiring for Model PTC Units



## COMPETITIVE ADVANTAGE

### sound pressure data models HD, HDS, and PTS



#### Some Notes on Sound Pressure Data

The sound pressure around a piece of equipment depends on a number of variables including building construction materials, size of building, location of equipment, as well as the proximity of the listener to the equipment within the three physical dimensions surrounding the equipment. Manufacturers sometimes indicate the sound pressure level of their products, expressed in dBA, with a lower number indicating a lower sound level. These values should only be used to compare noise levels of similar types of equipment at the same distance and in the same environment. Do not assume that the dBA levels shown in the performance data will in any way be similar to those achieved in practice. Since manufacturers have no idea where their equipment or the listener will be located, they are not in a position to calculate sound pressure levels for most applications. Data presented in this document is for general reference only and in no way constitutes a guarantee of actual performance.

**Table 1.1**  
**Model HD/HDS Sound Pressure Level (dBA) ①**

Model Size	Modine	Competitor ②
	5 ft.	5 ft.
30	53	59
45	57	59
60	59	59
75	58	69

**Table 1.2**  
**Model HD/HDS, PTS Sound Pressure Level (dBA) ①**

Model Size	Modine		Competitor ②	
	10 ft.	15 ft.	10 ft.	15 ft.
100	50	48	58	54
125	58	57	59	55
150	52	50	55	51
175	55	53	55	52
200	53	51	56	53
250	62	60	59	56
300	66	64	62	59
350	69	67	64	61
400	69	67	65	62

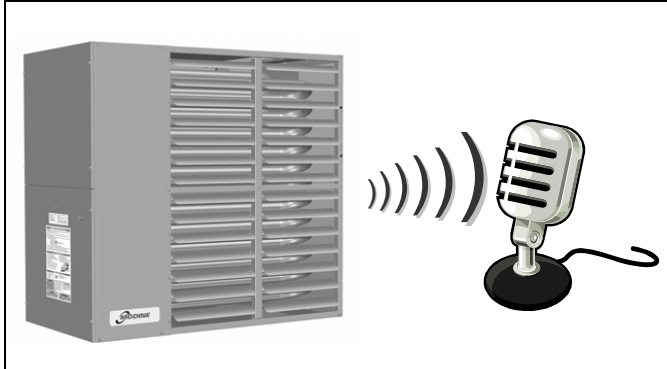
① Measured at distance from unit shown.

② Competitor published data.

Modine Manufacturing Company has a continuous product improvement program,  
and therefore reserves the right to change design and specifications without notice.

## COMPETITIVE ADVANTAGE

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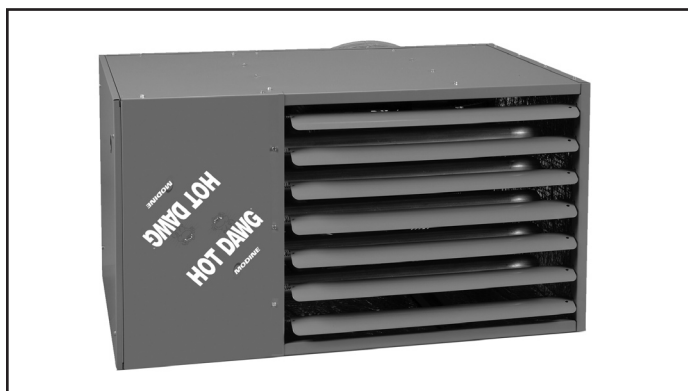
① Measured at distance from unit shown.

② Competitor published data.

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and therefore reserves the right to change design and specifications without notice.



## INSTALLATION AND SERVICE MANUAL gas-fired unit heaters model HD and HDB



All models approved for use in California by the CEC, in New York city by the MEA division, and in Massachusetts. Unit heater is certified for residential and commercial applications.

### FOR YOUR SAFETY

**The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous.**

### ! WARNING

1. Improper installation, adjustment, alteration, service, or maintenance can cause property damage, injury, or death, and could cause exposure to substances which have been determined by various state agencies to cause cancer, birth defects, or other reproductive harm. Read the installation, operating, and maintenance instructions thoroughly before installing or servicing this equipment.
2. Do not locate ANY gas-fired units in areas where chlorinated, halogenated, or acid vapors are present in the atmosphere. These substances can cause premature heat exchanger failure due to corrosion, which can cause property damage, serious injury, or death.

### IMPORTANT

**The use of this manual is specifically intended for a qualified installation and service agency. All installation and service of these units must be performed by a qualified installation and service agency.**

### FOR YOUR SAFETY

#### WHAT TO DO IF YOU SMELL GAS:

1. Open windows.
2. Do not try to light any appliance.
3. Do not touch any electrical switch; do not use any phone in your building.
4. Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you can not reach your gas supplier, call your fire department.

#### Inspection on Arrival

1. Inspect unit upon arrival. In case of damage, report it immediately to the transportation company and your local Modine sales representative.
2. Check rating plate on unit to verify that power supply meets available electric power at the point of installation.
3. Inspect unit upon arrival for conformance with description of product ordered (including specifications where applicable).

#### Table of Contents

Inspection on Arrival . . . . .	1
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# SPECIAL PRECAUTIONS

## SPECIAL PRECAUTIONS

THE INSTALLATION AND MAINTENANCE INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED TO PROVIDE SAFE, EFFICIENT, AND TROUBLE-FREE OPERATION. IN ADDITION, PARTICULAR CARE MUST BE EXERCISED REGARDING THE SPECIAL PRECAUTIONS LISTED BELOW. FAILURE TO PROPERLY ADDRESS THESE CRITICAL AREAS COULD RESULT IN PROPERTY DAMAGE OR LOSS, PERSONAL INJURY, OR DEATH. THESE INSTRUCTIONS SUBJECT TO ANY MORE RESTRICTIVE LOCAL OR NATIONAL CODES.

### HAZARD INTENSITY LEVELS

1. **DANGER:** Indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.
2. **WARNING:** Indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.
3. **CAUTION:** Indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury.
4. **IMPORTANT:** Indicates a situation which, if not avoided, MAY result in a potential safety concern.

## DANGER

Appliances must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.

## WARNING

1. Gas fired heating equipment must be vented - do not operate unvented.
2. A built-in power exhauster is provided - additional external power exhausters are not required or permitted.
3. If you are replacing an existing heater, it may be necessary to resize the venting systems. Improperly sized venting systems can result in vent gas leakage or the formation of condensate. Refer to the National Fuel Gas Code ANSI Z223.1 (NFPA 54) or CSA-B149.1 - latest edition. Failure to follow these instructions can result in injury or death.
4. Under no circumstances should two sections of double wall vent pipe be joined together within one horizontal vent system due to the inability to verify complete seal of inner pipes.
5. All field gas piping must be pressure/leak tested prior to operation. Never use an open flame. Use a soap solution or equivalent for testing.
6. Gas pressure to appliance controls must never exceed 14" W.C. (1/2 psi).
7. To reduce the opportunity for condensation, the minimum sea level input to the appliance, as indicated on the serial plate, must not be less than 5% below the rated input, or 5% below the minimum rated input of dual rated units.
8. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
9. All appliances must be wired strictly in accordance with wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
10. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
11. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than the rated voltage.
12. When servicing or repairing this equipment, use only factory-approved service replacement parts. A complete replacements parts list may be obtained by contacting the factory. Refer to the rating plate on the appliance for complete appliance model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at the owners risk.

## CAUTION

1. All literature shipped with this unit should be kept for future use for servicing or service diagnostics. Do not discard any literature shipped with this unit.
2. Consult piping, electrical, and venting instructions in this manual before final installation.
3. Do not attach ductwork, air filters, or polytubes to any propeller unit heater.
4. Clearances to combustible materials are critical. Be sure to follow all listed requirements.
5. Do not locate units in tightly sealed rooms or small compartments (commonly referred to as confined spaces) without provisions for adequate combustion air and venting. Combustion air must have access to the confined space through a minimum of two permanent openings in the enclosure, at least one near the bottom. They should provide a free area of one square inch per 1,000 BTU/Hr input rating of the unit with a minimum of 100 square inches for each opening, whichever is greater.
6. Low profile heaters are designed for use in heating applications with ambient temperatures between -40°F and 90°F.
7. Do not install unit outdoors.
8. In garages or other sections of aircraft hangars, such as offices and shops that communicate with areas used for servicing or storage, keep the bottom of the unit at least 7' above the floor unless the unit is properly guarded to provide user protection from moving parts. In parking garages, the unit must be installed in accordance with the standard for parking structures ANSI/NFPA 88A, and in repair garages the standard for repair garages NFPA #88B. In Canada, installation of heaters in airplane hangars must be in accordance with the requirements of the enforcing authority, and in public garages in accordance with the current CSA-B149 codes.
9. In aircraft hangars, keep the bottom of the unit at least 10' from the highest surface of the wings or engine enclosure of the highest aircraft housed in the hangars and in accordance with the requirements of the enforcing authority and/or NFPA 409 - latest edition.
10. Installation of units in high humidity or salt water atmospheres will cause accelerated corrosion resulting in a reduction of the normal life of the units.
11. Do not install units below 7' measured from the bottom of the unit to the floor in commercial applications (unless unit is properly guarded to provide user protection from moving parts) and 5' measured from the bottom of the unit to the floor in residential applications.
12. Be sure no obstructions block air intake and discharge of unit heaters.
13. The minimum distance from combustible material is based on the combustible material surface not exceeding 160°F. Clearance from the top of the unit may be required to be greater than the minimum specified if heat damage, other than fire, may occur to materials above the unit heater at the temperature described.
14. Allow 18" of clearance at rear (or 6" beyond end of motor at rear of unit, whichever is greater) and access side to provide ample air for combustion and proper operation of fan.
15. Installation must conform with local building codes or in the absence of local codes, with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) - latest edition. In Canada, installation must be in accordance with CSA-B149.1.
16. Purging of air from gas supply line should be performed as described in the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) - latest edition. In Canada, installation must be in accordance with CSA-B149.1.

# SPECIAL PRECAUTIONS / SI (METRIC) CONVERSION FACTORS

## ⚠ CAUTION

17. When leak testing the gas supply piping system, the appliance and its combination gas control must be isolated during any pressure testing in excess of 14" W.C. (1/2 psi).
18. The unit should be isolated from the gas supply piping system by closing its field installed manual shut-off valve. This manual shut-off valve should be located within 6' of the heater.
19. Turn off all gas before installing appliance.
20. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is less than 5% below the rated voltage.
21. Check the gas inlet pressure at the unit upstream of the combination gas control. The inlet pressure should be 6-7" W.C. on natural gas or 12-14" W.C. on propane. If inlet pressure is too high, install an additional pressure regulator upstream of the combination gas control.
22. Service or repair of this equipment must be performed by a qualified service agency.
23. Do not attempt to reuse any mechanical or electronic ignition controllers which has been wet. Replace defective controller.

## IMPORTANT

1. To prevent premature heat exchanger failure, do not locate ANY gas-fired appliances in areas where corrosive vapors (i.e. chlorinated, halogenated, or acidic) are present in the atmosphere.
2. To prevent premature heat exchanger failure, the input to the appliance as indicated on the serial plate must not exceed the rated input by more than 5%.
3. To check most of the Possible Remedies in the troubleshooting guide listed in Table 17.1 refer to the applicable sections of the manual.

## SI (METRIC) CONVERSION FACTORS

To Convert	Multiply By	To Obtain
"W.C.	0.249	kPa
°F	$(°F-32) \times 5/9$	°C
Btu	1.06	kJ
Btu/ft <sup>3</sup>	37.3	kJ/m <sup>3</sup>
Btu/hr	0.000293	kW
CFH (ft <sup>3</sup> /hr)	0.000472	m <sup>3</sup> /min
CFH (ft <sup>3</sup> /hr)	0.00000787	m <sup>3</sup> /s
CFM (ft <sup>3</sup> /min)	0.0283	m <sup>3</sup> /min
CFM (ft <sup>3</sup> /min)	0.000472	m <sup>3</sup> /s

To Convert	Multiply By	To Obtain
feet	0.305	m
Gal/Hr.	0.00379	m <sup>3</sup> /hr
Gal/Hr.	3.79	l/hr
gallons	3.79	l
Horsepower	746	W
inches	25.4	mm
pound	0.454	kg
psig	6.89	kPa
psig	27.7	"W.C.

## BEFORE YOU BEGIN

## ⚠ CAUTION

1. All literature shipped with this unit should be kept for future use for servicing or service diagnostics. Leave manual with the owner. Do not discard any literature shipped with this unit.
2. Consult piping, electrical, and venting instructions in this manual before final installation.
3. Do not attach ductwork, air filters, or polytubes to any propeller unit heater.

In the U.S., the installation of these units must comply with the National Fuel Gas Code, ANSI Z223.1 - latest edition (also known as NFPA 54) and other applicable local building codes. In Canada, the installation of these units must comply with local plumbing or waste water codes and other applicable codes and with the current code CSA-B149.1.

1. All installation and service of these units must be performed by a qualified installation and service agency only as defined in ANSI Z223.1 (NFPA 54) - latest edition, or in Canada by a licensed gas fitter.
2. This unit is certified with the controls furnished. For replacements parts, please order according to the replacement parts list on serial plate. Always know your model and serial numbers. Modine reserves the right to substitute other authorized controls as replacements.
3. Unit is balanced for correct performance. Do not alter fan or operate motors at reduced speed.
4. Information on controls is supplied separately.
5. The same burner is used for natural and propane gas.

# UNIT LOCATION

## UNIT LOCATION



### DANGER

Appliances must not be installed where they may be exposed to a potentially explosive or flammable atmosphere.



### CAUTION

1. Clearances to combustible materials are critical. Be sure to follow all listed requirements.
2. Do not locate units in tightly sealed rooms or small compartments (commonly referred to as confined spaces) without provisions for adequate combustion air and venting. Combustion air must have access to the confined space through a minimum of two permanent openings in the enclosure, at least one near the bottom. They should provide a free area of one square inch per 1,000 BTU/Hr input rating of the unit with a minimum of 100 square inches for each opening, whichever is greater.
3. Low profile heaters are designed for use in heating applications with ambient temperatures between -40°F and 90°F.
4. Do not install unit outdoors.
5. In garages or other sections of aircraft hangars such as offices and shops that communicate with areas used for servicing or storage, keep the bottom of the unit at least 7' above the floor unless the unit is properly guarded. In parking garages, the unit must be installed in accordance with the standard for parking structures ANSI/NFPA 88A, and in repair garages the standard for repair garages NFPA #88B. In Canada, installation of heaters in airplane hangars must be in accordance with the requirements of the enforcing authority, and in public garages in accordance with the current CSA-B149 codes.
6. In aircraft hangars, keep the bottom of the unit at least 10' from the highest surface of the wings or engine enclosure of the highest aircraft housed in the hangars and in accordance with the requirements of the enforcing authority and/or NFPA 409 - latest edition.
7. Installation of units in high humidity or salt water atmospheres will cause accelerated corrosion resulting in a reduction of the normal life of the units.

### IMPORTANT

To prevent premature heat exchanger failure, do not locate ANY gas-fired appliances in areas where corrosive vapors (i.e. chlorinated, halogenated or acid) are present in the atmosphere.

#### Location Recommendations

1. When locating the heater, consider general space and heating requirements, availability of gas and electrical supply, and proximity to vent locations.
2. When locating units, it is important to consider that the exhaust vent piping must be connected to the outside atmosphere.
3. Be sure the structural support at the unit location site is adequate to support the unit's weight. For proper operation the unit must be installed in a level horizontal position.
4. Do not install units in locations where the flue products can be drawn into the adjacent building openings such as windows, fresh air intakes, etc.
5. Be sure that the minimum clearances to combustible materials and recommended service clearances are maintained. Units are designed for installation with the minimum clearances as shown in Table 4.1.

Table 4.1 Clearances

Unit Side	Clearance To Combustible Materials	Recommended Service Clearance
Top and Bottom	1"	1"
Access Side	18"	18"
Non-Access Side	1"	1"
Rear	18"	18"
Vent Connector	4"	4"

6. Do not install units in locations where the gas ignition system is exposed to water spray, rain, or dripping water.
7. Mounting Height (measured from bottom of unit) at which unit heaters are installed is critical. Refer to mounting height and heat throw data on page 15 of this manual. The maximum mounting height for any unit is that height above which the unit will not deliver heated air to the floor.

#### Combustion Air Requirements

The National Fuel Gas Code defines an "unconfined space" as a space whose volume is greater than 50 cubic feet per 1,000 Btu/Hr input of the installed appliance(s). A confined space is 50 cubic feet or less per 1,000 Btu/Hr input of the installed appliance(s).

It is not recommended to install these unit heaters into residential confined spaces. This recommendation is due to the concern that at some point in time, the combustion air openings provided by the installer may become blocked or eliminated by the owner, either intentionally or unintentionally. Despite this recommendation, if these units are installed into a residential confined space, see National Fuel Gas Code ANSI Z223.1 (NFPA 54) or CSA-B149.1 Installation Code - latest edition, for detailed combustion air provisions. The installation must adhere to these requirements.

Units installed in confined spaces in industrial/commercial installations must be provided with two permanent openings - one near the top and one near the bottom of the confined space. Each opening should have a free area of not less than one square inch per 1,000 Btu/Hr of the total input rating of all units in the confined space, freely communicating with interior areas that have adequate infiltration from the outside.

For further details on supplying combustion air to a confined (tightly sealed) space or unconfined space, see the National Fuel Gas Code ANSI Z223.1 (NFPA 54) or CSA-B149.1 Installation Code - latest edition.

#### Turning The Unit 180° (Model Sizes 30-75 Only)

All units are produced at the factory with left-side controls (when looking at the unit). If the installation requires the controls to be on the right side, all heaters - with the exception of the HD/HDB 100 and 125 - can be turned over by following the instructions below.

- By turning the unit 180° from the way it was received from the factory, the sides become opposite, but the front and back remain in the same relative position. The bottom panel now becomes the top panel and vice-versa.
- Remove the access panel, turn it 180°, and re-attach it to the unit so that all the information labels can be read.
- Remove the spring loaded deflector blades, turn them over, replace, and adjust so they are open and in a position to direct the heated air down to the floor.

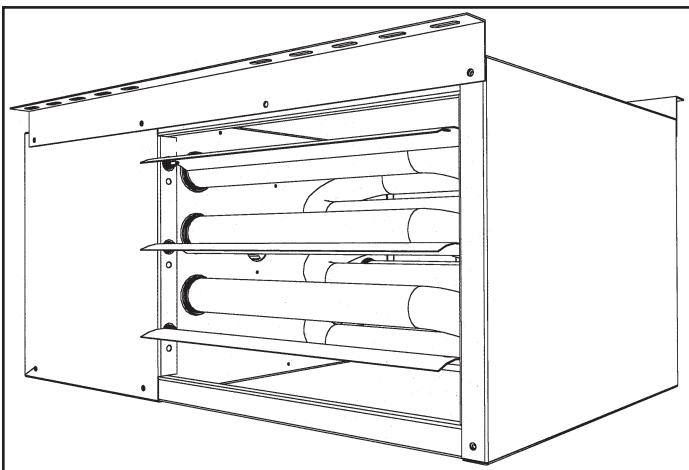
# UNIT MOUNTING

## ⚠ CAUTION

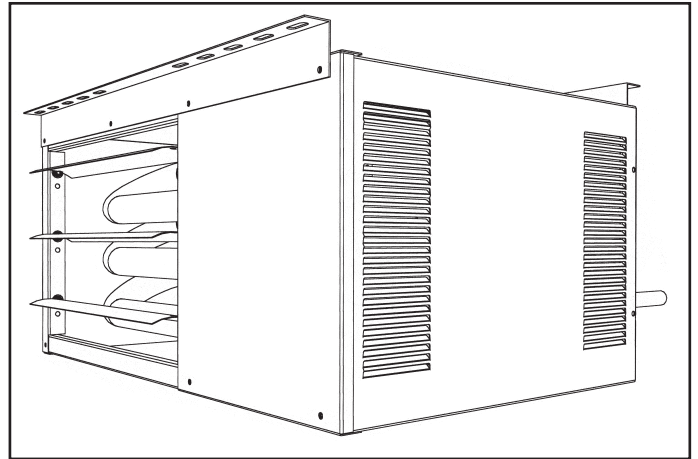
1. Do not install units below 7' measured from the bottom of the unit to the floor in commercial applications (unless unit is properly guarded to provide user protection from moving parts) and 5' measured from the bottom of the unit to the floor in residential applications.
2. Be sure no obstructions block air intake and discharge of unit heaters.
3. The minimum distance from combustible material is based on the combustible material surface not exceeding 160°F. Clearance from the top of the unit may be required to be greater than the minimum specified if heat damage, other than fire, may occur to materials above the unit heater at the temperature described.
4. Allow 18" clearance at rear (or 6" beyond end of motor at rear of unit, whichever is greater) and access side to provide ample air for combustion and proper operation of fan.

1. Be sure the means of suspension is adequate to support the weight of the unit (see page 16 for unit weights).
2. For proper operation, the unit must be installed in a level horizontal position.
3. Clearances to combustibles as previously specified must be strictly maintained.
4. For model sizes 30-75, before lifting the heater for suspension, the mounting brackets must be installed as follows (for bracket accessory installation on model sizes 100-125, see the latest revision of literature 6-594):
  - For standard (left side) control access, remove the (3) screws and mounting bracket along the top edge of both the front and back of the unit. Install the front bracket as shown in Figure 5.1 by aligning the screw holes on the bracket with the screw holes on the top edge of the unit. Repeat for the bracket on the back of the unit.
  - For right side control access, remove the (3) screws and mounting bracket along the top edge of both the front and back of the unit. Turn the unit over and install the front bracket as shown in Figure 5.2 by aligning the screw holes on the bracket with the screw holes on the top edge of the unit (originally the bottom edge). Repeat for the bracket on the back of the unit.
- 5a. **Suspension by screws/lag bolts:** Secure the mounting brackets to the ceiling joists or truss, using 1/4" screws with 1/2" washers. These unit mounting brackets are slotted to accommodate joists on 16" or 24" centerlines.

**Figure 5.1 - Unit Heater in Standard Mounting Configuration (30-75 Units Only)**

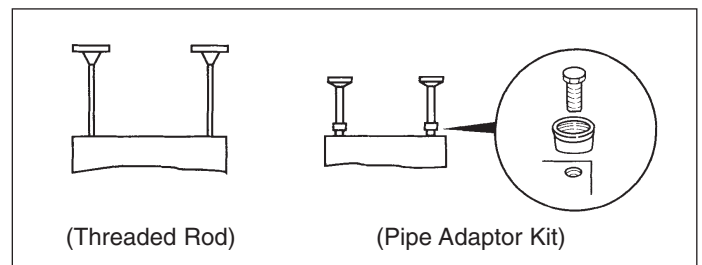


**Figure 5.2  
Unit Heater Turned 180° (30-75 units only)  
(Access panel and heated air outlet change sides)**



- 5b. **Suspension by threaded rod:** The unit can also be hung with threaded rod utilizing the same mounting brackets. Attach the threaded rod to the unit mounting brackets, securing with a top and bottom nut. For model sizes 100-125, the units are designed to be suspended by threaded rod without the use of brackets. On each piece of 3/8" threaded rod used, screw a nut a distance of about one inch onto the end of the threaded rods that will be screwed into the unit heater. Place a washer over the end of the threaded rod and screw the threaded rod into the unit heater weld nuts on the top of the heater at least 5 turns, and no more than 10 turns. Tighten the nut first installed onto the threaded rod to prevent the rod from turning.  
Next, drill holes into a steel channel or angle iron at the same centerline dimensions as those chosen for the heater being installed. The steel channels or angle iron pieces need to span and be fastened to appropriate structural members. Cut the threaded rods to the preferred length, push them through the holes in the steel channel or angle iron and secure with washers and lock nuts, lock washers and nuts, or a washer with double nut arrangement.  
**NOTE:** A pipe hanger adapter kit, shown in Figure 5.3, is available as an accessory. One kit consists of two drilled 3/4" IPS pipe caps and two 3/8 - 13 x 1-3/4" capscrews to facilitate threaded pipe suspension. Two kits would be required to install one unit.
- 5c. **Shelf mounted units:** The unit heater can also be installed on a shelf. The mounting brackets will need to be attached to the heater the same manner as explained in note #4, however, to mount on a shelf the brackets must go on the bottom of the heater. The brackets must be affixed to the shelf using similar screws (1/4" screw with 1/2" washer) as overhead joist or truss mounting. Be sure all clearance to combustible requirements are met.

**Figure 5.3 - Unit Heater Suspension Methods**



# INSTALLATION - VENTING

## ⚠ WARNING

1. Gas fired heating equipment must be vented - do not operate unvented.
2. A built-in power exhauster is provided - additional external power exhausters are not required or permitted.
3. If you are replacing an existing heater, it may be necessary to resize the venting systems. Improperly sized venting systems can result in vent gas leakage or the formation of condensate. Refer to the National Fuel Gas Code ANSI Z223.1 (NFPA 54) or CSA-B149.1 Installation Code - latest edition. Failure to follow these instructions can result in serious injury or death.
4. Under no circumstances should two sections of double wall vent pipe be joined together within one horizontal vent system due to the inability to verify complete seal of inner pipes.

## ⚠ CAUTION

Installation must conform with local building codes or in the absence of local codes, with Part 7, Venting of Equipment, of the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) - latest edition. In Canada, installation must be in accordance with CSA B149.1.

Model HD/HDB unit heaters must be vented with the proper passageway as described in these instructions to convey flue gases from the unit or the vent connector to the outside atmosphere.

The venting instructions are organized in sections, based on installation type. The sections are identified as follows:

Instructions Section	Applicable Installation Instructions by Vent System Type
A	General instructions for <b>ALL</b> installations
B	<b>VERTICAL Category I</b> vent systems ①
C	<b>HORIZONTAL Category III</b> vent systems ①

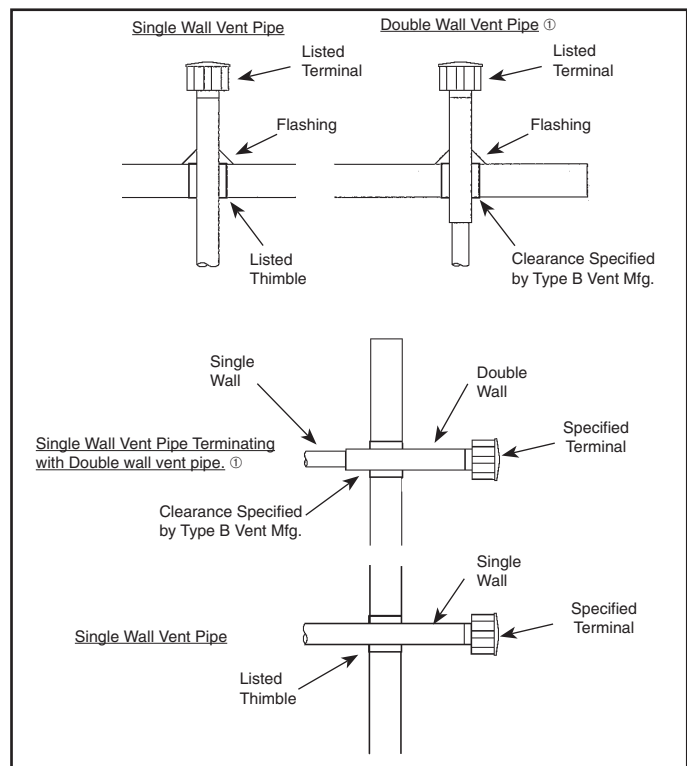
① The difference between Vertical Category I and Horizontal Category III will be identified in "Section A - General Instructions - All Units".

### Section A – General Instructions – All Units

- A1. If the unit heater being installed is replacing existing equipment and using the existing vent system from that equipment, inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code ANSI Z223.1 (NFPA 54) or CSA-B149.1 Installation Code - latest edition and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- A2. The vent pipe should be galvanized steel or other suitable corrosion resistant material (except for Horizontal Category III vent systems, which will be covered in "Section C – Horizontal, Category III Vent System Installation"). Follow the National Fuel Gas Code for minimum thickness of vent material. The minimum thickness for connectors varies depending on the pipe diameter. Do not vent unit with PVC or other forms of plastic venting material.
- A3. All heaters come with a factory installed vent adapter for attaching the vent pipe to the heater (3" for model sizes 30-75, 4" for model sizes 100-125). Attach the vent pipe to the adapter with 3 non-corrosive screws. (Drill pilot holes through the vent pipe and adapter prior to screwing in place).

- A4. A minimum of 12" straight pipe is recommended from the flue outlet before turns in the vent pipe.
- A5. Horizontal sections of vent pipe are to be installed with a minimum downward slope from the appliance of 1/4 inch per foot and suspended securely from overhead structures at points not greater than 3' apart.
- A6. Fasten individual lengths of vent together with at least three corrosion resistant sheet metal screws.
- A7. Keep single wall vent pipe at least 6" from combustible materials. For double wall vent pipe, follow the vent pipe manufacturer's clearances to combustibles. The minimum distance from combustible materials is based on the combustible material surface not exceeding 160°F. Clearance from the vent pipe (or the top of the unit) may be required to be greater than 6" if heat damage other than fire could result (such as material distortion or discoloration).
- A8. Avoid venting through unheated space when possible. When venting does pass through an unheated space or if the unit is installed in an environment that promotes condensation, insulate runs greater than 5' to minimize condensation. Inspect for leakage prior to insulating and use insulation that is noncombustible with a rating of not less than 400°F. Install a tee fitting at the low point of the vent system and provide a drip leg with a clean out cap as shown in Figure 8.1.
- A9. When the vent passes through a combustible INTERIOR wall or floor, a metal thimble 4" greater than the vent diameter is necessary. If there is 6' or more of vent pipe in the open space between the appliance and where the vent pipe passes through the wall or floor, the thimble need only be 2" greater than the diameter of the vent pipe. If a thimble is not used, all combustible material must be cut away to provide 6" of clearance. Where authorities have jurisdiction, type B vent may be used for the last section of vent pipe to maintain clearance to combustibles while passing through wall or floor. See Figure 6.1. Any material used to close the opening must be noncombustible.

**Figure 6.1**  
**Venting Through Combustible Roof or Wall**



① See Instruction A10 for attaching single wall pipe to double wall pipe

# INSTALLATION - VENTING

A10. The following are General Instructions for Double Wall (type B) Terminal Pipe Installation:

**How to attach a single wall vent terminal to double wall (type B) vent pipe:**

1. Look for the “flow” arrow on the vent pipe.
2. Slide the vent terminal inside the exhaust end of the double wall vent pipe.
3. Drill (3) holes through the pipe and the vent terminal. Using 3/4" long sheet metal screws, attach the cap to the pipe. Do not over tighten.

**How to connect a single wall vent system to double wall (type B) vent pipe:**

1. Slide the single wall pipe inside the inner wall of the double wall pipe.
2. Drill (3) holes through both walls of the single and double wall vent pipes. Using 3/4" sheet metal screws, attach the two pieces of pipe. Do not over tighten.
3. The gap between the single and double wall pipe must be sealed, but it is not necessary to fill the full volume of the annular area. To seal, run a large bead of 400°F silastic around the gap.

A11. Vent termination clearances must be maintained:

**Table 7.1 - Vent Termination Clearances**

Structure	Minimum Clearances for Vent Terminal Location
Forced air inlet within 10 feet	3 feet above
Combustion air inlet of another appliance	6 feet all directions
Door, window, gravity air inlet, or any building opening	4 feet horizontal and below 1 foot above
Electric meter, gas meter, gas regulator, and relief equipment ① Gas regulator ①	4 feet horizontal (U.S.) 6 feet horizontal (Canada) 3 feet horizontal (U.S.) 6 feet horizontal (Canada)
Adjoining building or parapet wall	6 feet all directions
Adjacent public walkways	7 feet all directions
Grade (ground level)	3 feet above ②

① Do not terminate the vent directly above a gas meter or regulator.

② The vent must be at least 6" higher than anticipated snow depth.

A12. Do NOT use dampers or other devices in the vent or combustion air pipes.

A13. Precautions must be taken to prevent degradation of building materials by flue products.

A14. Single wall vent pipe must not pass through any unoccupied attic, inside wall, concealed space, or floor.

A15. Uninsulated single wall vent pipe must not be used outdoors for venting appliances in regions where the 99% winter design temperature is below 32°F.

A16. In addition to following these General Instructions, specific instructions for Vertical Category I or Horizontal Category III vent systems must also be followed. Table 7.2 outlines the differences:

**Table 7.2 - ANSI Unit Heater Venting Requirements**

Category	Description	Venting Requirements
I	Negative vent pressure Non-condensing	Follow standard venting requirements.
II	Negative vent pressure Condensing	Condensate must be drained.
III	Positive vent pressure Non-condensing	Vent must be gas tight.
IV	Positive vent pressure Condensing	Vent must be liquid and gastight. Condensate must be drained.

Note: Vent connectors serving Category I appliances shall not be connected into any portion of mechanical draft systems operating under positive pressure.

**Vertical Category I Vent System Determination**

- Vertical vent systems terminate vertically (up).
- The horizontal portion of the vent run cannot exceed 75% of the vertical rise (Example: If the vent height is 10 feet, the horizontal portion of the vent system cannot exceed 7.5 feet).
- The vent terminates a minimum of 5' above the vent connector on the unit.
- If the vent system to be installed meets ALL these criteria (an example is shown in Figure 9.1), proceed to “Section B – Vertical Vent System Installation”. For all other cases, proceed to the next section for Horizontal Category III Vent System Determination:

**Horizontal Category III Vent System Determination**

- Horizontal vent systems terminate horizontally (sideways).
- A vent system that terminates vertically but has a horizontal run that exceeds 75% of the vertical rise is considered horizontal.

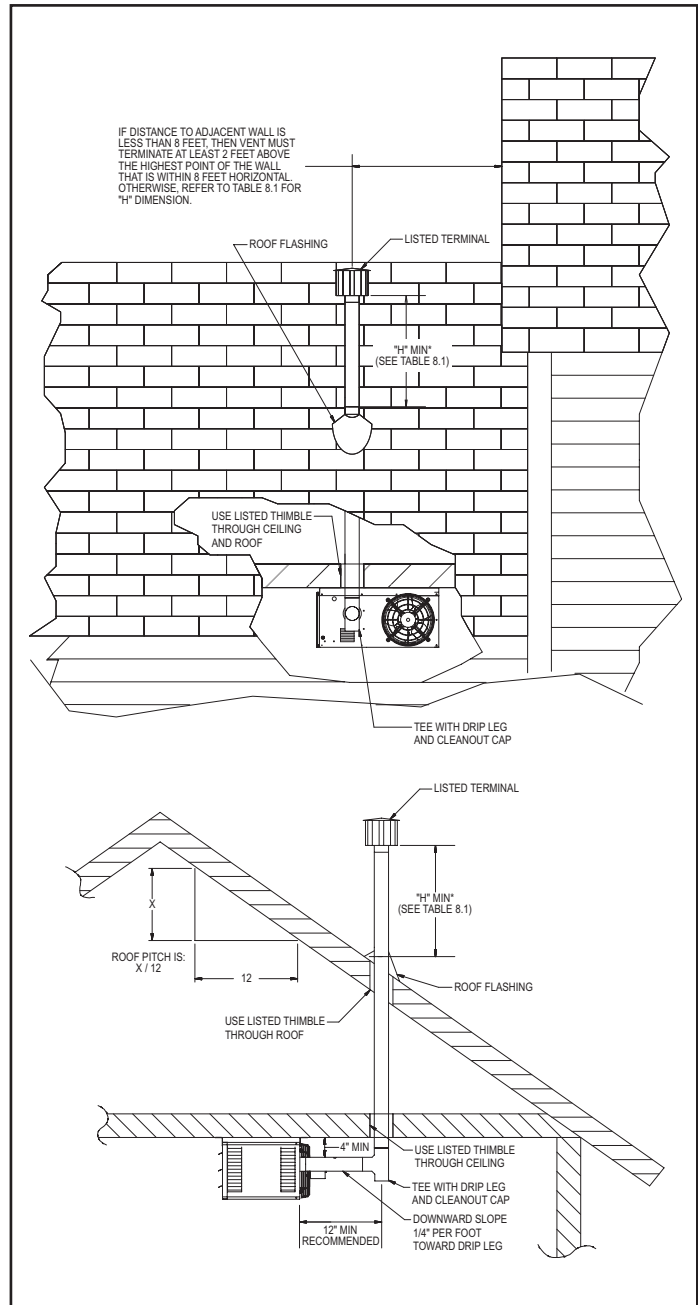
Horizontal vent configurations are Category III. For residential installations, this requires the use of an agency approved (UL1738) Category III vent system. Additional requirements, including those for commercial and industrial installations are covered in “Section C – Horizontal, Category III Vent System Installation”.

# INSTALLATION - VENTING

## Section B – Vertical Vent System Installation

- B1. This section applies to vertically vented Category I vent systems and is in addition to “Section A – General Instructions – All Units”.
- B2. Vertical vent systems terminate vertically.
- B3. The horizontal portion of the vent run cannot exceed 75% of the vertical rise (Example: If the vent height is 10 feet, the horizontal portion of the vent system cannot exceed 7.5 feet).
- B4. It is recommended to install a tee with drip leg and clean out cap as shown in Figure 8.1.
- B5. The vent terminates a minimum of 5' above the vent connector on the unit.
- B6. All vertically vented heaters that are Category I must be connected to a chimney or vent complying with a recognized standard, or a lined masonry (or concrete) chimney with a material acceptable to the authority having jurisdiction. Venting into an unlined masonry chimney is not permitted. Refer to the National Fuel Gas Code for common venting and pages 11-12 of this manual.
- B7. Use a listed vent terminal to reduce down drafts and moisture in the vent.
- B8. Double wall vent pipe is recommended, although single wall can be used if the requirements of the National Fuel Gas Code are followed.
- B9. Vertical vents must terminate a minimum horizontal and vertical distance from roof lines and adjacent walls or obstructions. These minimum distances are outlined as follows (based on National Fuel Gas Code requirements for vents with diameters less than 12”):
- For **double wall** vent pipe and **8' or greater** horizontal distance to any vertical wall or similar obstruction, the vent must terminate above the roof in accordance with Figure 8.1 and Table 8.1.
  - For **double wall** vent pipe and **less than 8'** horizontal distance to any vertical wall or similar obstruction, the vent must terminate at least 2' above the highest point where it passes through a roof of a building and at least 2' higher than any portion of a building within a horizontal distance of 10'. See Figure 8.1.

**Figure 8.1 - Vertical Vent Termination for Double Wall Vent Pipe and Greater Than or Less Than 8' Horizontally From a Vertical Wall or Obstruction**



**Table 8.1 - Minimum Height from Roof to Lowest Discharge Opening**

Rise X (in)	Roof Pitch	Min Height H (ft) ①
0-6	Flat to 6/12	1.00
6-7	6/12 to 7/12	1.25
7-8	7/12 to 8/12	1.50
8-9	8/12 to 9/12	2.00
9-10	9/12 to 10/12	2.50
10-11	10/12 to 11/12	3.25
11-12	11/12 to 12/12	4.00
12-14	12/12 to 14/12	5.00
14-16	14/12 to 16/12	6.00
16-18	16/12 to 18/12	7.00
18-20	18/12 to 20/12	7.50
20-21	20/12 to 21/12	8.00

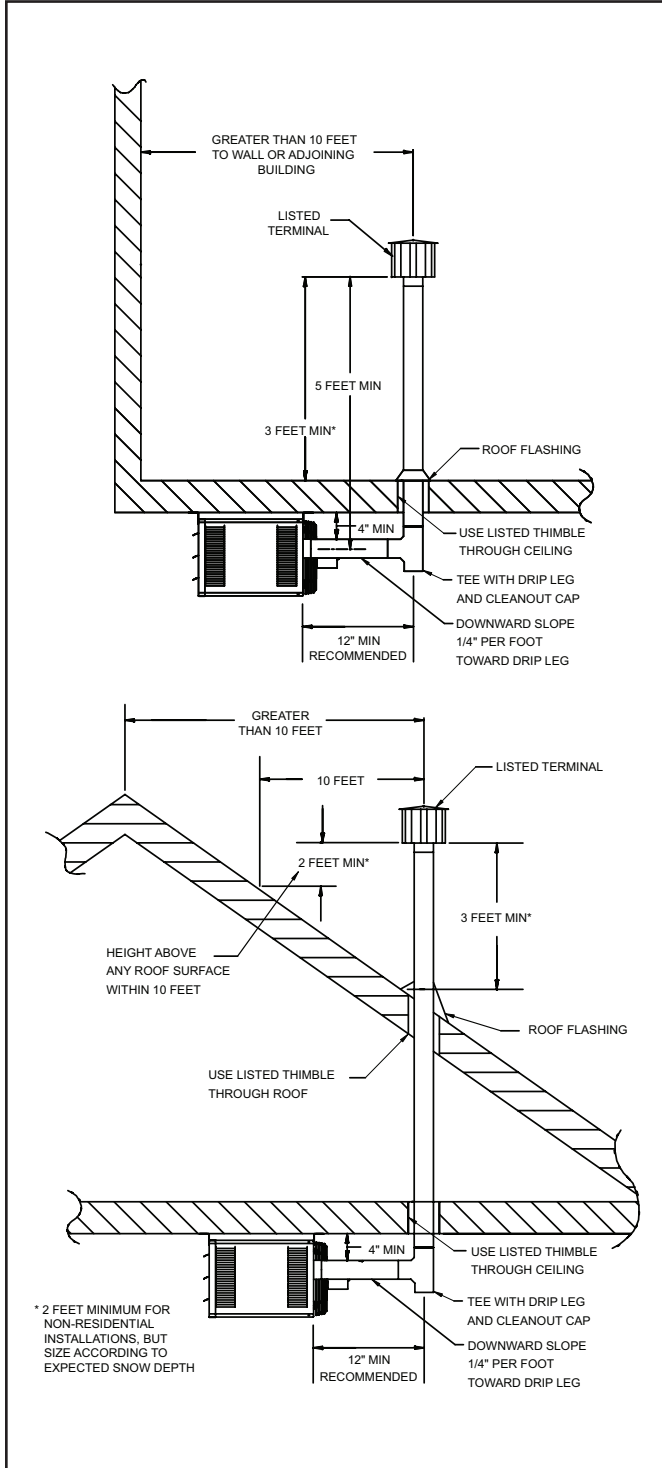
① Size according to expected snow depth.



# INSTALLATION - VENTING

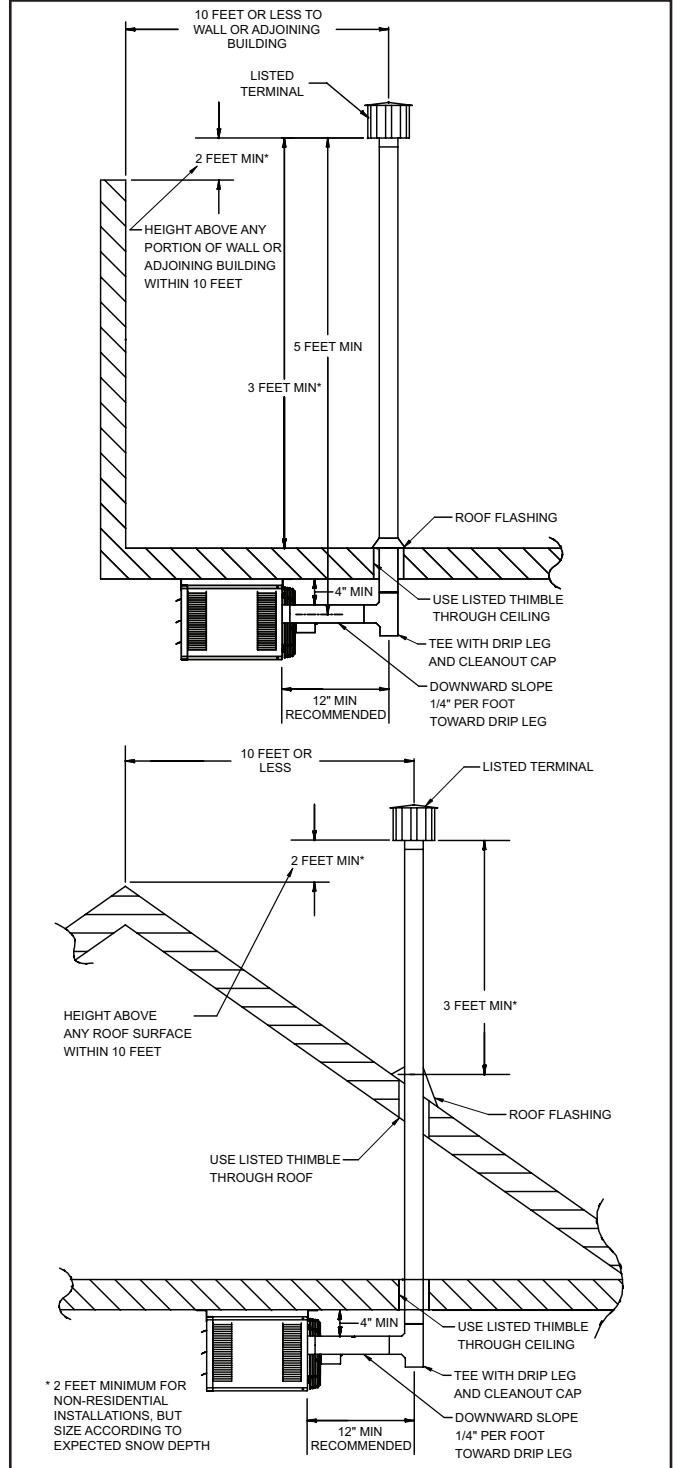
- For **single wall vent pipe and 10' or greater** horizontal distance to any portion of a building, the vent must terminate at least 3' (2' for non-residential installations) above the highest point where it passes through a roof of a building and at least 2' higher than any portion of a building within a horizontal distance of 10'. See Figure 9.1

**Figure 9.1 - Vertical Vent Termination for Single Wall Vent Pipe and Greater Than 10' Horizontally From Adjacent Wall or Building**



- For **single wall vent pipe and less than 10'** horizontal distance to any portion of a building, the vent must terminate 2' higher than any portion of that building. See Figure 9.2

**Figure 9.2 - Vertical Vent Termination for Single Wall Vent Pipe and 10' or Less Horizontally From Adjacent Building or Building**



B10. Once venting is complete, proceed to the section titled "Installation – Gas Connections".

# INSTALLATION - VENTING

## Section C – Horizontal, Category III Vent System Installation

- C1. This section applies to horizontally vented Category III vent systems and is in addition to “Section A – General Instructions – All Units”.
- C2. All heaters that are horizontally vented with 3" (for sizes 30-75) or 4" (for sizes 100 and 125) vent pipe perform as a Category III appliance. Category III venting has special venting requirements as follows:
- All **residential**, horizontally vented Category III heaters must be vented with an agency certified (UL1738) Category III venting system. Agency certified Category III venting systems are available from your local vent pipe distributor. Follow the agency certified Category III vent manufacturer's instructions for installation.
  - For **commercial and industrial** horizontally vented heaters you may use either agency certified Category III venting systems as noted above, or single wall galvanized or stainless steel vent pipe. If single wall vent pipe is used, all seams and joints must be sealed with metallic tape or silastic suitable for temperatures up to 400°F. Wrap the tape two full turns around the vent pipe. For single wall vent systems, one continuous section of double wall vent pipe may be used within the vent system. Refer to instruction A10 in “Section A – General Instructions – All Units” for attaching double wall pipe to single wall pipe.
- C3. Limit the total equivalent vent pipe length to a minimum of 3' and a maximum of 30', making the vent system as straight as possible. The equivalent length of a 3" elbow is 1' and for a 4" elbow is 5'.
- C4. All horizontal Category III vents must be terminated with a Gary Steel 1092 vent cap. The cap must terminate a minimum distance from the external wall, as summarized in Table 10.1.

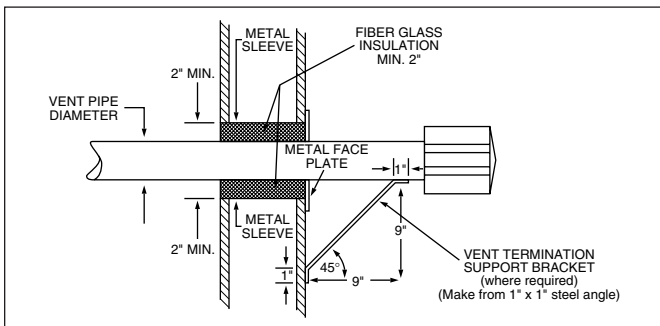
**Table 10.1 - Minimum Length Between External Wall and Vent**

Model Size	Application	Min. Length A ①
30-75	Residential & Commercial	11"
100, 125	Residential	12"
100, 125	Commercial	24"

① Refer to Figure 10.2 and 10.3.

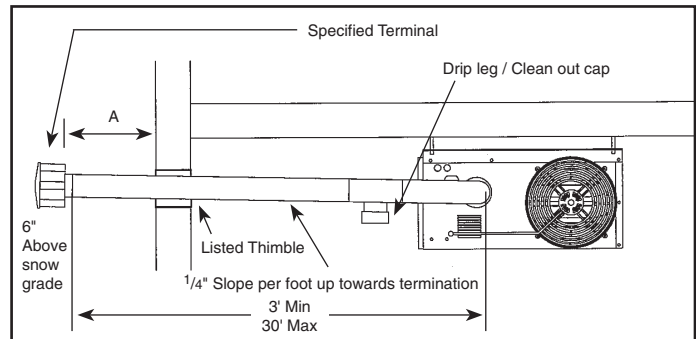
C5. The vent must be supported as shown in Figure 10.1.

**Figure 10.1 - Exhaust Vent Construction Through Combustible Walls and Support Bracket**

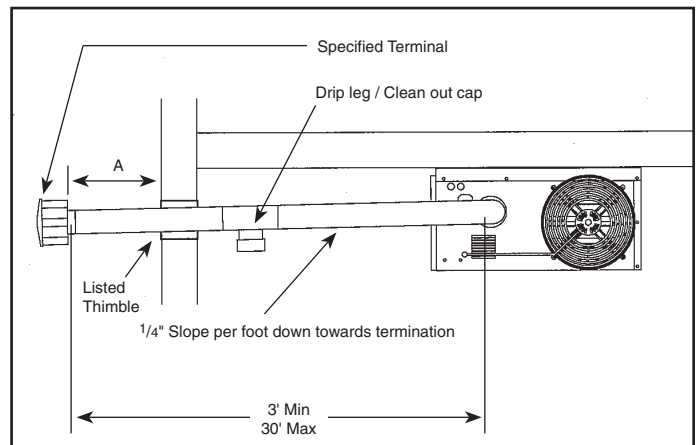


- C6. When condensation may be a problem, the vent system shall not terminate over public walkways or over an area where condensate or vapor could create a nuisance or hazard or could be detrimental to the operation of regulators, relief openings, or other equipment.
- C7. The venting system must be exclusive to a single unit, and no other unit is allowed to be vented into it.
- C8. When vented horizontally, maintain a 1/4" per foot rise away from the heater and place a drip leg with clean out near the unit as shown in Figure 10.2. Where local authorities have jurisdiction, a 1/4" per foot downward slope is acceptable with a drip leg and clean out near the exit of the vent as shown in Figure 10.3, or allow the condensate to drip out the end.

**Figure 10.2 - Horizontal Category III Venting with Upward Pitch**



**Figure 10.3 - Horizontal Category III Venting with Downward Pitch (with drip leg)**



- C9. For a vent termination located under an eave, the distance of the overhang must not exceed 24". The clearance to combustibles above the exterior vent must be maintained at a minimum of 12". Consult the National Fuel Gas Code for additional requirements for eaves that have ventilation openings.
- C10. Once venting is complete, proceed to the section titled “Installation – Gas Connections”.

# INSTALLATION - VENTING

## Additional Requirements for Common Venting:

1. The common vent system and all attached appliances must be Category I.
2. The vent connector should be routed in the most direct route from the units to the common vent.
3. Where two or more vent connectors enter a common gas vent or chimney flue, the smaller connector shall enter at the highest level consistent with the available head room or clearance to combustible material.
4. Restrictions within the common vent such as elbows should be minimized. Each elbow installed within the common portion of the venting system reduces maximum common vent capacity by 10% (refer to Tables 11.2 and 11.3 for capacity)
5. The vent connector capacities included in these tables allow for the use of two 90 degree elbows (or turns). For each additional elbow, the vent connector capacity shall be reduced by 10%. Refer to NFPA54/ IFEC tables for capacity ratings.
6. The common vent cross sectional area must be equal to or greater than the largest vent connector cross-sectional area.
7. If all appliances are located on one level of the building, the vent height shall be measured from the highest draft hood or vent connector to be installed within the common vent system (Refer to Figures 11.1 and 11.2).
8. All units must be vented in strict accordance of the common venting Tables 11.1 through 11.3.
9. All masonry chimneys must comply with all applicable local and national codes.
10. When combining multiple vent connectors into a manifold prior to the vertical portion of the common vent, the size of the common vent manifold and the common vent shall be determined by applying a 10% reduction (.90 x maximum vent capacity from Table 11.2 or 11.3) to the common vent capacity part of the common vent tables. The length of the common vent manifold (Lm) may not exceed 18 inches per inch of manifold diameter.
11. Refer to the National Fuel Gas Code for instructions on multi-level common venting and exterior masonry chimneys as well as additional installation of the listed applications.

**Table 11.1 - Maximum Vent Connector Horizontal Run (ft) - Type B Vent Connector**

Connector Dia.	Model	Max Horiz. Run
3"	30,45,60,75	4.5
4"	100, 125	6

Based on ANSI Z223.1 (NFPA 54)-2009. For reference only.

**Table 11.2 - Maximum Total Appliance Input Capacities (MBh) - Type B Vent Connector and Type B Common Vent**

Vent Height (ft)	Diameter of Common Vent							
	4 in.		5 in.		6 in.		7 in.	
	Fan+ Fan	Fan+ Nat	Fan+ Fan	Fan+ Nat	Fan+ Fan	Fan+ Nat	Fan+ Fan	Fan+ Nat
6	92	81	140	116	204	161	309	248
8	101	90	155	129	224	178	339	275
10	110	97	169	141	243	194	367	299
15	125	112	195	164	283	228	427	352
20	136	123	215	183	314	255	475	394
30	152	138	244	210	361	297	547	459

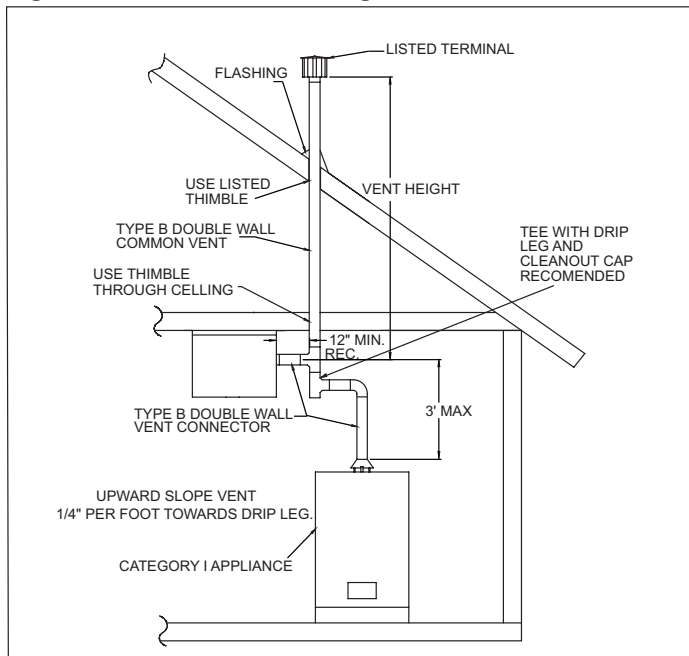
Based on ANSI Z223.1 (NFPA 54)-2009. For reference only.

**Table 11.3 - Maximum Total Appliance Input Capacities (MBh) - Type B Vent Connector with Common Vent into Masonry Chimney**

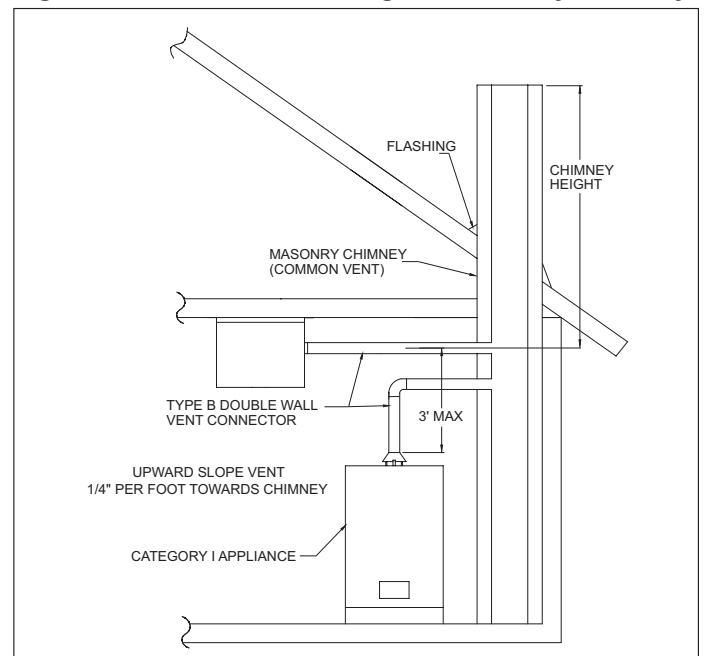
Vent Height (ft.)	Area of Common Vent							
	12 in <sup>2</sup>		19 in <sup>2</sup>		28 in <sup>2</sup>		38 in <sup>2</sup>	
	Fan+ Fan	Fan+ Nat	Fan+ Fan	Fan+ Nat	Fan+ Fan	Fan+ Nat	Fan+ Fan	Fan+ Nat
6	NA	74	NA	119	NA	178	NA	257
8	NA	80	NA	130	NA	193	NA	279
10	NA	84	NA	138	NA	207	NA	299
15	NA	NA	NA	152	NA	233	NA	334
20	NA	NA	NA	NA	NA	250	NA	368
30	NA	NA	NA	NA	NA	270	NA	404

Based on ANSI Z223.1 (NFPA 54)-2009. For reference only.

**Figure 11.1 - Common Venting into Double Wall B Vent**



**Figure 11.2 - Common Venting into Masonry Chimney**



# INSTALLATION - GAS CONNECTIONS

## ⚠ WARNING

1. All field gas piping must be pressure/leak tested prior to operation. Never use an open flame. Use a soap solution or equivalent for testing.
2. Gas pressure to appliance controls must never exceed 14" W.C. (1/2 psi).
3. To reduce the opportunity for condensation, the minimum sea level input to the appliance, as indicated on the serial plate, must not be less than 5% below the rated input, or 5% below the minimum rated input of dual rated units.

## ⚠ CAUTION

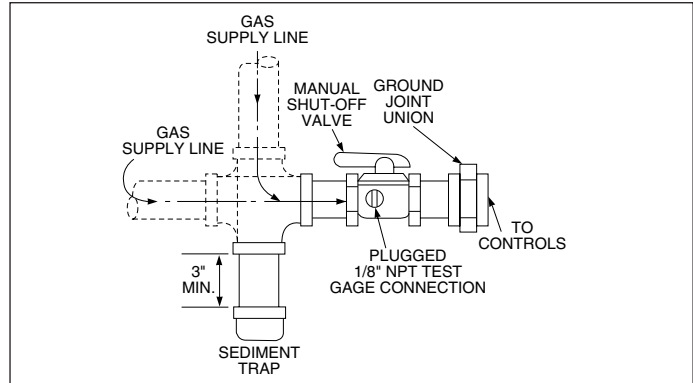
1. Purging of air from gas lines should be performed as described in the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) - latest edition or in Canada CSA-B149 codes.
2. When leak testing the gas supply piping system, the appliance and its combination gas control must be isolated during any pressure testing in excess of 14" W.C. (1/2 psi).
3. The unit should be isolated from the gas supply piping system by closing its field installed manual shut-off valve. This manual shut-off valve should be located within 6' of the heater.
4. Turn off all gas before installing appliance.

## IMPORTANT

To prevent premature heat exchanger failure, the input to the appliance, as indicated on the serial plate, must not exceed the rated input by more than 5%.

1. Installation of piping must conform with local building codes, or in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) - latest edition. In Canada, installation must be in accordance with CSA-B149.1.
2. Piping to units should conform with local and national requirements for type and volume of gas handled and pressure drop allowed in the line. Refer to Table 12.1 to determine the cubic feet per hour (CFH) for the type of gas and size of unit to be installed. Using this CFH value and the length of pipe necessary, determine the pipe diameter from Table 12.2. Where several units are served by the same main, the total capacity, CFH, and length of main must be considered. Avoid pipe sizes smaller than 1/2". Table 12.2 allows for a 0.3" W.C. pressure drop in the supply pressure from the building main to the unit. The inlet pressure to the unit must be 6-7" W.C. for natural gas and 11-14" W.C. for propane gas. When sizing the inlet gas pipe diameter, make sure that the unit supply pressure can be met after the 0.3" W.C. has been subtracted. If the 0.3" W.C. pressure drop is too high, refer to the Gas Engineer's Handbook for other gas pipe capacities.
3. Install a ground joint union with brass seat and a manual shut-off valve adjacent to the unit for emergency shut-off and easy servicing of controls, including a 1/8" NPT plugged tapping accessible for test gauge connection (See Figure 12.1).
4. Provide a sediment trap before each unit in the line where low spots cannot be avoided. (See Figure 12.1).
5. When Pressure/Leak testing, pressures above 14" W.C. (1/2 psi), close the field installed shut-off valve, disconnect the appliance and its combination gas control from the gas supply line, and plug the supply line before testing. When testing pressures 14" W.C. (1/2 psi) or below, close the manual shut-off valve on the appliance before testing.

**Figure 12.1 - Recommended Sediment Trap/Manual Shut-off Valve Installation - Side or Bottom Gas Connection** ①



① Manual shut-off valve is in the "OFF" position when handle is perpendicular to pipe.

**Table 12.1 - Manifold Pressure & Gas Consumption**

Model Size	BTU/Cu. Ft. Specific Gravity	Natural	Propane	No. of Orifices
		1050 0.60	2500 1.53	
<b>Manifold Pressure In. W.C.</b>		<b>3.5</b>	<b>10.0</b>	
30	CFH	28.6	12.0	2
	Gal/Hr. Propane	.33	.33	
	Sec/cu. ft.	126	300	
	Orifice Drill Size	49	56	
45	CFH	42.9	18.0	3
	Gal/Hr. Propane	.50	.50	
	Sec/cu. ft.	84	200	
	Orifice Drill Size	49	56	
60	CFH	57.1	24.0	4
	Gal/Hr. Propane	.66	.66	
	Sec/cu. ft.	63	150	
	Orifice Drill Size	49	56	
75	CFH	71.4	30.0	5
	Gal/Hr. Propane	.83	.83	
	Sec/cu. ft.	50	180	
	Orifice Drill Size	49	56	
100	CFH	95.2	40	5
	Gal/Hr. Propane	1.09	1.09	
	Sec/cu. ft.	38	90	
	Orifice Drill Size	45	55	
125	CFH	119	50	5
	Gal/Hr. Propane	1.37	1.37	
	Sec/cu. ft.	30	72	
	Orifice Drill Size	42	53	

**Table 12.2 - Gas Pipe Capacities - Natural Gas** ① ②

Pipe Length (ft)	Natural Gas					
	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"
10	132	278	520	1050	1600	3050
20	92	190	350	730	1100	2100
30	73	152	285	590	890	1650
40	63	130	245	500	760	1450
50	56	115	215	440	670	1270
60	50	105	195	400	610	1150
70	46	96	180	370	560	1050
80	43	90	170	350	530	930
100	38	79	150	305	460	870
125	34	72	130	275	410	780
150	31	64	120	250	380	710

① Capacities in Cubic Feet per Hour through Schedule 40 pipe with maximum 0.3" W.C. pressure drop with up to 14" W.C. gas pressure. Specific gravity is 0.60 for Natural gas and 1.50 for Propane gas.

② For Pipe Capacity with Propane Gas, divide Natural gas capacity by 1.6. Example: What is the propane gas pipe capacity for 60 feet of 1-1/4" pipe? The Natural gas capacity is 400 CFH. Divide by 1.6 to get 250 CFH for Propane gas.

# INSTALLATION - ELECTRICAL CONNECTIONS

## ELECTRICAL CONNECTIONS

### ⚠ WARNING

1. Disconnect power supply before making wiring connections to prevent electrical shock and equipment damage.
2. All appliances must be wired strictly in accordance with wiring diagram furnished with the appliance. Any wiring different from the wiring diagram could result in a hazard to persons and property.
3. Any original factory wiring that requires replacement must be replaced with wiring material having a temperature rating of at least 105°C.
4. Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% greater than rated voltage.

### ⚠ CAUTION

Ensure that the supply voltage to the appliance, as indicated on the serial plate, is not 5% less than the rated voltage.

All field installed wiring must be done in accordance with the National Electrical Code ANSI/NFPA 70 – latest edition or Canadian Electrical Code CSA C22.1 Part 1 or local codes. Unit must be electrically grounded according to these codes. If any of the original wire supplied with the heater must be replaced, replace it with wiring material having a temperature rating of at least 105°C.

The power to these unit heaters should be protected with a circuit breaker.

Location of thermostat should be determined by heating requirements and be mounted on an inside wall about 5' above floor level where it will not be affected by heat from the unit or other sources, or drafts from frequently opened doors. See instructions packed with thermostat.

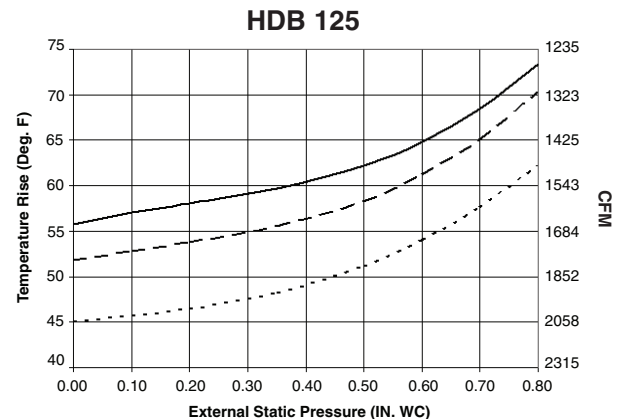
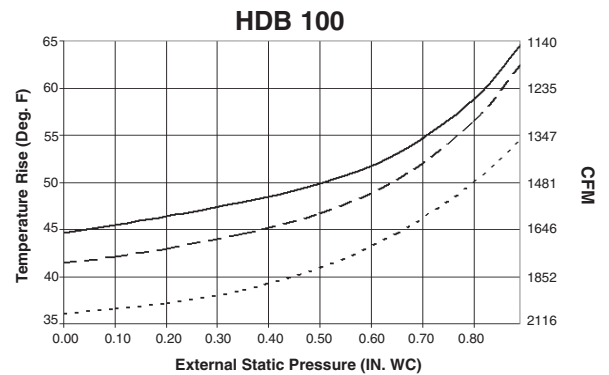
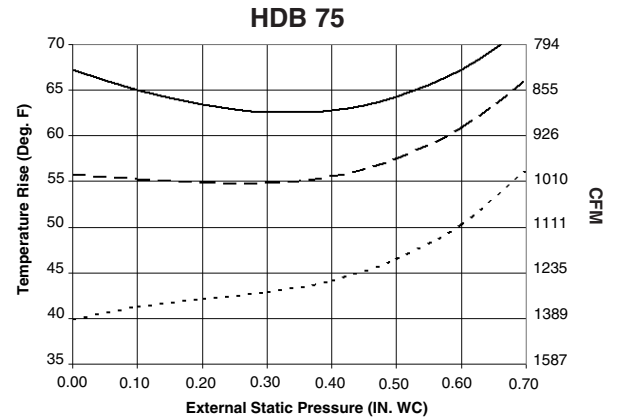
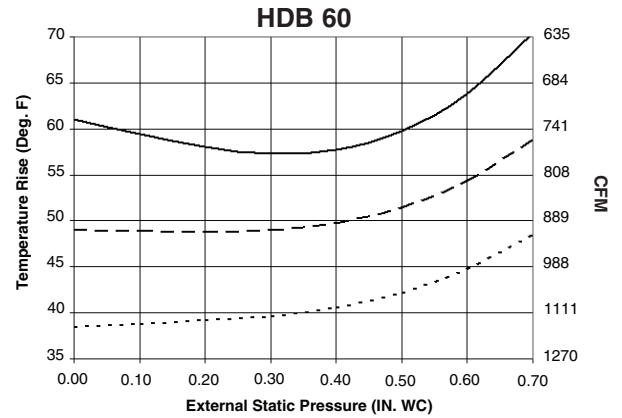
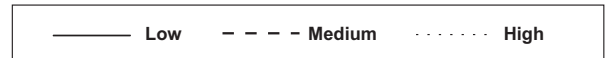
### Wiring Adjustments for Blower Motors

The blowers used on Modine HDB units are direct drive and equipped with three speed motors. Air temperature rise of the unit is determined by the speed setting and the amount of static pressure in the system. Units are normally shipped with motors set at high speed. Motor speed is changed by connecting the motor lead for the desired fan speed to the “EAC” or “BLO” terminal of the control board. Unused motor leads for other speeds are placed on the “PARK” terminals of the board. See the wiring diagram on page 20.

When applying a blower equipped unit to a duct system or other load, consult the performance curves on this page to determine the air temperature rise for a given motor speed range and static pressure. Verify that the static pressure on the outlet of the unit does not exceed the maximum specified for the unit. If static pressure is too high it must be reduced either by modifications to the system or using the medium or low motor speed. If the unit shuts down on high limit during normal operation, a higher motor speed should be used.

## Blower Curve Models (HDB 60-125 Only)

Speeds



# INSTALLATION - OPERATION

## OPERATION

### Prior to Operation

# IMPORTANT

1. To prevent premature heat exchanger failure, observe heat exchanger tubes. If the bottom of the tubes become red while blower and furnace are in operation, check to be sure the blower has been set to the proper RPM for the application. Refer to page 14 for Wiring Adjustments for Blower Motors.
2. Start-up and adjustment procedures should be performed by a qualified service agency.

Although this unit has been assembled and fire-tested at the factory, the following pre-operational procedures should be performed to assure proper on-site operation.

1. Turn off power to the unit at the disconnect switch. Check that fuses or circuit breakers are in place and sized correctly. Turn all hand gas valves to the "OFF" position.
2. Remove the side control access panel.
3. Check that the supply voltage matches the unit supply voltage listed on the Model Identification plate. Verify that all wiring is secure and properly protected. Trace circuits to insure that the unit has been wired according to the wiring diagram.
4. Check to insure that the venting system is installed correctly and free from obstructions. Before you start use the following steps to verify that the venting system is adequately sized:
  - a. Seal any unused openings in the venting system.
  - b. Inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code, ANSI Z223.1 (NFPA 54) or CSA B149.1 Installation Code - latest edition and these instructions. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies, which could cause an unsafe condition.
  - c. Insofar as practical, close all building doors and windows and all doors between the space in which the appliance(s) connected to the venting system are located and other spaces of the building. Turn on clothes dryers and any exhaust fans such as range hoods and bathroom exhausts, so they shall operate at maximum speed. Do not operate a summer exhaust fan. Close fireplace dampers.
  - d. Follow the lighting instructions. Place the appliance being inspected in operation. Adjust thermostat so that the appliance will operate continuously.
  - e. After it has been determined that each appliance connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use.
  - f. If improper venting is observed during any of the above tests, the venting system must be corrected.
5. Check to see that there are no obstructions to the intake and discharge of the unit.
6. Check fan clearance. Fan should not contact casing when spun by hand.
7. Check to make sure that all filters are in place and that they are installed properly according to direction of air flow (if applicable).
8. Perform a visual inspection of the unit to make sure no damage has occurred during installation.
9. Check that all horizontal deflector blades are open a minimum of 30° as measured from vertical.
10. Turn on power to the unit at the disconnect switch.

11. Check the thermostat, ignition control, gas valve, and supply fan blower motor for electrical operation. If these do not function, check that the wiring is per the diagram.
12. Check the blower wheel for proper direction of rotation when compared to the air flow direction arrow on the blower housing (if applicable). Blower wheel rotation, not air movement, must be checked as some air will be delivered through the unit with the blower wheel running backwards.
13. For blower units, check the blower speed (RPM). Refer to Blower Adjustments for modification.
14. Check the motor speed (RPM).
15. Check the motor voltage.
16. Check the motor amp draw to make sure it does not exceed the motor nameplate rating.
17. Recheck the gas supply pressure at the field installed manual shut-off valve. The minimum inlet pressure should be 6" W.C. on natural gas and 11" W.C. on propane gas. The maximum inlet pressure for either gas is 14" W.C. If inlet pressure exceeds 14" W.C., a gas pressure regulator must be added upstream of the combination gas valve.
18. Open the field installed manual gas shut-off valve.
19. Place the manual main gas valve on the combination gas valve in the "ON" position. Call for heat with the thermostat.
20. Check to make sure that the main gas valve opens. Check the manifold gas pressure (See Main Burner Adjustment) while the supply fan blower is operating.
21. Check to insure that gas controls sequence properly (See Control Operating Sequence). If you are not familiar with the unit's controls (i.e. combination gas control), refer to the control manufacturer's literature supplied with the unit.
22. Once proper operation of the unit has been verified, remove any jumper wires that were required for testing.
24. Replace the side control access panel.

## Main Burner Adjustment

The gas pressure regulator (integral to the combination gas control) is adjusted at the factory for average gas conditions. It is important that gas be supplied to the unit heater in accordance with the input rating on the serial plate. Actual input should be checked and necessary adjustments made after the unit heater is installed. Over-firing, a result of too high an input, reduces the life of the appliance and increases maintenance. Under no circumstances should the input exceed that shown on the serial plate.

Measuring the manifold pressure is done at the outlet pressure tap of the gas valve.

### To Adjust the Manifold Pressure

1. Move the field installed manual shut-off valve to the "OFF" position.
2. Remove the 1/8" pipe plug from the outlet pressure tap on the gas valve and attach a water manometer of "U" tube type which is at least 12" high.
3. Move the field installed manual gas shut-off valve to the "ON" position.
4. Create a high-fire call for heat from the thermostat.
5. Refer to Table 12.1 to determine the correct high fire manifold pressure for the gas type of the unit. Adjust the main gas pressure regulator spring to achieve the proper manifold pressure (for location, see the combination gas control literature supplied with unit).
6. After adjustment, move the field installed manual shut-off valve to the "OFF" position and replace the 1/8" pipe plug.
7. After the plug is in place, move the field installed manual shut-off valve to the "ON" position and recheck pipe plugs for gas leaks with soap solution.

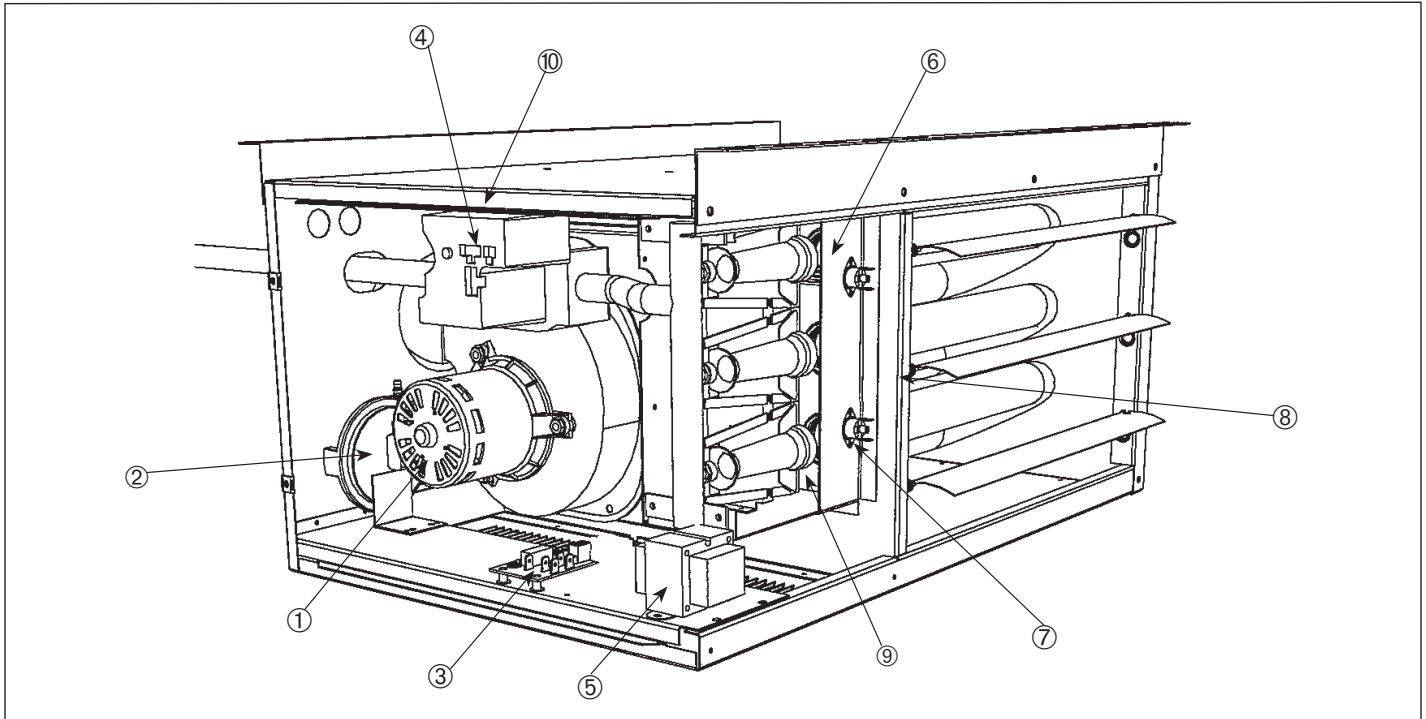
# CONTROL OPERATING SEQUENCE / UNIT COMPONENTS

## CONTROL OPERATING SEQUENCE

Upon a call for heat from the thermostat, power is supplied to the power exhauster motor. The unit will go through a purge period and then the direct spark igniter will be energized. At the same time, the main valve in the combination control valve will open to allow gas to flow to the burners. If the fan motor has

not all ready started it will start shortly. If a flame is not sensed for any reason the main valve will close and there will be a short purge period before ignition is tried again. If the flame is not sensed after four tries, there will be at least a one hour wait before ignition is tried again.

**Figure 15.1 - Major Gas, Electrical Service, Safety and Other Components**



- |  |                            |   |
|--|----------------------------|---|
| 1. Power Exhauster                       | 4. Combination Gas Control | 8. Auto Reset Limit Control (hidden)                      |
| 2. Pressure Switch                       | 5. Control Transformer     | 9. Direct Spark Igniter (hidden)                          |
| 3. Integrated Direct Spark Control Board | 6. Flame Sensor (hidden)   | 10. Manual Reset Control (hidden, propeller 100-125 only) |
|  | 7. Flame Rollout Switch    |   |

## Control Options

Control Description	Control Code No.	Service Voltage	Thermostat Voltage	Type of Gas	Model Size
<b>Single-Stage, Direct Spark Ignition, 100% Shut-Off with Continuous Retry</b> - Utilizes a single-stage combination gas control with ignition control. Gas is lit with a direct spark igniter on call for heat.	11	115V	24V	natural	30-125
	21	115V	24V	propane	30-125
<b>Two-Stage, Direct Spark Ignition, 100% Shut-Off with Continuous Retry</b> - Utilizes a two-stage combination gas control with built-in ignition control. Firing rate is 100% and 50% of full rated input. Gas is lit with a direct spark igniter on call for heat.	12	115V	24V	natural	75-125
	22	115V	24V	propane	75-125

## Performance - Model HD

Models	HD30	HD45	HD60	HD75	HD100	HD125
Btu/Hr Input	30,000	45,000	60,000	75,000	100,000	125,000
Btu/Hr Output	24,000	36,000	48,000	60,000	80,000	100,000
Entering Airflow (CFM)	505	720	990	1,160	1,490	1,980
Outlet Velocity	523	749	653	769	565	747
Air Temp. Rise (°F)	44	46	45	48	50	47
Mounting Height (Max ft.)	10	10	12	14	12	16
Heat Throw (ft.)	25	27	36	38	42	56
Motor Data	Horsepower	1/15	1/15	1/12	1/12	1/8
	RPM	1,550	1,550	1,625	1,625	1,050
	Type	S.P.	S.P.	P.S.C.	P.S.C.	S.P.
	Amps	2.4	2.4	1.2	1.2	2.7
Unit Total Amps	3.7	3.7	2.5	2.5	4.7	4.2

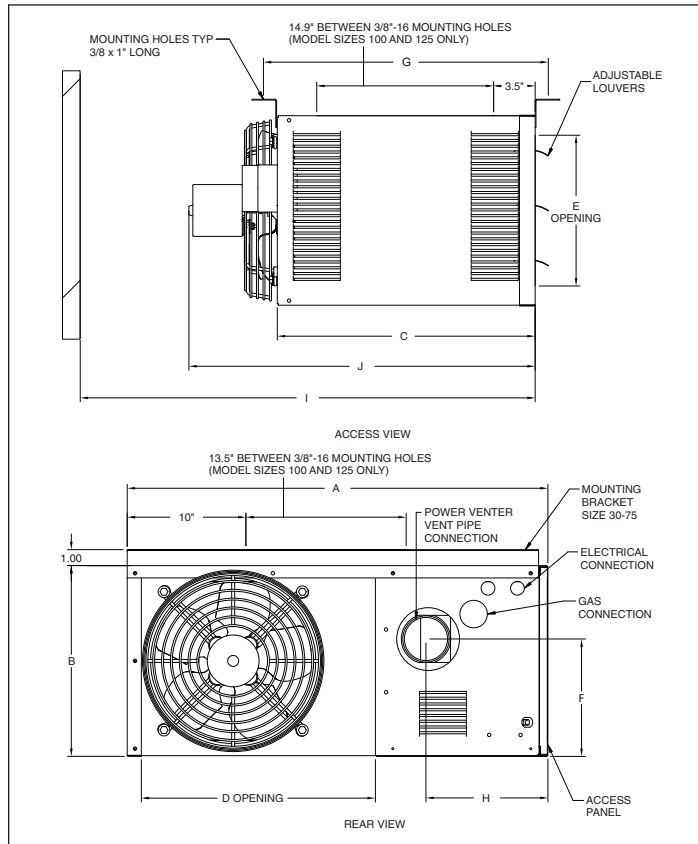
## Performance - Model HDB

Models	HDB60	HDB75	HDB100	HDB125
Btu/Hr Input	60,000	75,000	100,000	125,000
Btu/Hr Output	48,000	60,000	80,000	100,000
Air Flow CFM Range	635-1100	795-1390	1060-1850	1240-2050
Static Pressure (max)	0.7	0.7	0.8	0.8
Air Temp. Rise (°F)	40-70	40-70	40-70	45-75
Motor Speeds	3	3	3	3
Motor Data	Horsepower	1/4	1/3	1/2
	RPM	Max 1,100	Max 1,100	Max 1,100
	Type	P.S.C.	P.S.C.	P.S.C.
	Amps	5.4	7.1	9.5
Unit Total Amps	6.4	8.1	11.5	11.5

# DIMENSIONAL DATA - MODEL HD/HDB

## Propeller Units - Model HD

Figure 16.1 - Dimensional Drawings - Model HD



## Blower Units - Model HDB

Figure 16.2 - Dimensional Drawings - Model HDB

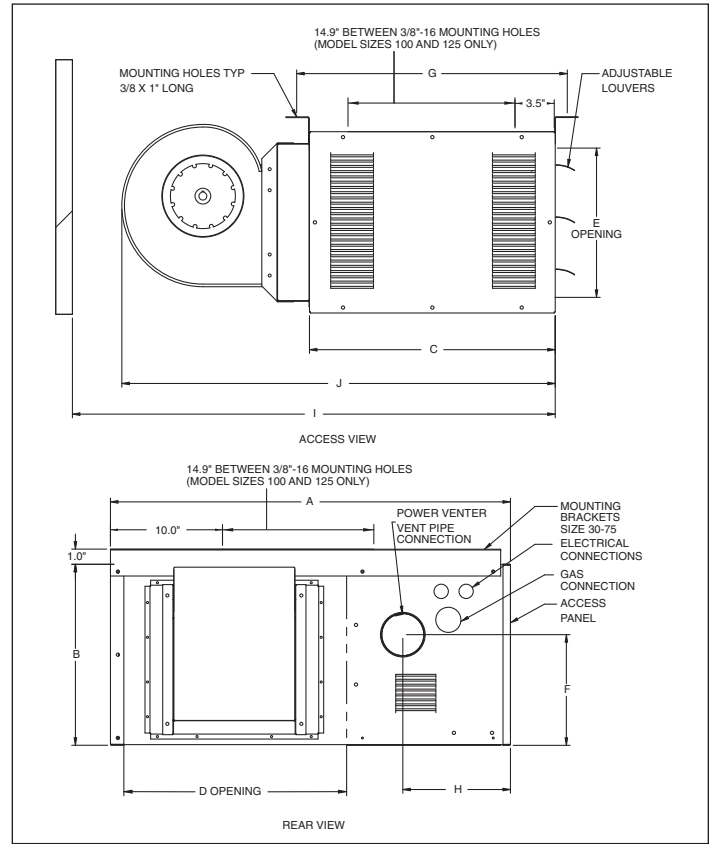


Table 16.1 - Dimensions (inches) - HD

Models	HD30	HD45	HD60	HD75	HD100/125
A	26.8	26.8	26.8	26.8	35.5
B	12.2	12.2	18.0	18.0	20.5
C	16.5	16.5	16.5	16.5	22.0
D	14.9	14.9	14.9	14.9	22.5
E	10.1	10.1	15.9	15.9	18.4
F	7.5	7.5	10.7	10.7	14.0
G	18.5	18.5	18.5	18.5	-
H	7.6	7.6	7.8	7.8	8.4
Gas Connection	1/2	1/2	1/2	1/2	1/2
I	34.5	34.5	34.5	34.5	43.0
J	22	22	25	25	31.0
Fan Diameter	10	10	14	14	18.0
Approx. Shipping Weight (lbs.)	55	60	80	85	125
Vent Connector Size (in)	3	3	3	3	4

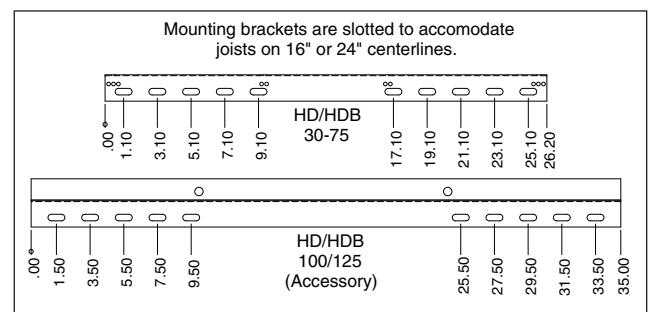
Table 16.2 - Dimensions (inches) - HDB

Models	HDB 60	HDB 75	HDB100/125
A	26.8	26.8	35.5
B	18.0	18.0	20.5
C	16.5	16.5	22.0
D	14.9	14.9	22.5
E	15.9	15.9	18.4
F	10.7	10.7	14.0
G	18.5	18.5	-
H	7.8	7.8	8.4
Gas Connection	1/2	1/2	1/2
I	34.5	34.5	44.5
J	25.0	25.0	41.5
Blower	9 - 7	9 - 7	10 - 10
Approx. Shipping Weight (lbs.)	92	97	151
Vent Connector Size (in)	3	3	4

Table 16.3 - Clearance to Combustibles, Model HD/HDB

Unit Side	Clearance To Combustible Materials	Recommended Service Clearance
Top and Bottom	1"	1"
Access Side	1"	18"
Non-Access Side	1"	1"
Rear	18"	18"
Vent Connector	4"	4"

## Mounting





# SERVICE / MAINTENANCE / TROUBLESHOOTING

## **WARNING**

When servicing or repairing this equipment, use only factory-approved service replacement parts. A complete replacement parts list may be obtained by contacting the factory. Refer to the rating plate on the appliance for complete appliance model number, serial number, and company address. Any substitution of parts or controls not approved by the factory will be at the owner's risk.

## **CAUTION**

1. Service or repair of this equipment must be performed by a qualified service agency.
2. Do not attempt to reuse any mechanical or electrical controllers which have been wet. Replace defective controller.

## **IMPORTANT**

To check most of the Possible Remedies in the troubleshooting guide listed in Table 19.1, refer to the applicable sections of the manual.

### General Maintenance

The unit and venting system must be checked once a year by a qualified service technician.

**All installation and service of these units must be performed by a qualified installation and service agency.**

**Before any service, BE SURE TO TURN OFF GAS AT THE MANUAL SHUT-OFF VALVE AHEAD OF THE COMBINATION GAS CONTROL AND TURN OFF ALL ELECTRIC POWER TO THE HEATER.**

1. Service air moving components annually.
  - a. Check fan for fit on motor shaft and for damage to blades.
2. Keep unit free from dust, dirt, grease, and foreign matter, paying particular attention to:
  - a. Combustion air inlets.
  - b. Burners and burner orifices. Turn off gas ahead of the combination gas control and shut off electric power to the heater. Remove the access panel, open the union on the gas line, and disconnect the igniter and sensor wires. Remove the screws that attach the burner tray to the header plate and remove the burner tray and manifold assembly from the heater. Carefully clean the burners with a wire brush or other suitable means. Replace any damaged or deteriorating burners or orifices. Install the burner assembly back on to the header making certain that all screws, pipes and electrical connections are tight.
 

**CAUTION:** Be careful when handling the igniter and flame sensor.

    1. Inspect the flame sensor and igniter for deterioration and/or cracks.
    2. Verify that the burners are touching each other at the carryover points. This will ensure flame carryover from burner to burner.
  - c. Clean exterior of heat exchanger tubes.
  - d. Fan blades.
3. Check wiring for possible loose connections.
4. Controls – The gas valves and piping should be checked annually for general cleanliness and tightness. The gas controls should be checked to insure that the unit is operating properly. See control instruction sheets furnished separately with the unit heater.
5. Power exhaust assembly/motor – The power exhaust motor bearings have been lubricated for long life and do not require additional lubrication. In dirty environments, it may be desirable to clean the motors and blower housing and blow out the cooling air passages of the motor with compressed air.
6. Perform periodic cleaning of inlet and vent terminal screens.

**Table 17.1 - Troubleshooting**

TROUBLE	POSSIBLE CAUSE	POSSIBLE REMEDY
Unit does nothing	<ol style="list-style-type: none"> <li>1. Power supply is off</li> <li>2. No 24V power to thermostat</li> <li>3. Thermostat malfunction</li> <li>4. LED flashes</li> <li>5. Defective control</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn on main power</li> <li>2 a. Check control transformer                             <ol style="list-style-type: none"> <li>b. If failed transformer - check thermostat wire gauge and length</li> </ol> </li> <li>3 a. Verify wire connections to R&amp;W terminals only                             <ol style="list-style-type: none"> <li>b. Check / replace thermostat</li> </ol> </li> <li>4. Check LED flash code</li> <li>5. Replace control</li> </ol>
LED light off or flashing	<ol style="list-style-type: none"> <li>1. Multiple causes</li> </ol>	<ol style="list-style-type: none"> <li>1. Control board LED flash codes vary with control type. A decal is installed in the unit giving a brief description of the applicable codes for the heater. For more detail, see the control board data sheet included with this manual.</li> </ol>
Unit starts, but does not ignite	<ol style="list-style-type: none"> <li>1. Main gas is off</li> <li>2. Air in gas line</li> <li>3. Main or manifold gas pressure</li> <li>4. Check gas valve switch</li> </ol>	<ol style="list-style-type: none"> <li>1. Open manual gas valve</li> <li>2. Purge gas line</li> <li>3. Set gas pressures per manual instructions</li> <li>4. Set gas valve switch to "ON" position</li> </ol>
Unit goes through cycle, but the burners go out in less than 10 seconds	<ol style="list-style-type: none"> <li>1. Reversed main power polarity</li> <li>2. Unit not grounded</li> <li>3. Flame not sensed</li> </ol>	<ol style="list-style-type: none"> <li>1. Black wire - HOT, White wire - NEUTRAL, Green wire - Ground</li> <li>2. Ground unit and verify quality of ground connection</li> <li>3. Check flame sense probe and connection</li> </ol>
Air circulating fan inoperable	<ol style="list-style-type: none"> <li>1. Loose connections</li> <li>2. Defective control board</li> <li>3. Defective fan motor</li> </ol>	<ol style="list-style-type: none"> <li>1. Check all connections</li> <li>2. Check control board data sheet and function</li> <li>3. Check fan motor</li> </ol>

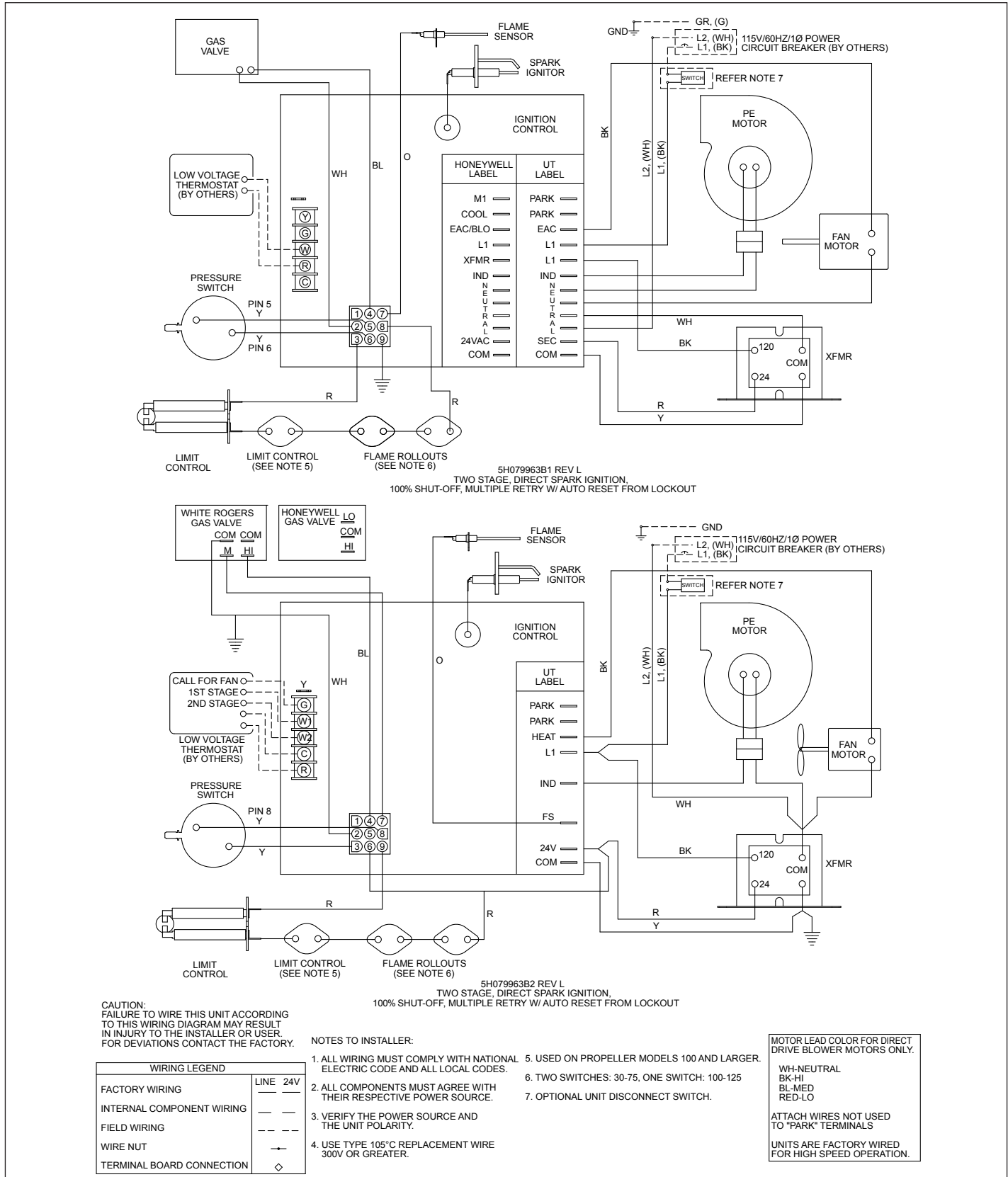
# UNIT WIRING

## Wiring Diagram Selection

Since internal or factory wiring may vary depending on the controls manufacturer, the wiring diagrams must be appropriately selected with the proper gas valve and ignition

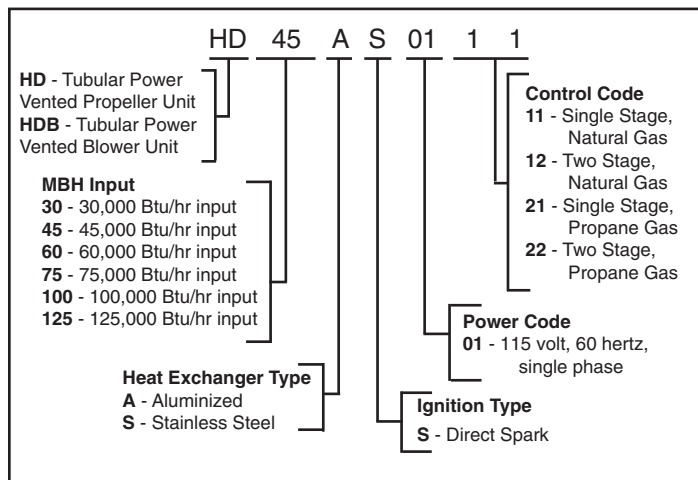
type. The following wiring diagram represents a unit equipped with a single or two stage gas valve and direct spark ignition.

**Figure 18.1 - Unit Heater Wiring Diagram (Single and Two Stage, Direct Spark Ignition)**

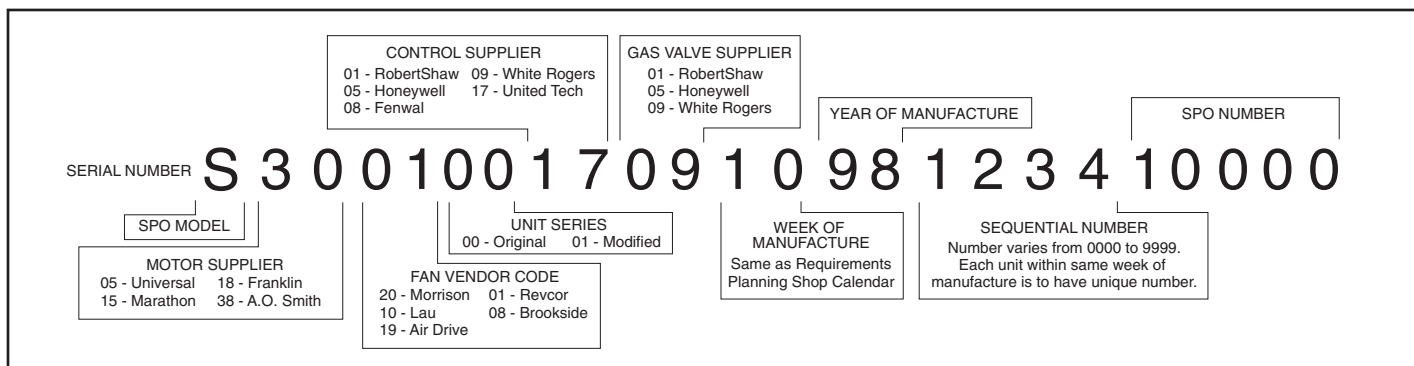


# SERIAL & MODEL NUMBER / REPLACEMENT PARTS

## Model Number Designations (Remove access cover to locate)



## Serial Number Designations (Remove access cover to locate)



## Replacement Parts

When requesting parts please contact your local representative. Please have full model and serial number available. If you require assistance in locating your representative, please call the number located on the back page.

**Figure 22.1 - Common Replacement Parts** (The list is subject to change. Please refer to unit mounted parts list for most up-to-date list.)

Model Size	Power Exhauster	Limit Control Switch	Flame Roll-out Switch	Transformer	Pressure Switch	Igniter	Ignition Control (1 Stage)	Combination Gas Valve (1 Stage)		Ignition Control (2 Stage)	Combination Gas Valve (2 Stage)	
								Code 11	Code 21		Code 12	Code 22
HD 30	5H75038	5H75769B1	5H75002-7	5H75029	5H75030-3	5H79636	5H79749	5H79751B	5H79869B	NA	NA	NA
HD 45	5H75038	5H75769B1	5H75002-7	5H75029	5H75030-3	5H79636	5H79749	5H79751B	5H79869B	NA	NA	NA
HD 60	5H75038	5H75769B2	5H75002-7	5H75029	5H75030-3	5H79636	5H79749	5H79751B	5H79869B	NA	NA	NA
HDB 60	5H75038	5H75769B4	5H75002-7	5H75029	5H75030-3	5H79636	5H79749	5H79751B	5H79869B	NA	NA	NA
HD 75	5H75038	5H75769B2	5H75002-7	5H75029	5H75030-4	5H79636	5H79749	5H79751B	5H79869B	5H79804B	5H79748B	5H79871B
HDB 75	5H75038	5H75769B2	5H75002-7	5H75029	5H75030-4	5H79636	5H79749	5H79751B	5H79869B	5H79804B	5H79748B	5H79871B
HD 100	5H79795	5H75769B2	5H75002-4	5H75029	5H79441-9	5H79636	5H79749	5H79751B	5H79869B	5H79804B	5H79748B	5H79871B
HDB 100	5H79795	5H75769B3	5H75002-4	5H75029	5H79441-9	5H79636	5H79749	5H79751B	5H79869B	5H79804B	5H79748B	5H79871B
HD 125	5H79795	5H75769B1	5H75002-4	5H75029	5H79441-9	5H79636	5H79749	5H79751B	5H79869B	5H79804B	5H79748B	5H79871B
HDB 125	5H79795	5H75769B2	5H75002-4	5H75029	5H79441-9	5H79636	5H79749	5H79751B	5H79869B	5H79804B	5H79748B	5H79871B

# COMMERCIAL WARRANTY

Seller warrants its products to be free from defects in material and workmanship, EXCLUSIVE, HOWEVER, of failures attributable to the use of materials substituted under emergency conditions for materials normally employed. This warranty covers replacement of any parts furnished from the factory of Seller, but does not cover labor of any kind and materials not furnished by Seller, or any charges for any such labor or materials, whether such labor, materials or charges thereon are due to replacement of parts, adjustments, repairs, or any other work done. This warranty does not apply to any equipment which shall have been repaired or altered outside the factory of Seller in any way so as, in the judgment of Seller, to affect its stability, nor which has been subjected to misuse, negligence, or operating conditions in excess of those for which such equipment was designed. This warranty does not cover the effects of physical or chemical properties of water or steam or other liquids or gases used in the equipment.

BUYER AGREES THAT SELLER'S WARRANTY OF ITS PRODUCTS TO BE FREE FROM DEFECT IN MATERIAL AND WORKMANSHIP, AS LIMITED HEREIN, SHALL BE IN LIEU OF AND EXCLUSIVE OF ALL OTHER WARRANTIES, EITHER EXPRESS OR IMPLIED, WHETHER ARISING FROM LAW, COURSE OF DEALING, USAGE OF TRADE, OR OTHERWISE, **THERE ARE NO OTHER WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY OR FITNESS FOR PURPOSE, WHICH EXTEND BEYOND THE PRODUCT DESCRIPTION CONFIRMED BY BUYER AND SELLER AS OF THE DATE OF FINAL AGREEMENT.**

This warranty is void if the input to the product exceeds the rated input as indicated on the product serial plate by more than 5% on gas-fired and oil-fired units, or if the product in the judgment of SELLER has been installed in a corrosive atmosphere, or subjected to corrosive fluids or gases, been subjected to misuse, negligence, accident, excessive thermal shock, excessive humidity, physical damage, impact, abrasion, unauthorized alterations, or operation contrary to SELLER'S printed instructions, or if the serial number has been altered, defaced or removed.

BUYER AGREES THAT IN NO EVENT WILL SELLER BE LIABLE FOR COSTS OF PROCESSING, LOST PROFITS, INJURY TO GOODWILL, OR ANY OTHER CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND RESULTING FROM THE ORDER OR USE OF ITS PRODUCT, WHETHER ARISING FROM BREACH OF WARRANTY, NONCONFORMITY TO ORDERED SPECIFICATIONS, DELAY IN DELIVERY, OR ANY LOSS SUSTAINED BY THE BUYER.

BUYER'S REMEDY FOR BREACH OF WARRANTY, EXCLUSIVE OF ALL OTHER REMEDIES PROVIDED BY LAW, IS LIMITED TO REPAIR OR REPLACEMENT AT THE FACTORY OF SELLER, ANY COMPONENT WHICH SHALL, WITHIN THE APPLICABLE WARRANTY PERIOD DEFINED HEREIN AND UPON PRIOR WRITTEN APPROVAL, BE RETURNED TO SELLER WITH TRANSPORTATION CHARGES PREPAID AND WHICH THE EXAMINATION OF SELLER SHALL DISCLOSE TO HAVE BEEN DEFECTIVE; EXCEPT THAT WHEN THE PRODUCT IS TO BE USED BY BUYER AS A COMPONENT PART OF EQUIPMENT MANUFACTURED BY BUYER, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO ONE YEAR FROM DATE OF SHIPMENT FROM SELLER. FOR GAS-FIRED PRODUCTS INSTALLED IN HIGH HUMIDITY APPLICATIONS AND UTILIZING STAINLESS STEEL HEAT EXCHANGERS, BUYER'S REMEDY FOR BREACH, AS LIMITED HEREIN, SHALL BE LIMITED TO TEN YEARS FROM DATE OF SHIPMENT FROM SELLER.

These warranties are issued only to the original owner-user and cannot be transferred or assigned. No provision is made in these warranties for any labor allowance or field labor participation. Seller will not honor any expenses incurred in its behalf with regard to repairs to any of Seller's products. No credit shall be issued for any defective part returned without proper written authorization (including, but not limited to, model number, serial number, date of failure, etc.) and freight prepaid.

## OPTIONAL SUPPLEMENTAL WARRANTY

Provided a supplemental warranty has been purchased, Seller extends the warranty herein for an additional four (4) years on certain compressors. Provided a supplemental warranty has been purchased, Seller extends the warranty herein for an additional four (4) years or nine (9) years on certain heat exchangers.

## EXCLUSION OF CONSUMABLES & CONDITIONS BEYOND SELLER'S CONTROL

This warranty shall not be applicable to any of the following items: refrigerant gas, belts, filters, fuses and other items consumed or worn out by normal wear and tear or conditions beyond Seller's control, including (without limitation as to generality) polluted or contaminated or foreign matter contained in the air or water utilized for heat exchanger (condenser) cooling or if the failure of the part is caused by improper air or water supply, or improper or incorrect sizing of power supply.

<b>Component</b> Applicable Models	<b>"APPLICABLE WARRANTY PERIOD"</b>
<b>Heat Exchangers</b> Gas-Fired Units except PSH/BSH	TEN YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN TEN YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN ONE HUNDRED TWENTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST
<b>Heat Exchangers</b> Low Intensity Infrared Units  <b>Compressors</b> Condensing Units for Cassettes	FIVE YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER OR ANY OTHER USER, WITHIN FIVE YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN SIXTY-SIX MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST
<b>Burners</b> Low Intensity Infrared Units  <b>Other</b> Components excluding Heat Exchangers, Coils, Condensers, Burners, Sheet Metal	TWO YEARS FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN TWO YEARS FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN THIRTY MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST
<b>Heat Exchangers/Coils</b> Indoor and Outdoor Duct Furnaces and System Units, PSH/BSH, Steam/Hot Water Units, Oil-Fired Units, Electric Units, Cassettes, Vertical Unit Ventilators  <b>Compressors</b> Vertical Unit Ventilators  <b>Burners</b> High Intensity Infrared Units  <b>Sheet Metal Parts</b> All Products	ONE YEAR FROM DATE OF FIRST BENEFICIAL USE BY BUYER OR ANY OTHER USER, WITHIN ONE YEAR FROM DATE OF RESALE BY BUYER IN ANY UNCHANGED CONDITION, OR WITHIN EIGHTEEN MONTHS FROM DATE OF SHIPMENT FROM SELLER, WHICHEVER OCCURS FIRST

As Modine Manufacturing Company has a continuous product improvement program, it reserves the right to change design and specifications without notice.



**Commercial Products Group**  
 Modine Manufacturing Company  
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 Racine, WI 53403  
 Phone: 1.800.828.4328 (HEAT)  
 www.modinehvac.com

# Thermal Control Panel



# Four-Stage Controller and miniSTEP Installation & User's guide

Version 2.3



[www.WadsworthControls.com](http://www.WadsworthControls.com)  
800-821-5829  
5541 Marshall Street  
Arvada, CO 80002



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## Navigating the Manual



Boxes with the light bulb icon will highlight an important tip in using your four-stage controller.



Boxes with the Exclamation Mark will have strongly recommended information or ‘must do’s’ to ensure your four-stage controller runs optimally.

Read these instructions carefully! Failure to follow them could damage the product or cause a hazardous condition.

Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.

Installer must be a licensed and experienced control wiring electrician.



**Disconnect power before installation to prevent electrical shock or equipment damage!  
All wiring must comply with applicable codes and ordinances.**



## MiniSTEP Four-Stage Control Specifications

Description	Electronic Temperature Controller with 1 Temperature Inputs, 4 SPDT Relays, Floating Output Option, 1 Sensor Included, NEMA 4X Enclosure. Wadsworth only supports one temperature input.
Application	On/off or analog controller for applications where electronic accuracy and remote sensing of temperature is required.
Type	Standard-NEMA 4X
Relay Outputs	4 SPDT
Sensor Inputs	1
Voltage	24 Vac or 120/240 Vac. Use only one voltage input. Using both will damage the control.
Frequency	60 Hz
Frequency	50 Hz
Relay Contact Ratings (24 Vac)	10.0A resistive
Relay Contact Ratings (120 Vac)	1/2 hp; 9.8 AFL, 58.8 ALR, 125 VA Pilot Duty
Relay Contact Ratings (240 Vac)	1/2 hp; 4.9 AFL, 29.4 ALR, 125 VA Pilot Duty
Dimensions (in.)	8 5/32 in. high x 4 13/32 in. wide x 2 15/16 in. deep
Dimensions (mm)	207.1 mm high x 112.1 mm wide x 74 mm deep
Sensor Element	1097 ohms PTC at 77 F (25 C)
Sensor and 75' of cable included	Wadsworth Part number S-1509
Maximum distance to sensor (ft)	Up to 1,000 ft
Maximum distance to sensor (m)	up to 304 m
Bulb Size (in.)	1/4 in. diameter x 2 in. long
Bulb Size (mm)	6.35 mm diameter x 50.8 mm
Setpoint Temperature Range (F)	-40 F to 248 F
Setpoint Temperature Range (C)	-40 C to 120 C
Accuracy (F)	±1 F at 77 F
Accuracy (C)	±1 C at 25 C
Differential Temperature (F)	1 F to 150 F
Differential Temperature (C)	0.5 C to 66 C
Operating Ambient Temperature Range (F)	-40 F to 140 F @ 60 Hz
Operating Ambient Temperature Range (F)	-40 F to 125 F @ 50 Hz
Operating Ambient Temperature Range (C)	-40 C to 52 C @ 50 Hz
Operating Ambient Temperature Range	-40 C to 60 C @ 60 Hz
Approvals, Underwriters Laboratories	Approved

Approvals, Others	IP65: Approved
Approvals, CE and C-Tick	Approved

## MiniSTEP Features

MiniSTEP offers a complete package control contactor panel, sensor and wiring diagrams. Standard

MiniSTEP controls **MUST HAVE** high gable louver and 2 high speed exhaust fan. If your greenhouse does not, contact Wadsworth Controls Technical Support at 1-800-482-7943. Custom MiniSTEP controls are available. For more information, please contact Wadsworth Controls.

- One temperature input and Four Equipment output stages.
- Voltage input: 120 VAC, 50 / 60 Hz.
- Setpoint temperature range is -40°F to +220°F.
- Adjustable temperature range and differential for each output.
- LCD display of current temperature, mode and output status.
- Keypad provides easy programming and operation.
- Easily converted to Celsius or Fahrenheit.
- UL approved.
- Preprogrammed from the factory for one heat and three cooling stages.
- Solar shielded remote sensor with 75' of shielded cable.
- Electronic thermostat is attached and pre-wired to a power relay panel.
- Power relay panel is designed to control the following equipment in a single house:
  - Up to two gas fired unit heaters on one stage.
  - One single speed exhaust fan.
  - One two speed exhaust fan.
  - Pad shutters *or* vent control system.
  - Pad pump.
  - Fan jet *or* HAF fans.
- Electrical blueprints include the following:
  - Control schematic
  - Control diagram
  - One line power
  - Conduit and wiring diagrams

## When Installing This Product



**Installer must be a trained, experienced control wiring electrician.**

Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition. Check the ratings on the specifications on page 3 to ensure this product is suitable for your application.

## Location and Mounting

Mount the controller on any convenient interior location away from direct sunlight, water / mist systems or locations where condensation can accumulate and drip onto the system. Use #6 or #8 screws (screws are not provided and must be obtained separately).

**Do not put conduit or cable entry in the top of the cabinet. Bring conduit and cables into the bottom of the cabinet.** Do not tamper with the sealed knock out on the top of the box. Ensure all holes are sealed to protect the control from damage.

Use the mounting ears of the control to attach it to a solid surface. If mounting on DIN rail, be sure to remove the knockouts before mounting. If you do not use an opened knockout be sure to cover it.

The system's operation ambient temperature is 140°F @ 60Hz. Sometimes a shade structure will need to be constructed to help prevent excessive temperature buildup in the system control.

## Sensor Location

The sensor should be located in the center of the greenhouse at plant height. 75' of shielded cable has been provided.

Using nylon cable ties, route the sensor cable over head to a central location in the house from this point it can be lowered down to plant level. Do not over tighten the cable ties as it can cause damage to the cable over time. Extra cable can be wound up and placed above the sensor.

Do not place the sensor over an area where radiated heat can cause inaccuracies, i.e. concrete walkways, ensure the sensor will not get wet from irrigation or mist systems.

All wiring must comply with applicable NEC codes and ordinances.

Do not use the 24 VAC power at terminals P7 in the electronic control to power any external loads.



**Important: Erratic temperature readings from the sensor can be caused by poor wiring practices that must be avoided to assure proper operation.**

- Do not route the temperature sensor wiring with building power wiring
- Do not locate the temperature sensor wiring near electrical motors.
- Do not locate the temperature sensor wiring near welding equipment.

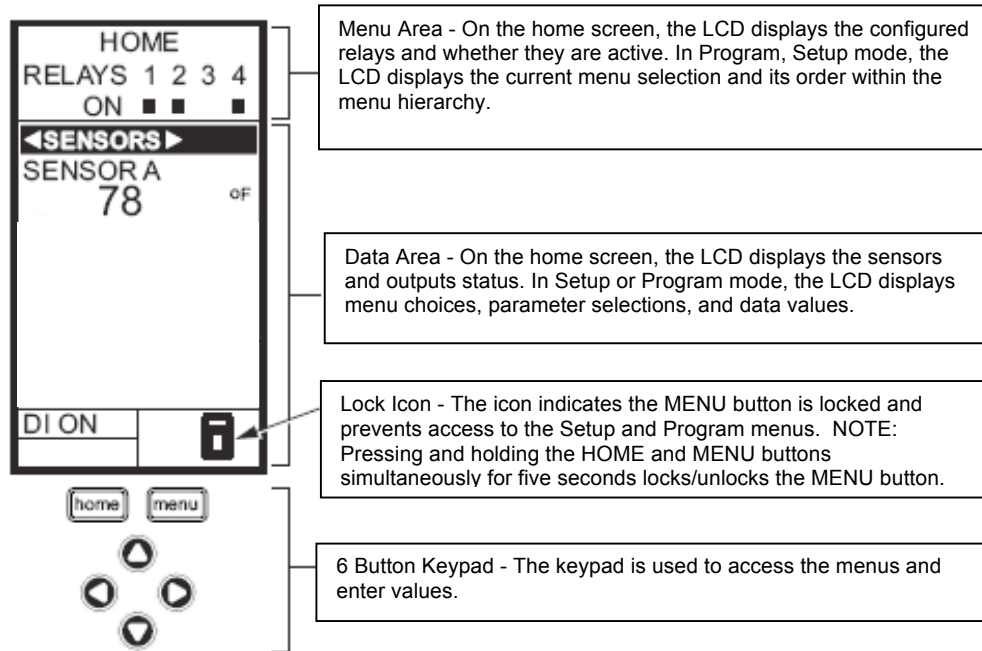
The system has been pre-programmed at the factory and pre-wired to the power relay panel. **Field wiring to the power relay panels terminal block is all that is required at the control.** See drawings in the back of this manual.



**If equipment you are installing deviates from the drawings supplied as part of this booklet, call Wadsworth Control's Technical Support at 800-482-7943. Damage can be done to the control and a possible electrical hazard could exist.**

## Menu Overview

The four-stage controller has an LCD panel and 6-button keypad to provide status information and permit user input of the programming, and setup. The following figure describes the display areas of the LCD and the keypad.

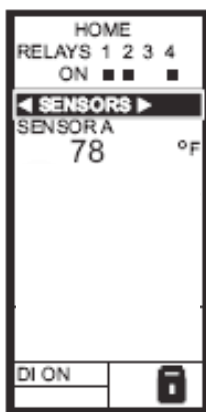


## Using the LCD Panel Interface

The 6-button keypad is used to move through the menus and enter or change parameter values.

### Home Button

Pressing the HOME button at any time exits the current Programming or Setup display screen and returns to the home screen as shown below.



### Menu Button

Pressing the **MENU** button always displays the Program menu. If you are in Setup mode, you exit setup and return to the Program menu. **Pressing and holding the MENU button for five seconds leaves the current screen and displays the Setup menu.**

### Left and Right Arrow Buttons (◀ and ▶)

Use these buttons to move backward (◀) and forward (▶) through the Program and Setup menus.

### Up and Down Arrow Buttons (▲ and ▼)

Use these buttons to move your selection up and down through a menu or list. When the desired item is highlighted, you press the ▶ arrow button to display that item's content. When a value is displayed (e.g. 70°F), the up and down arrows increase and decrease the value.



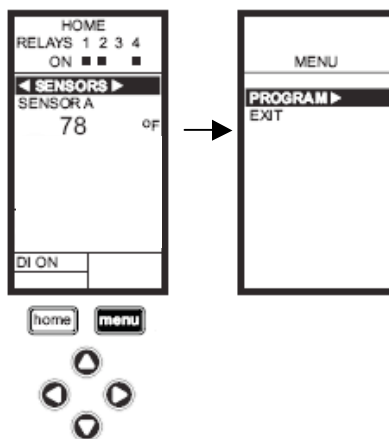
**A control value or operation will not be entered into the memory of the microprocessor until the ▶ or ◀ or HOME button key is pressed.**

### Home Screen

In the normal run state, the LCD home screen displays the current sensed temperatures, the active status of the output relays, and error and status codes. Active relays are indicated by the small black square (■) just below the relay number. Pressing the ◀ and ▶ buttons from the home screen cycles through each active output relay.

### Accessing the Menus

Menus are used for programming and viewing the settings. To access these menus from the home screen, press the **MENU** button.



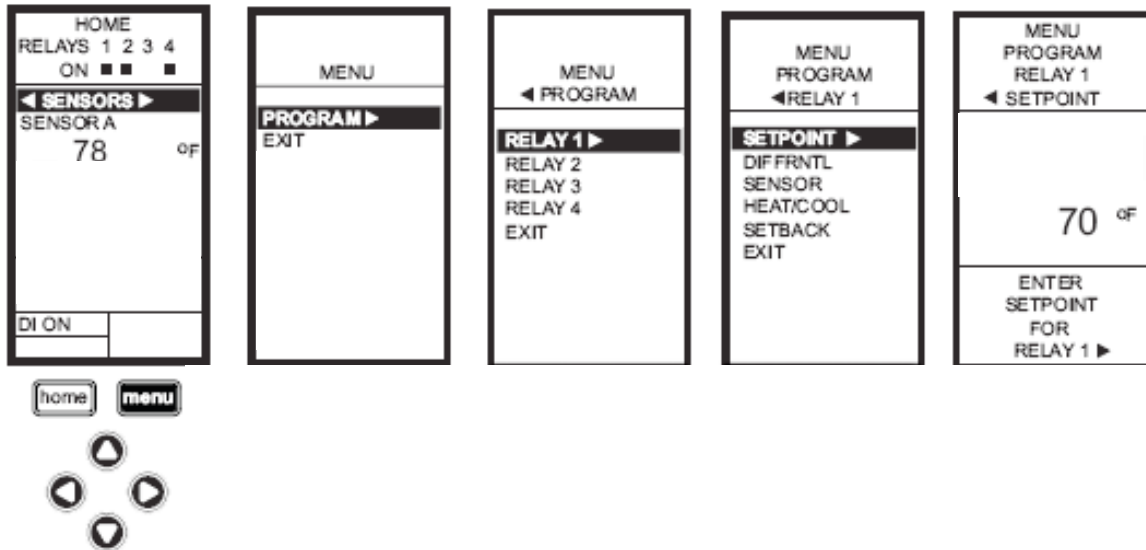
### Locking the Keypad

To lock the keypad, press and hold **HOME** and **MENU** for five seconds. To unlock, do the same.

## Changing Temperature Setpoint Values on Your Control

1. Press **MENU** to display program or exit option.
2. Press **▶** at the **PROGRAM** prompt.
3. Press the **▲** (up arrow) or **▼** (down arrow) to choose the relay to program. Press the **▶** to select.
4. Choose **SETPOINT** and press the **▶**
5. Enter the setpoint temperature using the **▲** or **▼** buttons. Press **▶** button to save your setpoint.

Repeat steps 1 through 5 to program the temperature setpoint each additional stage.



## Changing Differential Values on Your Control

1. Press **MENU** to display program or exit option.
2. Press **▶** at the **PROGRAM** prompt to view relays 1 through 4.
3. Press the **▲** (up arrow) or **▼** (down arrow) to choose the relay to program. Press the **▶** to select.
4. Choose **DIFFRNTL** and press the **▶**
5. Enter the differential value using the **▲** or **▼** buttons. Press **▶** to save.

Repeat steps 1 through 5 to program the differential values for each additional stage.

In heating mode, the Differential is below the setpoint. The relay de-energizes when the temperature rises to the setpoint. As the temperature drops to the setpoint minus the Differential, the relay energizes. In cooling mode, the Differential is above the setpoint. The relay de-energizes when the temperature falls to the setpoint. As the temperature rises to the setpoint plus the Differential, the relay energizes.

## PROGRAMMING STAGE CONTROL VALUES

Your system has been preprogrammed with the following values:

Stage 1 <b>Heating</b>	Set Point 62° F	Differential 2° F	On at 60° F	Off at 62° F
Stage 2 <b>Cooling</b>	Set Point 70° F	Differential 3° F	On at 73° F	Off at 70° F
Stage 3 <b>Cooling</b>	Set Point 73° F	Differential 3° F	On at 76° F	Off at 73° F
Stage 4 <b>Cooling</b>	Set Point 76° F	Differential 3° F	On at 79° F	Off at 76° F

**Caution:** The control will allow the user to program for both heating and cooling loads to be energized at the same time.



**Your four-stage controller may be programmed differently than as shown above if you have ordered drawings with specific controller requirements.**

### Changing Heat or Cool Stage operation

1. Press **MENU** to display program or exit option.
2. Press **▶** at the **PROGRAM** prompt to view relays 1 through 4.
3. Press the **▲** (up arrow) or **▼** (down arrow) to choose the relay to program. Press the **▶** to select.
4. Choose **HEAT/COOL** and press the **▶**
5. Choose **Heat** or **Cool** and press **▶** to save selection

### Locking the Keypad

To lock the keypad, press and hold **HOME** and **MENU** for five seconds. To unlock, do the same.

### How to Program for Night Setback

The controller does night setback using an optional feature called “Scheduling” and by referring to its internal clock and calendar. You must enable scheduling and set the calendar and then the clock in order to use night setback successfully. Here are the steps to make these settings:

### Initial Setup Procedure

#### Enabling scheduling

1. Press and hold the **MENU** button until the **Setup** screen appears.
2. Press the **▼** (down arrow) to choose **OUTPUTS**
3. Press the **▶** (right arrow key) to select **OUTPUTS**
4. Press the **▼** (down arrow) to choose **OPTIONS**
5. Press the **▶** (right arrow key) to reach **USE SCHED**
6. Press the **▶** (right arrow key), Then press the **▲** (up arrow key) to highlight the word **YES** to turn on scheduling.
7. Press the **MENU** key to save your setting (this returns you to the Menu screen)

## Setting the date

1. From the **Menu** screen
2. Press the ▼ button (down arrow key) to enter SCHEDULE
3. Press the ► (right arrow key) to select SCHEDULE
4. Press the ► (right arrow key) to select OPTIONS
5. Press the ▼ (down arrow) to highlight SET DATE
6. Press the ► (right arrow key) to set the date
7. On this menu the month will be blinking. Press the ▲ or ▼ (up or down arrow keys) to set the current month.
8. Press the ► (right arrow key) once to select date, it will be blinking. Use the ▲ or ▼ buttons. (up or down arrow keys) to set the current date.
9. Use the ► (right arrow key) to move to the year it will be blinking. Use the ▲ or ▼ (up or down arrow keys) to set the current year.
10. Press the **MENU** key to set the date.

## Setting the time

1. From the **Menu** screen
2. Press the ▼ (down arrow key) to highlight the word **SCHEDULE**
3. Press the ► (right arrow key) to choose **SCHEDULE**
4. Press the ► (right arrow key) to select **OPTIONS**
5. The words **SET TIME** will be highlighted. Press the ► (right arrow key) to set the time. The **hour** will be blinking. Use the ▲ or ▼ buttons. (up or down arrow key) to set the correct hour.
6. Press the ► (right arrow key) to move to the minute. The minute will be blinking. Use the ▲ or ▼ buttons (up or down arrow key) to set the correct minute.
7. Press the ► (right arrow key) to select the A.M./P.M. setting. A.M. or P.M. will be blinking. Use the ▲ or ▼ buttons. (up or down arrow key) to set the A.M. or P.M. and press the **MENU** key to save the time.

## Setting daylight savings time

1. From the **Menu** screen
2. Use the ▲ or ▼ buttons. (up or down arrow key) to highlight the word **SCHEDULE**
3. Press the ► (right arrow key) to select **SCHEDULE**
4. Press the ► (right arrow key) to select **OPTIONS**
5. Press the ▼ (down arrow) to highlight the word **DAYLIGHT** on the menu.
6. Press the ► (right arrow key) to program the controller for daylight savings time.
  - If today's date is between the second Saturday in March and the first Sunday in November highlight the word **YES**.
  - If today's date is on or after the first Sunday in November but before the first Sunday in March, highlight the word **NO**.
  - Press the **MENU** key to save your setting.

## Scheduling Night Setback

We will use the controller's built-in calendar and clock to make a night setback schedule. The controller requires that we **enter the schedule twice: once for Monday through Friday operation, and a second time for Saturday and Sunday operation.**

The controller defines day and night using settings it calls **Events**, The controller starts using **daytime** temperatures when **Event 1 (E1)** occurs. **E1** is a programmable time of day that you will set for some time in the morning. The controller starts using **nighttime** temperatures when **Event 2 (E2)** occurs. **E2** is a programmable time of day that you will set for some time in the evening.



## Establishing a schedule for night setback

1. From the **Menu** screen
2. Press the ▼ (down arrow key) to highlight the word **SCHEDULE**
3. Press the ► (right arrow key) to choose **SCHEDULE**
4. Press the ▼ (down arrow) to highlight **MON. – FRI.**
5. Press the ► (right arrow key) **E1 SETPT** will be highlighted.
6. Press the ► (right arrow key) **SETPOINT** will be highlighted. Press the ► (right arrow key) to enter your setting.
7. **E1 TIME** will be highlighted. Press the ► (right arrow key) to set **E1 time**. Remember that **E1** is the time of day when we begin to use **daytime temperatures**. Use the arrow keys to set the time.
8. Press the ◀ (left arrow key) to return to the schedule menu.
9. Press the ▼ (down arrow) to highlight the item **E2 SETPT**
10. Press the ► (right arrow key) for the **E2 menu**. Press the ▼ (down arrow key) to highlight the word **SETBACK**.
11. Press the ► (right arrow key) to return to the **Menu Schedule**.
12. **E2 TIME** will be highlighted. Press the ► (right arrow key) to set **E2 time**. Remember that **E2** is when we begin to use **evening temperatures**. Use the arrow keys to set the time you want your night setpoint period to begin.
13. Press the ◀ (left arrow key) to return to the **Menu Schedule**.
14. Press the ▼ (down arrow) to highlight the word **EXIT**.
15. Press the ► (right arrow key) to return to the **Menu Schedule**.
16. **SAT – SUN** should be highlighted. If it is not use the ▲ or ▼ buttons. (up or down arrow keys) to highlight it.
17. Press the ► (right arrow key) for **Saturday and Sunday scheduling menu**.
18. Follow the procedure in steps 6 through 14 for setting the time for night setback. Enter the same times and other settings as you did for the Monday through Friday segment.

## Setting the relays to use night setback

In order to make use of night setback you will need to establish a setback temperature for each of the four output relays of the control. The setback temperature should be lower than the setpoint temperature for that relay. The steps below show how to establish a setpoint and a setback for relay number one. Repeat the same steps for all four relays.

### Setting the relays

1. From the **Menu** screen
2. Highlight the word **PROGRAM** then Press the ► (right arrow key)
3. Highlight **RELAY 1 - 4** as necessary then to Press the ► (right arrow key) to program the relay.
4. Highlight the word **SETPOINT**
5. Press the ► (right arrow key) to adjust the setpoint. Use the ▲ or ▼ buttons. (up or down arrow key) to adjust the blinking temperature to the daytime temperature for the relay.
6. Press the ► (right arrow key) to return to the menu.
7. **DIFFERENTIAL** will be highlighted. Press the ► (right arrow key) to change the differential. In most cases you will set the differential to a small number of degrees in the range of two to five.
8. Press the ► (right arrow key) to return to the menu.
9. **SENSOR** will be highlighted. Press the ► (right arrow key) for sensor selections be sure that sensor A is highlighted, then press ► (right arrow key) to return to the menu.
10. **HEAT/COOL** will be highlighted. Press the ► (right arrow key) to select heat or cool depending on what type of equipment is connected to relay. Once the setting is correct press the ► (right arrow key) to return to the menu.

11. **SETBACK** will be highlighted. Press the ► (right arrow key) to enter a **setback temperature setting**.
12. Use the ▲ or ▼ buttons. (up or down arrow keys) to adjust the blinking temperature to your desired night setback temperature.
13. Press the ► (right arrow key) to return to the menu.
14. Press the ► (right arrow key) to return to the list of relays.
15. Repeat steps 3 through 13 above for the remaining relays.

### Temperature Sensor Calibration

As wire length increases, resistance increases and thus the temperature reading increases. If necessary, calibrate the sensor input by reducing the value by the amount shown in the table below. For example, a wire run with 18 gauge wire of 1,000 feet, requires a calibration offset of -6.0°F.



**If the calibration value in the table exceeds the controller's calibration limits of +/-10°F (+/-6°C), you must use a heavier gauge wire. For example, with a wire run of 1,000 feet you must use 20 AWG wire or heavier in order to calibrate for wire loss within the limits of the controller.**

AWG Rating	mΩ/ft	Temperature Offset in °F (Foot) <sup>a</sup>		
		200 ft	500 ft	1,000 ft
14	2.5	0.46	1.14	2.28
16	4.0	0.72	1.82	3.64
18	6.4	1.16	2.90	5.82
20	10.2	1.86	4.64	9.28
22	16.1	2.92	7.32	14.64
AWG Rating	mΩ/m	Temperature Offset in °C (Meter) <sup>a</sup>		
		100 m	200 m	300 m
14	8.3	0.44	0.86	1.30
16	13.2	0.68	1.38	2.06
18	21.0	1.10	2.18	3.28
20	33.5	1.74	3.48	5.22
22	52.8	2.74	5.48	8.22

<sup>a</sup> This is the distance from the controller to the sensor (already accounts for round trip distance).

### Calibrate the Sensor

Press and hold the menu button for 5 seconds. The screen will go blank during this time. After 5 seconds, the setup menu will display.

1. Choose SENSORS by pressing ►
2. At Setup Sensors menu, press ▼ to choose SENSOR A
3. Press ► and choose CALIBRATE
4. Enter the value using the ▼ and ▲
5. Press ► to save

## Operation

Each stage of the electronic controller has its own independent temperature that can be configured to operate in either the heating or cooling mode. The mode of operation for each stage is user determined by the programming keys.

### Cooling Mode Operation

Relay outputs are energized at the temperature setpoint plus differential value

Relay outputs are de-energized at the temperature setpoint value.

### Heating Mode Operation

Relay outputs are energized at the temperature setpoint minus the differential value.

Relay outputs are de-energized at the temperature setpoint value

Example: Using a device with one relay output, the corresponding load would be energized at the temperatures following based on the initial settings

Example of heating output:

<b>Stage (any) Heating</b>	Set Point 68° F	Differential 2° F	On at 66° F	Off at 68° F
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Example of cooling output:

<b>Stage (any) Cooling</b>	Set Point 70° F	Differential 3° F	On at 73° F	Off at 70° F
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## Temperature Display (Celsius/ Fahrenheit)

The controller by default uses Fahrenheit. To change to Celsius, complete the following:

**Press and hold the menu button for 5 seconds. The screen will go blank during this time. After 5 seconds, the setup menu will display.**

1. Choose **SENSORS** by pressing ►
2. At Setup Sensors menu, press ▼ to choose **SENSOR A**
3. Press ► and choose **UNITS**
4. Press ▼ to choose **DEG C.**
5. Press ► to save

To change from Celsius to Fahrenheit, complete the following:

**Press and hold the menu button for 5 seconds. The screen will go blank during this time. After 5 seconds, the setup menu will display.**

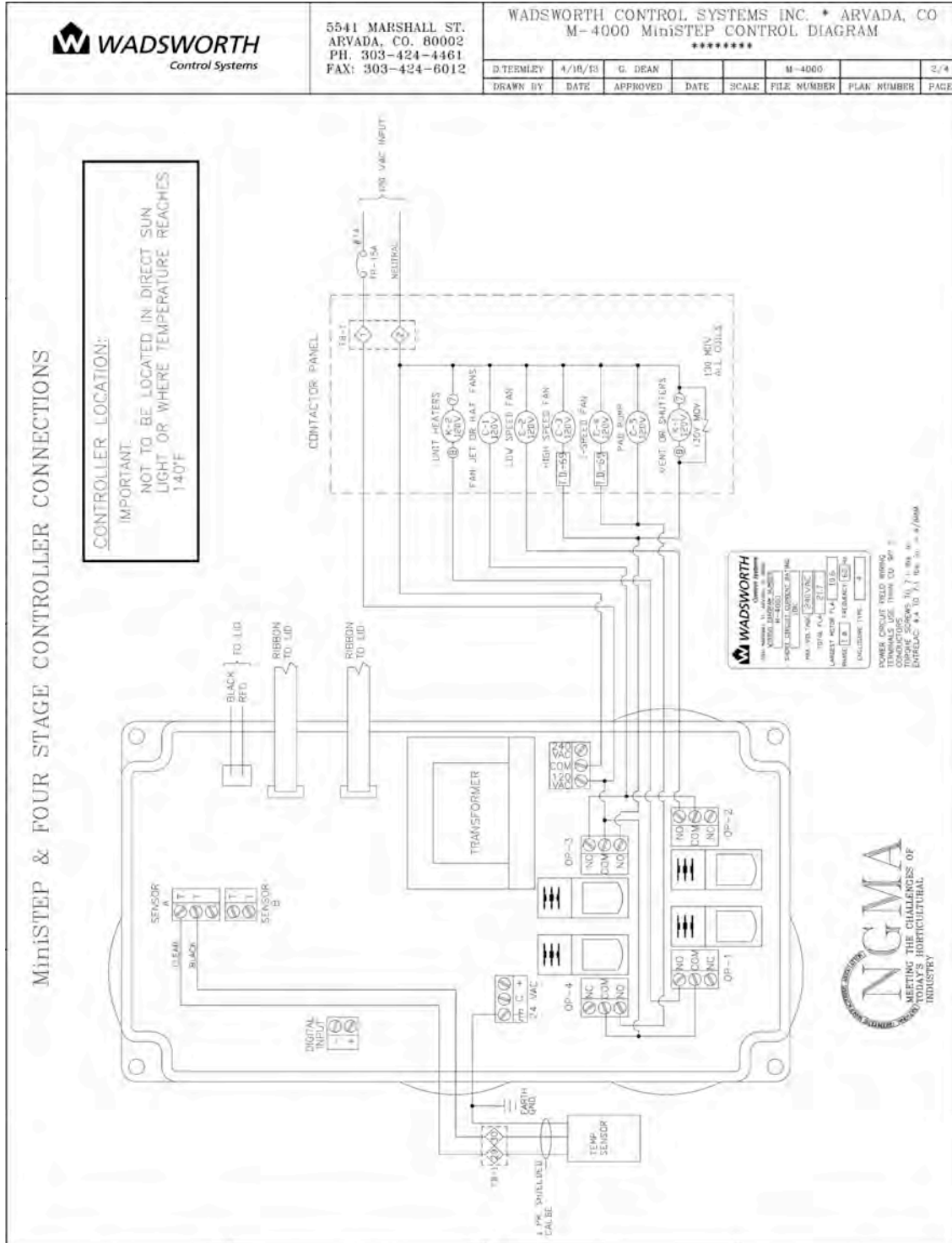
1. Choose **SENSORS** by pressing ►
2. At Setup Sensors menu, press ▼ to choose **SENSOR A**
3. Press ► and choose **UNITS**
4. Press ▼ to choose **DEG F.**
5. Press ► to save

**Parts list**

- M-4000 MiniSTEP 4-Stage Control, includes temperature probe and 75' of one-pair shielded cable.
- G-0407 Cable one-pair Shielded, 20 AWG, Stranded (sold by the foot) Sensor cable.
- H-2008 Solar Shield 4" diameter
- H-2832 Connects cable to solar shield and to MiniSTEP 4-stage control.

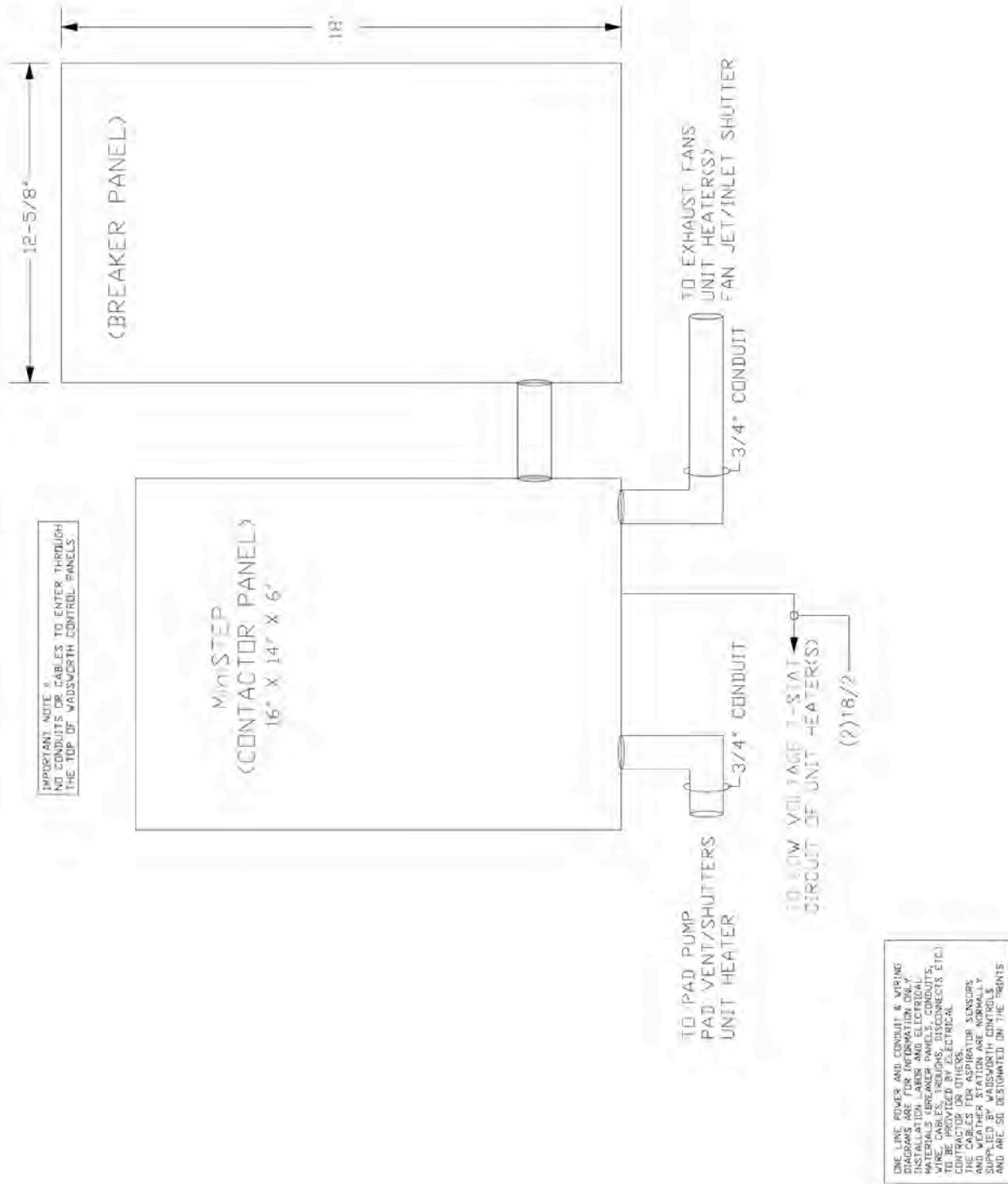
# MiniSTEP Diagrams

## Overview

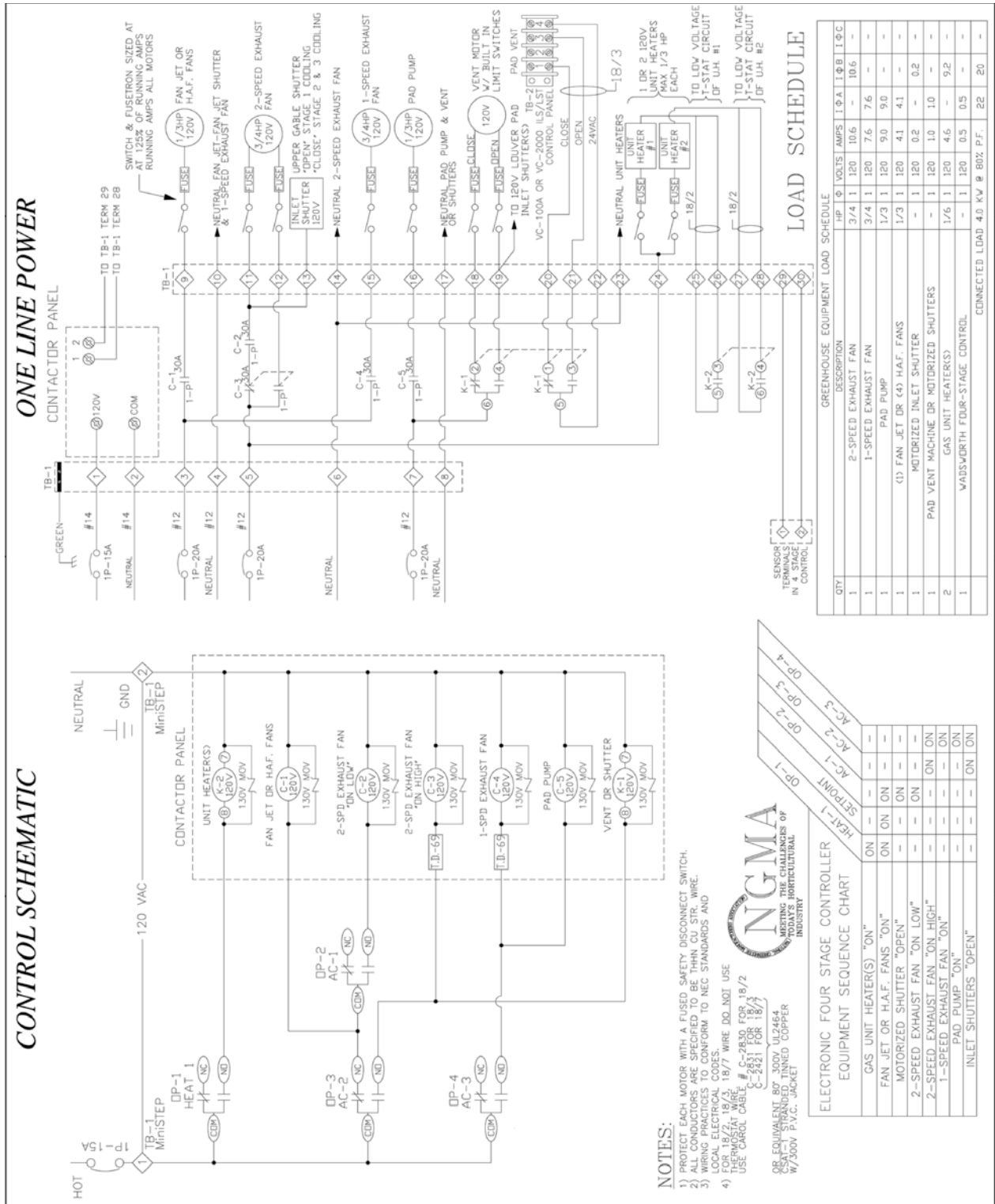




MiniSTEP Panel Layout



**MiniSTEP Control Schematic and One Line Power**





Troubleshooting

Problem	Solution
<b>Controller seems to read higher or lower than the actual temperature.</b>	If the controller reading seems to disagree with your reference reading by more than 10°F +/-, you may have corrosion in a splice in the cable that connects the sensor to the controller. Also, refer to the calibration section.
<b>EE error message</b>	<b>EEPROM Failure</b> — The values read back from the EEPROM are not the same as written into the EEPROM. This error cannot be field repaired. Contact Wadsworth to replace the device.
<b>-- on HOME Menu</b>	<b>Sensor Open or Shorted</b> — Two dashes display when a sensor (typically temperature) is open or shorted. An open circuit is considered anything greater than 1570 ohms (greater than 300F), shorted anything less than 770 ohms (less than -73F). Whichever stages are operating with this sensor cease to control (meaning relays go to OFF). This message can also mean that the sensor is programmed, but not physically connected.
<b>-60°F or 270°F (-51°C or 132°C) Blinking</b>	<b>Temperature Out of Range</b> — The temperature display blinks when the sensed temperature range is outside of the display range, below -60°F (-51°C) or above 270°F (132°C). The displayed value remains at that displayed limit and control continues. Controller continues to function unless an open or shorted state is detected.
<b>Does the controller save programmed values if the power is lost?</b>	Yes. The controller has an EEPROM that saves all values entered and restores them once power is reapplied.
<b>Can a controller be powered with DC voltage?</b>	No. The controller may be powered with 24 Vac, 120 Vac, or 240 Vac only, and a separate earth ground is required. You can only use one source of power, not a combination. Using more than one source of power may damage the controller.
<b>How do I know that my selection or value has been entered?</b>	Once you have selected an item from a list or entered a value using the ▼ and ▲ buttons, pressing the ◀ or ▶ or HOME button accepts your selection or value and stores it in the controller's memory.

## Contact Information

### Wadsworth Control Systems, Inc.

5541 Marshall Street  
Arvada, CO 80002  
1-800-821-5829  
303-424-4461  
Fax: 303-424-6012

Hours: 7:30 AM - 5:00 PM Mountain Standard Time.

### To Place an Order:

1-800-821-5829  
[orders@wadsworthcontrols.com](mailto:orders@wadsworthcontrols.com) (preferred)  
Fax: 303-424-6012

### Technical Support:

Hours: 7:30 AM – 4:30 PM Mountain Standard Time  
1-800-821-5829  
303-456-0436  
For emergency tech support  
720-879-3936 or 1-800-482-7943 (24/7 paging is available)  
Fax: 303-424-2389  
[tech@wadsworthcontrols.com](mailto:tech@wadsworthcontrols.com)

### Manuals:

There is a small fee for additional printed copies of the manual. However you are welcome to download additional copies free of charge by visiting our website. Note a password is required; you'll need to complete a quick form to gain access to the manuals on our website. <http://www.wadsworthcontrols.com/html/downloads.htm>

### Sales and Marketing:

[sales@wadsworthcontrols.com](mailto:sales@wadsworthcontrols.com)

We would like to hear about your experience with your STEP Up control. Please contact us with your feedback or to tell us your story [info@wadsworthcontrols.com](mailto:info@wadsworthcontrols.com).

### General Information:

[info@wadsworthcontrols.com](mailto:info@wadsworthcontrols.com)

## Limited Warranty:

Wadsworth Controls warrants that products of its own manufacture are free from defects of material and workmanship at the time of shipment by Wadsworth Controls. Wadsworth Controls extends no warranty of any kind on part or components purchased by Wadsworth Controls and any warranty on such parts or components is limited to the warranty granted by the original manufacturer or supplier thereof, if any. This warranty does not extend to goods subjected to misuse, neglect, accident, improper installation or alteration. This warranty is in lieu of any and all warranties under the Uniform Commercial Code relating to implied warranties of Merchantability and Fitness for a Particular Purpose and in lieu of all other warranties express or implied, except as to title. There are no warranties which extend beyond the description on the face thereof. The warranty expressed herein may be amended only by written instrument signed by an officer of Wadsworth Controls. The sole liability of Wadsworth Controls under this warranty is limited to replacing, repairing or issuing credit (at Wadsworth Controls discretion) for any products which are returned to Wadsworth Controls by Buyer during the warranty period. Wadsworth Controls obligation shall be additionally conditioned upon (a) Wadsworth Controls being promptly notified in writing upon discovery of such defects by Buyer, (b) the product being returned to Wadsworth Controls, transportation charges prepaid by Buyer, within 12 months from the date of shipment from Wadsworth Controls, and (c) Wadsworth Controls examination of such unit disclosing, to Wadsworth Controls satisfaction, that any defect has not been caused by misuse, neglect, improper installation, repair, alteration or accident.

CONTINGENCIES: Wadsworth shall not be responsible for any failure to perform due to causes beyond its control. These causes shall include, but not be restricted to, fire, storm, flood, earthquake, explosion, accident, acts of the public enemy, war, rebellion, insurrection, sabotage, delays in transportation, inability to secure raw materials or machinery for the manufacturer of its devices, acts of GOD, acts of Federal Government, or any agency thereof, acts of any state or local government, or agency thereof, judicial action, and strikes.

# Grow Light Control

Notes:

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1 Square = 1 Foot



**TITAN**  
CONTROLS

# Helios 1™

## 4 Light - 120 Volt Controller Instruction Manual



**Sunlight Supply, Inc.**

National Garden Wholesale.

VANCOUVER, WASHINGTON U.S.A.



[www.titancontrols.net](http://www.titancontrols.net)



**Sunlight Supply, Inc.**

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# Helios 1

- Warnings
- Helios 1 – Lighting Controller Overview
- Instructions for Operation
- Troubleshooting Tips
- Controller Specifications
- Installation Examples
- Warranty Information
- Service and Repair Program

## Warnings & Cautions

- Read all instructions before operating controller.
- \*This controller is designed for use with MAGNETIC OR ELECTRONIC BALLASTS.
- Do not put your controller in an area where it can get wet or sprayed.
- Mount your controller securely to the wall using hardware provided.
- When using “bug bombs” in area, cover controller completely to avoid corrosion.
- There are no serviceable parts in controller. Do not attempt to repair the unit.
- Breaking “warranty” seal will void your warranty.
- Do not put paperclips, tools, etc. into unit. Possible electrocution may occur.
- Make sure to verify your power source prior to wiring controller into power source.
- Check that all equipment that will be activated by this controller is the proper voltage.
- This controller is designed for 'Inside Use' only.
- Avoid placing the controller near heat generating sources.
- Use caution when operating controller in extremely humid environments.
- Do not use controller for purposes other than the unit was designed to function.
- Use controller within defined environmental specifications.
- Ask your Dealer for tips and techniques regarding the use of this controller.
- Be conscientious when disposing of any products.
- Enjoy your Titan Controls® environmental controller for years to come!

WARRANTY SERVICE: Please read warranty information first

If after reviewing the troubleshooting tips the unit will still not work, you should return it to the Dealer where you purchased the controller. They will be able to further evaluate the unit and test its various components and quite possibly will be able to identify and/or fix any problems. If the Dealer is unable to fix the unit, they will return it to us for factory repair.

If there are no Dealers in your area, you may contact us directly for technical support. If we cannot help you resolve the problem over the phone, we will issue you a RMA # (return merchandise authorization) authorizing you to return the unit to us for factory reconditioning (if the unit is under warranty). Contact the number below for a RMA and shipping address. Complete the form below and include it with your unit. Also please write the RMA # on the outside of the box.

Please package the unit in its original packaging. If it is damaged in shipment we cannot be responsible.

Once we receive the unit back, we will repair the controller within 48 hours (business) and return it to you freight prepaid via FedEx or UPS ground shipment.

Include the following if returning directly to Titan Controls

- Proof of purchase
- This completed form
- RMA # on the outside of the box

Return Merchandise Authorization Number (Required)

Company Name: \_\_\_\_\_

Contact Name: \_\_\_\_\_

Address: \_\_\_\_\_  
\_\_\_\_\_

Phone #: \_\_\_\_\_

Email address: \_\_\_\_\_

What is the nature of the problem? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Send to your nearest location – shipping address will be given when the RMA # is issued:



[www.titancontrols.net](http://www.titancontrols.net)

For technical assistance call us at 1-888-80-Titan or 1-888-808-4826.

## Warranty Information

- Titan Controls® warrants the original purchase of this product against defects in material and workmanship under normal use for three (3) years from the date of purchase.
- During the warranty period, Titan Controls® will, at our option, and without charge, repair or replace this product if the controller or any of its components fail or malfunction.
- All returns or repairs must be accompanied by a Return Merchandise Authorization (RMA) number prior to any service of the product.
- This warranty is expressly in lieu of all other warranties, expressed or implied, including the warranties of merchantability and fitness for use and of all other obligations or liabilities on the part of the seller.
- This warranty shall not apply to this product or any part thereof which had been damaged by accident, abuse, misuse, modification, negligence, alteration or misapplication.
- Controllers with serial numbers or date tags that have been removed, altered or obliterated; broken seals or that show evidence of tampering; mismatched board serial numbers or nonconforming parts, are excluded from coverage.
- Titan Controls® makes no warranty whatsoever in respect to accessories or parts not supplied by Titan Controls®.
- Monetary refunds of the warranty will not be given.
- The Buyer assumes all responsibility regarding the use & installation of this controller.
- All warranty service is provided through the factory or an authorized service representative.
- This warranty shall apply only to the United States, including Alaska, Hawaii and territories of the United States.
- Defective controllers need to be returned with the “proof of purchase/receipt”.
- For additional warranty information, contact a Titan Controls® Technical Service Representative or your Dealer.
- NOTE: Titan Controls® is a manufacturer of environmental controls. All sales offerings to the public are done through a nationwide group of Dealers. No sales offerings will be made directly to the general public.

## Service and Repair Program

- For all service and repairs please contact one of our Technical Service Representatives for a Return Merchandise Authorization (RMA) number.
- All factory service & repairs will be completed within 48 hours of receipt of controller and after authorization by customer for repairs.
- Titan Controls® will, at its discretion, repair or replace the controller.
- Factory calibration services are available for all Titan Controls®.
- Returning Units: Please contact your retail store for returns.

## Helios 1 – 120 Volt / 4 Light Controller Overview

The Helios 1 lighting controller is specifically designed for operation of high intensity discharge (HID) lighting systems. The controller will run your lights for any sequence over a 24 hour period by using premium German manufactured analog timer. The controller can handle up to a maximum of four (4) 1000 watt HID metal halide or high pressure sodium (HPS) grow lights. There is a 120 Volt accessory outlet located on the front of the controller. This outlet is only active when your lights are 'ON' and may be used to power devices up to 5 amps, such as an in-line lamp ventilation fan or a pump. The Helios 1 lighting controller provides up to 50 amps of capacity on a standard 120 volt circuit. The Helios 1 is built with only the highest quality components and will provide the user with years of trouble free service.

## Instructions for Operation

- \*Please consult with a licensed electrician prior to installation of the Helios 1.
  - \*DO NOT install this controller yourself if you DO NOT fully understand these instructions. High voltage is dangerous!
  - Connect your incoming 120 Volt power to the 3 screws under the protective back cover. Black/hot ( left screw), green/ground (center screw) & white/neutral (right screw).
  - \* Securely mount your Helios 1, using the hardware included, near your enclosure and away from any spray/water/mist, etc.
  - Hardwire or plug the controller into a confirmed 120 volt power source.
  - \*Verify that all your wiring connections are tight and that no loose wires are exposed.
  - \* Plug your lights into the outlets on the right and left side of the controller.
  - \* Adjust the analog timer to the current time of day. Set your timing pattern by pushing the 'time trippers' towards the center of the timer.
  - Make sure that all wires and cables have been properly secured.
  - Turn on the power switch to activate your light bank. When the relay is activated you will hear a “Click” sound.
  - Your Helios 1 will now control your lights at the desired settings until the power is defeated.
  - To change your lamps, turn 'OFF' the power switch and replace bulb.
- Caution: Lamps are hot and should be allowed to cool completely before handling.

## Troubleshooting Tips

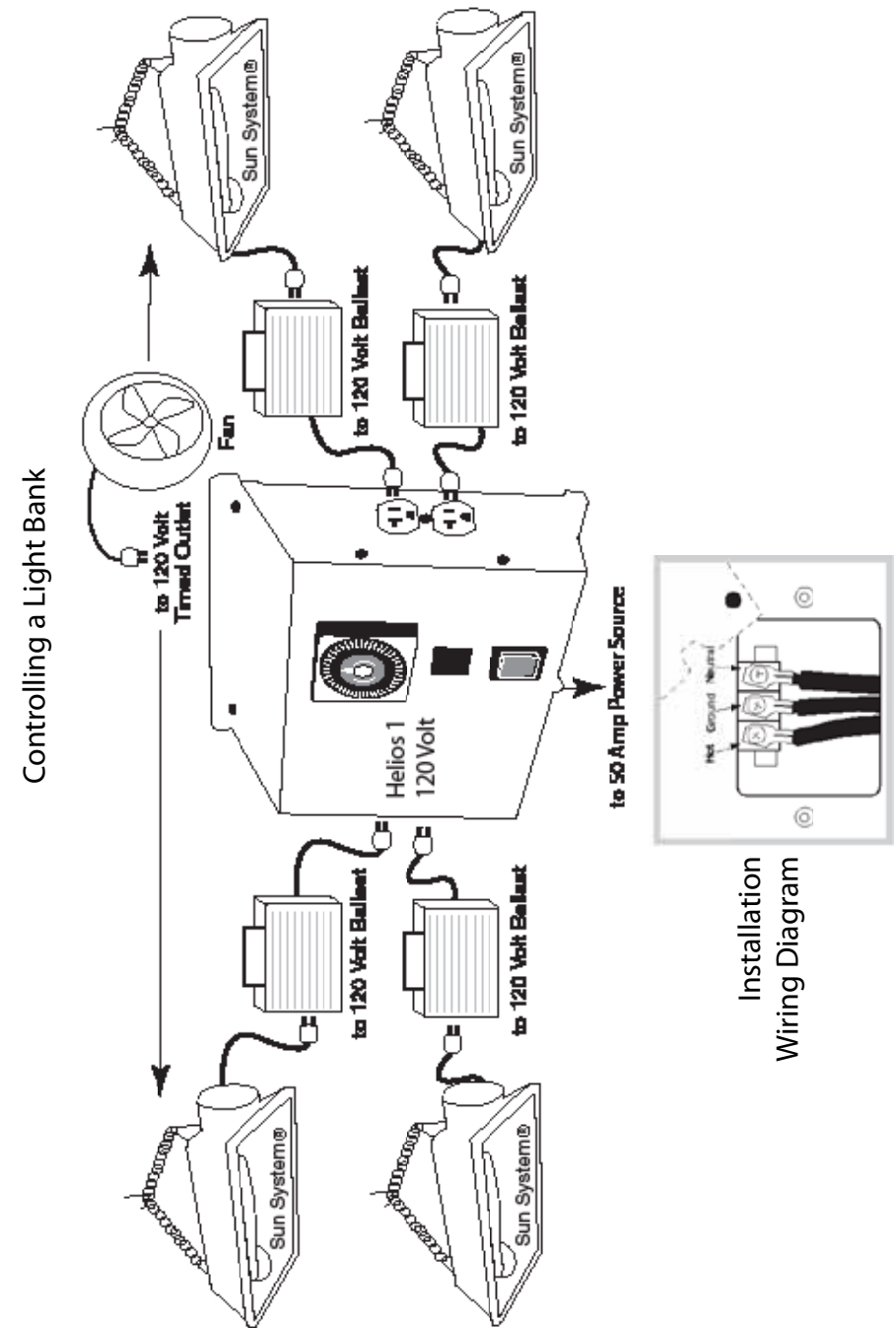
If the Helios 1 is not performing as expected, try the following:

- Confirm that your power input is active from your breaker panel and providing 120 Volts/50 Amps/60 Hz to the controller.
- Check the voltage input of your incoming cord set using a voltage test meter to verify power is flowing to the controller.
- Make sure all of your connections are tight. Loose connections can cause "arcing".
- Then confirm that power is active and proper at your 120 volt outlets.
- Verify that your power cords and ballasts are functioning properly and that there are no shorts or arcing occurring.
- Should you find your circuit breaker keeps tripping, check your breakers to verify that they are the right amperage for your application.
- If you turn 'OFF' the power switch and your lights remain on, contact us immediately for resolution.
- Still having problems with your Helios1? Please contact our Technical Service Representative to assist you further.

## Controller Specifications:

- Size = 11"H x 11"W x 4"D
- Weight = 4 lbs.
- Voltage Input = 120 VAC
- Voltage Output = 120 VAC
- \*Relay Coil Voltage = 120 Volts
- Maximum Amperage = 50 Amps
- \*Maximum Wattage = 4000 Watts (1000 watts per outlet)
- Hertz = 60Hz
- \*Time Switch = 24 hours with 15 minute increments
- Mechanical Relay Operations = 500,000 Cycles
- \*Electrical Relay Operations = 100,000 Cycles
- RoHS compliant = Yes
- Storage Temperature = 32°F (0°C) to 135°F (57°C)
- Operating Temperature = 40°F (5°C) to 125°F (52°C)

## Installation Example





# Evaporative Cooler

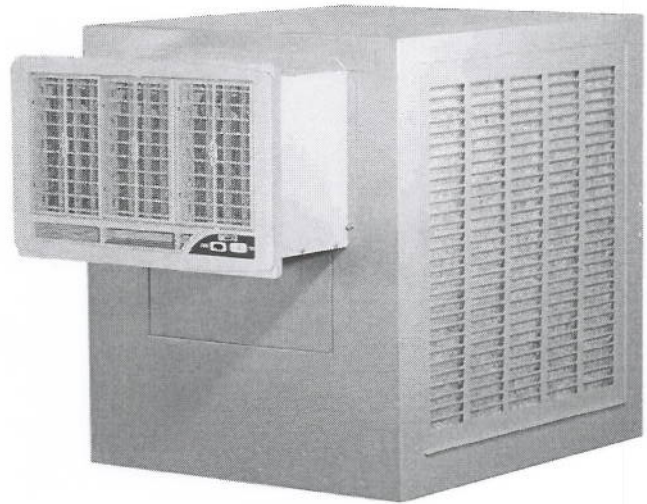


# OWNER'S GUIDE USE AND CARE MANUAL

**WINDOW COOLER MODEL: BW5501**

For Customer Assistance  
CALL 1-800-325-6952

DO NOT RETURN TO PLACE OF PURCHASE!



- \* Safety
- \* Installation
- \* Start-up
- \* Operation
- \* Maintenance
- \* Troubleshooting

**Congratulations:** You have purchased a product of superior performance and design, which will give the best service when properly installed, operated and maintained.

This guide will provide you with information needed to mount, operate, inspect, maintain, and troubleshoot your Aerocool window evaporative air cooler.

The first section, Installation and Start-Up, gives details for installation. The second section, Maintenance, contains operational and maintenance instructions, while Troubleshooting includes information on commonly encountered problems.

INSTALLER: Please deliver this guide to owner.

**READ AND SAVE THESE  
IMPORTANT SAFETY INSTRUCTIONS**

**WARNING - TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS, OBSERVE THE FOLLOWING.**

- Read all instructions carefully before installation.
- This cooler must be connected to 120 volt AC, 60 Hz (cycle) power only. NOTE: Improper voltage will void the pump and/or motor warranties and may cause serious personal injury or property damage.
- This cooler must be plugged into a GFCI protected receptacle, which has been properly installed in accordance with all local and national codes. If you are not sure that the receptacle is GFCI protected, consult with a qualified electrician.
- This cooler is equipped with a power cord having an equipment grounding conductor and grounding plug. Do not attempt to defeat this safety device by removing the grounding pin.
- Use of an extension cord is not recommended.
- Do not operate if plug or cord is damaged in any way. If the unit is damaged or malfunctions, do not continue to operate it.
- Always disconnect electrical power to unit before attempting to work on or service your cooler.
- Pump water tube has a restricting orifice to assure proper water flow rate to the pad. Do not remove this restrictor!

- Remove the plug from the electrical receptacle by pulling on the plug and not the cord.
- Do not operate this blower (fan) motor with any solid-state speed control device.
- Do not remove pad frames while cooler is running, this may cause the blower (fan) motor to overload and damage the motor windings.

**NOTE:**

- Do not locate unit near exhaust or vent pipes as odors or fumes may be drawn into cooler.
- Use of anode devices, chemical additives or treatments in this cooler will void the warranty.
- Your warranty does not cover shipping damage. Report all shipping damage at once to dealer or carrier making the delivery.
- For future reference, record the model and serial numbers, date and place of purchase of your evaporative cooler here:

Model # \_\_\_\_\_ BW5501 \_\_\_\_\_

Serial # \_\_\_\_\_

Date of Purchase: \_\_\_\_\_

Place of Purchase: \_\_\_\_\_

## INTRODUCTION

Your Aerocool evaporative air cooler was thoroughly tested and inspected before leaving the factory. This manual is your guide to proper installation procedures along with information about reasonable care and maintenance that will ensure safe, economical and trouble free cooling. Failure to follow these instructions may damage your cooler, impair its operation, create the potential for serious personal injury and/or void the warranty.

**Read it carefully.**

### A Note About Air Exhausting / Maximum Cooling

Since coolers function best when there are plenty of openings for the air to exhaust, you can leave doors or windows open so your house can breathe. To get the maximum capacity of your cooler, and to help keep insects, dust, dirt, etc out of the cooled space, the house should be maintained at a slightly positive air pressure (that is, there should be slightly more air going into the house than is leaving). This is controlled by how much the windows or doors are opened.

How much should you open your windows or doors? You should adjust your openings until the air pressure inside the house is nearly balanced with the air outside. A good method to determine when the air is reasonably balanced is to place a tissue paper against the screen in the window or door farthest from the cooler and adjust the other openings in the house until the tissue paper stays lightly on the screen. You can adjust different windows in the house to direct the most airflow to the areas that are occupied during different times of the day or night (example: living room windows during the daytime, bedroom windows at night.)

**HINT:** To avoid a rush of warm air when starting the cooler, be sure to turn on the pump for a few minutes to completely wet out the pads before starting the blower.

## INSTALLATION

Carefully read the contents of this manual and review the drawings of the cooler to familiarize yourself with the various parts before beginning the installation process.

**CAUTION:** Disconnect all electrical power to the cooler before attempting to install, open, or service your cooler.

Even while routinely inspecting or servicing the inside, the cooler can be accidentally started. Keep people and pets away from the cooler and electrical supply when you are working on it. Before opening, servicing or cleaning the unit, unplug the unit from the wall receptacle and take steps to ensure that the cord cannot be plugged back in and the cooler turned on accidentally. Do not plug power cord into the wall receptacle until installation or service work is complete.

Before attempting to install the cooler, confirm that the following preparations have been made:

- This cooler must be plugged into a 120 volt GFCI (Ground Fault Circuit Interrupter) protected receptacle. If you are not sure that the receptacle is GFCI protected, consult with a qualified electrician. This receptacle should be located within 5 feet of the window opening (cooler power cord is 6 feet long, use of extension cords is not recommended).
- Install cooler in a window where only fresh outside air can enter. Avoid installing the cooler in an area where the free air movement around and into the cooler is restricted or locations where obnoxious odors or fumes may be drawn into cooler from vent pipes, kitchen exhausts, etc.
- Verify that the supporting surface is strong enough to bear the weight of the cooler when in use. This unit will weigh approximately 250 pounds when operating at full capacity.
- Verify that the supporting surface is level in all directions.

### Platform or stand mounting

Installation normally involves locating the unit in a suitable window and the construction of a platform or stand to support the weight of the cooler. Since every installation is different, the exact requirements to mount and seal a cooler against the weather will be best determined by the location and at the time of the installation. Most installations will require blocking of the unused portion of the window around the duct, or other modifications to the window frame may be necessary. See illustration (Fig. 1) for a typical installation. Construct a platform or stand below the window, strong enough to support the weight of the cooler (approximately 250 pounds).

- Measure and construct a level platform or stand that will allow the bottom surface of the cooler duct to rest on the window sill. Allow clearance for the drain/overflow standpipe connection.
- Position the cooler so that the duct rests on the window sill and the grille flanges are inside the window frame. **DO NOT drive nails or screws through bottom pan into mounting surface, this will void the warranty.**
- Lower the window to rest on the top of the duct (vertically hung windows) or slide window closed against side of duct (horizontal slider windows). Block any remaining unused portion of the window opening with a suitable blocking material (Plexiglas, solid plastic sheet, solid wood panel, etc.). It will be necessary to seal any joints around the duct to prevent entry of rain, dust/dirt, insects, etc. Any good quality caulking or foam tape will work.

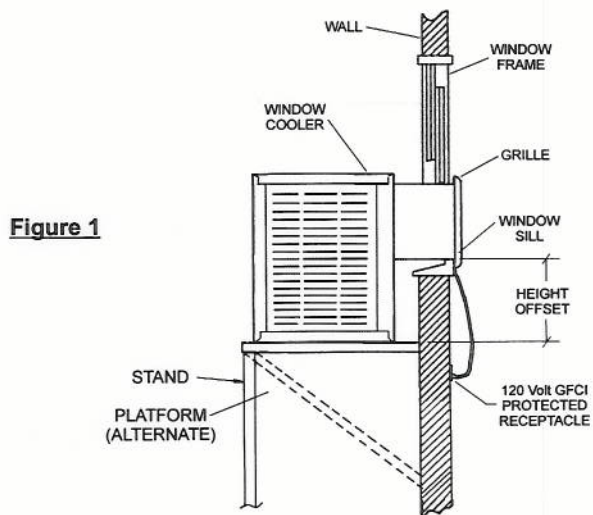


Figure 1

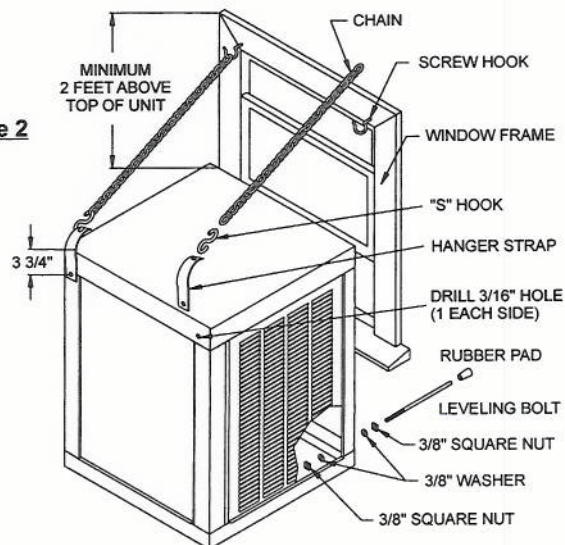


Figure 2

## Mounting using chain kit

An alternate installation method involves locating the unit in a suitable window and using the included chain mounting kit to support the weight of the cooler. As with platform or stand mounting, every installation will be different. The exact requirements to mount and seal a cooler against the weather will be best determined by the location and at the time of the installation. Most installations will require blocking of the unused portion of the window around the duct, or other modifications to the window frame may be necessary. See illustration (Fig. 2) for a typical installation. Remember, the framing around the window must be strong enough to support the weight of the cooler (approximately 250 pounds).

### Chain Kit contains:

2 - Screw Hooks	2 - "S" Hooks
2 - Leg Leveling Bolts	2 - Rubber Pads
4 - 3/8" Square Nuts	4 - 3/8" Washers
2 - Hanger Straps	2 - #10-24 x 1/2" long Bolts
2 - #10-24 Nuts	2 - 5' long Chain

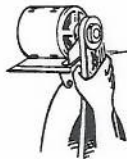
### Install chain kit as follows:

- Attach screw hooks to outside window frame approximately two feet above top of cooler. Be sure hooks are inserted to full depth in window framing for maximum strength.
- Attach chain to each hook.
- Attach hanging straps to top of rear corner support legs in the 3/16" diameter holes using the #10-24 bolts and nuts provided. Install "S" hooks in straps.
- Place leg leveling bolts thru 7/16" diameter holes in bottom of front corner support legs. Use nut and washer on outside of cabinet and install rubber pads on outside ends of leveling bolts. Place second nut and washer on leveling bolts inside cabinet.
- Position the cooler so that the duct rests on the window sill and the grille flanges are inside the window frame, allowing the "Z" shaped bracket, located under the grille, to rest on the window sill and butt against inside of window sill flange. Connect "S" hooks and screw hooks to chain links that bring the cooler closest to a level position.
- Use leg leveling bolts to brace the cooler away from the wall. Adjust bolts and chain to level cooler. NOTE: Cooler may need to be re-leveled to compensate for the added weight of water. Tighten nuts on leveling bolts inside cabinet.
- Lower the window to rest on the top of the duct (vertically hung windows) or slide window closed against side of duct (horizontal slider windows). Block any remaining unused portion of the window opening with a suitable blocking material (Plexiglas, solid plastic sheet, solid wood panel, etc.). It will be necessary to seal any joints around the duct to prevent entry of rain, dust/dirt, insects, etc. Any good quality caulking or foam tape will work.

## Belt Tension Adjustment

**CAUTION:** Disconnect all electrical power to the cooler and insure that belt is not rotating before adjusting belt tension.

Correct belt tension and alignment is important, proper setup reduces power consumption and prolongs life of belt and motor. Check belt tension by squeezing belt. Proper tension will allow deflection of 1/2 to 3/4 inch. To increase or decrease belt tension, loosen bolt in slot of motor support bracket. Adjust belt to proper tension and retighten bolt.

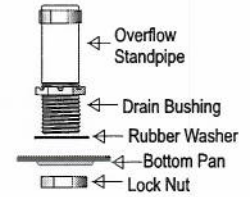


**CAUTION:** Never operate unit with pad frames removed. This will result in an overloaded condition and may damage the blower motor.

## Install Overflow Standpipe / Drain Line

Install overflow drain bushing in bottom of cooler as follows:

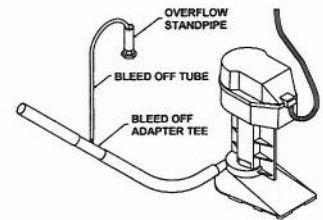
- Slide rubber washer over drain bushing.
- Push drain bushing through bottom of cooler, assemble and tighten lock nut.
- Screw plastic overflow standpipe into the drain bushing and tighten snugly (hand tight) to prevent leakage.
- Connect a suitable drain line (copper / PVC / garden hose) to drain bushing. Never drain water onto a roof; mineral build-up or damage to roof may occur.



**NOTE:** Drain water in accordance with local plumbing codes.

## Install Bleed-off

To minimize mineral scale "build-up" use the included bleed-off assembly. Remove the cap from the bleed-off tee; insert the black tubing and route the tubing through standpipe opening into the drain line. To prevent siphoning of the water, make sure that the bleed-off tee is above the water level.



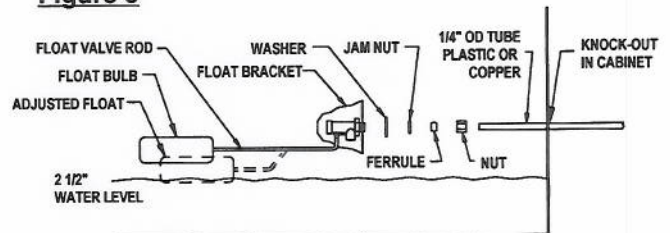
## Connect Water Supply

**CAUTION:** All plumbing installations must comply with local building and safety codes, and must be performed by qualified personnel only.

**NOTE:** Coolers should not be connected to "soft" water systems. Soft water will accelerate corrosion and decrease the effective life of pads and cooler cabinet. Connect water line as follows:

- A water supply valve should be installed at a convenient location, to allow the water supply to be turned on and off for servicing or winterizing. Minimum 1/4" diameter tubing should be used to provide water to the cooler, larger tubing is recommended if the distance from the valve to the cooler is greater than 100 feet, then reduced to 1/4" at the unit.
- Install float valve in the bracket provided.
- Connect tubing from water supply to float valve. Place compression nut and ferrule over end of tubing, insert tube into float valve then tighten compression nut to secure.

**Figure 3**



## OPERATION

### Controls

The rocker control switches are used to select the operating mode of the cooler. These switches control fan speed (High/Off/Low) and the cooling (pump) operation (On/Off).

## GENERAL INSPECTION

### Initial Start-up or Annual Inspection

**CAUTION:** Disconnect all electrical power to the cooler before attempting to install, open, or service your cooler.

Before start-up the cooler for the first time, or at the beginning of each cooling season, make sure that all required connections, adjustments, etc. have been made. Verify that:

- ✓ Cooler mounting is level; window and duct are sealed.
- ✓ Power supply cord is correctly routed, safe and secure.
- ✓ Motor, pump, drain, bleed-off, float valve, etc. are correctly installed and fully functional.
- ✓ Water line securely connected, turned on, no leaks noted.
- ✓ Float adjusted for proper water level.
- ✓ Pump impeller turns free and smooth. If in doubt, remove impeller cover (see "Cleaning Pump") and check rotation.
- ✓ Blower wheel, shaft, pulley and motor sheave bolts / setscrews are tight.
- ✓ Motor sheave / Blower pulley alignment okay; belt correctly tensioned, blower wheel turns freely.

### Start-up Check List

**CAUTION:** Never operate cooler with pad frames removed. This will result in an overloaded condition and may damage the blower motor.

To verify and check out the cooler installation on initial or annual start-up, the following procedure should be followed.

- ✓ Open building exhaust / relief vents (windows, doors, etc.)
- ✓ Plug supply cord into wall receptacle. Switch cooler "ON".
- ✓ Verify that pump starts and pads are evenly wet.
- ✓ Observe that motor starts and runs.

In case of trouble on any of these steps, refer to the Troubleshooting Chart on page 6.

### Cabinet Inspection Checklist

After initial start-up and for a few weeks afterwards, check for and/or observe the following: Refer to the Troubleshooting Chart on page 6 if necessary.

- ✓ Leaks from water lines, pad frames, cabinet, etc.
- ✓ Cooler pads: even wetting, no dry streaks.
- ✓ Confirm water level depth setting is correct.
- ✓ Verify full, even flow in water distribution system.
- ✓ Blower wheel / motor rotates freely, no unusual noises.
- ✓ Belt condition / tension / alignment OK.
- ✓ Check motor mounting, cabinet hardware, setscrews on pulleys, blower wheel are tight

## MAINTENANCE SCHEDULE

Regular maintenance and periodic inspection is the key to long and successful service from your Aerocool cooler. The cooler should receive major servicing at least once a year, more often if conditions require (dusty environment, constant use, poor water quality, etc.) For maximum cooling efficiency, long life and appearance, every two months during operation, the cooler should be inspected and cleaned.

### NOTE: Do Not Undercoat the Water Reservoir

Your cooler's water reservoir is finished with our Peblar XT® appliance-type finish. It is so hard that asphalt-type cooler water pan under-coatings will not stick to it. Undercoating will break free, clogging the pump and water distribution system.

**NOTE:** Do not use cooler cleaners, cooler treatments, anodes or other chemical additives in this evaporative cooler. Use of any additives or water treatment other than the furnished bleed-off will void your warranty and may impair the life of the cooler.

**Before starting any maintenance operation, thoroughly read all operating and maintenance instructions and observe all cautions and warnings.**

### Cleaning

**CAUTION:** Never wash your cooler cabinet with a garden hose; water may harm motor and pump or seep into ductwork. Motors damaged by water are NOT covered under warranty.

All foreign materials, mineral scale, hard water deposits, dirt, etc. should be removed from pad frames, water pan and other components. Your cooler's long lasting finish can be brought to like-new condition by using warm water and a soft cloth.

**NOTE:** Avoid using scouring pads, steel wool or wire brushes, as these will damage the finish and encourage corrosion.

### Maintenance & Inspection

**IMPORTANT:** Before operating cooler at the beginning of each cooling season, turn blower wheel, cooler motor and pump motor shafts by hand to make sure they turn freely. Failure to do so may result in burning out motor.

Periodic inspection of your cooler will enhance the chance for long, trouble-free service life. For maximum efficiency, every two months during operation, or any time the cooler is opened, the cooler should be inspected. Some suggested items to look for:

- ✓ Check for leaks from pad frames, cabinet, etc.
- ✓ Any dry spots or streaks on pads when pump is operating?
- ✓ Are bolts, nuts and set screws still snug?
- ✓ Are the bearings, etc., making any unusual noises?
- ✓ Does the blower wheel turn freely?
- ✓ Is float level set correctly?
- ✓ Is water in the bottom pan clean?
- ✓ Belt condition / tension / alignment OK?

### Adjust Belt Tension

Each time you inspect your cooler, be sure to check belt tension on motor and blower assembly. Check belt condition and replace it if frays or cracks appear. Check alignment of blower pulley with motor pulley (see page 3 for detailed steps).

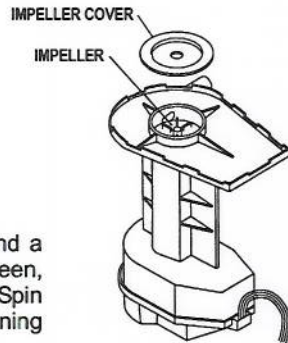
## Cleaning Water Pump & Hose

**CAUTION:** Disconnect all electrical power to the cooler before attempting to install, open, or service your cooler.

**CAUTION:** Do not allow pump to fall over and become submerged; water will damage pump motor.

Clean water pump and hose assembly as follows:

- Unplug pump cord, remove mounting bracket screw and remove pump from cooler. Shake gently to remove water.
- To prevent breakage, carefully release the snap-out impeller cover plate and remove cover plate from the pump body.
- Using a mild detergent solution and a soft cloth, clean deposits from screen, around impeller and cover plate. Spin impeller to dislodge any remaining foreign material.
- Remove any foreign material in the hose adapter (between the pump and hose), or between the hose and the water distributor assembly.
- Rinse and reinstall impeller cover plate.
- Reinstall pump and reconnect pump cord.



## Draining

Drain the cooler for cleaning or at the end of the season as follows:

- Unplug cooler power supply cord from wall receptacle.
- Turn off water supply and remove pad frames.
- Connect a drain hose to the drain fitting on the bottom of the reservoir, if not already connected to drain line.
- Remove overflow standpipe from the drain fitting.
- Drain and clean reservoir. Remove any remaining water with a rag or sponge.

## Touch-Up

The hardness, adhesion and smoothness of the internal and external finish on your cooler makes it extremely unlikely that scratches or chipping will occur. In the event that finish damage does occur, it should be promptly repaired by the following procedures:

1. Sand the area around bare metal spots.
2. Prime and paint with a quality paint.

**Do not use asphalt type cooler undercoat material in water reservoir. Undercoat will break free, clogging the pump and water distributor.**

## Lubrication

### Motor Bearings

The motors used in Aerocool coolers have ports for lubricating the motor and are oiled at the factory. If the need for oiling is indicated, see individual motor nameplate for specific instructions on re-lubricating the motor. Under normal use, these motors require oiling about every 12 months of operation. **Do Not Over-Oil.**

### Blower Shaft Bearings

Blower shaft bearings need periodic lubrication. They should be checked 20-30 days after initial start-up of operation. The oil cups on the bearings should be filled with a good grade of SAE 20W or 30W non-detergent oil when necessary. Under normal use, oiling is required every three months of operation. **Do Not Over-Oil.**

### Pump Motor Bearings

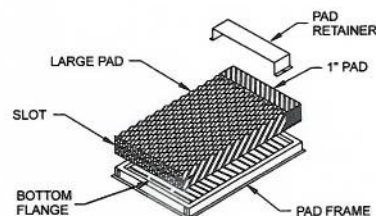
The pump motor does not require lubrication.

## Changing Cooler Pads

**CAUTION:** Disconnect all electrical power to the cooler before attempting to install, open, or service your cooler.

The condition of your cooler pad should be checked at least once a year; at the beginning of the season is best. However, your pad may need to be checked more frequently, depending on local air and water conditions. For instance, in areas where mineral content of the water is high or the air is dusty, deposits may build up in the cooler pad, restricting airflow. Clean or replace pad as follows:

- Remove pad assembly from cabinet.
- Lay pad frame on smooth, flat surface with pad retainer up. Observe the location / placement of the pad retainer. Remove retainer by sliding it out from under the pad frame flange. Carefully remove and discard old pad.
- Using a mild detergent, wash dirt and scale from pad frame and rinse with fresh water. Check slots at top of pad frame to be sure they are open and clear. Wire brushing is not recommended. If finish is damaged or rusting is noted, repair area as noted in the "Touch-Up" section.
- Place the slot in the end of the new pad over the bottom flange of the pad frame and push the pad down against the flange until it stops. Gently push the top of the pad into the pad frame. Slide the 1" thick pad on top of the large pad already in place. Replace the pad retainer by sliding the retainer under the pad frame flanges.
- Pre-soak pad (this will help with the wetting of the pad on start-up). Reinstall pad frame assembly into unit.



## Winter Shut Down:

- **Always** drain all of the water out of the cooler and water supply line when not in use for prolonged periods, and particularly at the end of the season. Keep the water line disconnected from both the cooler and the water supply so it does not freeze.
- **Disconnect** power from cooler during extended periods of non-use.

## REPLACEMENT PARTS

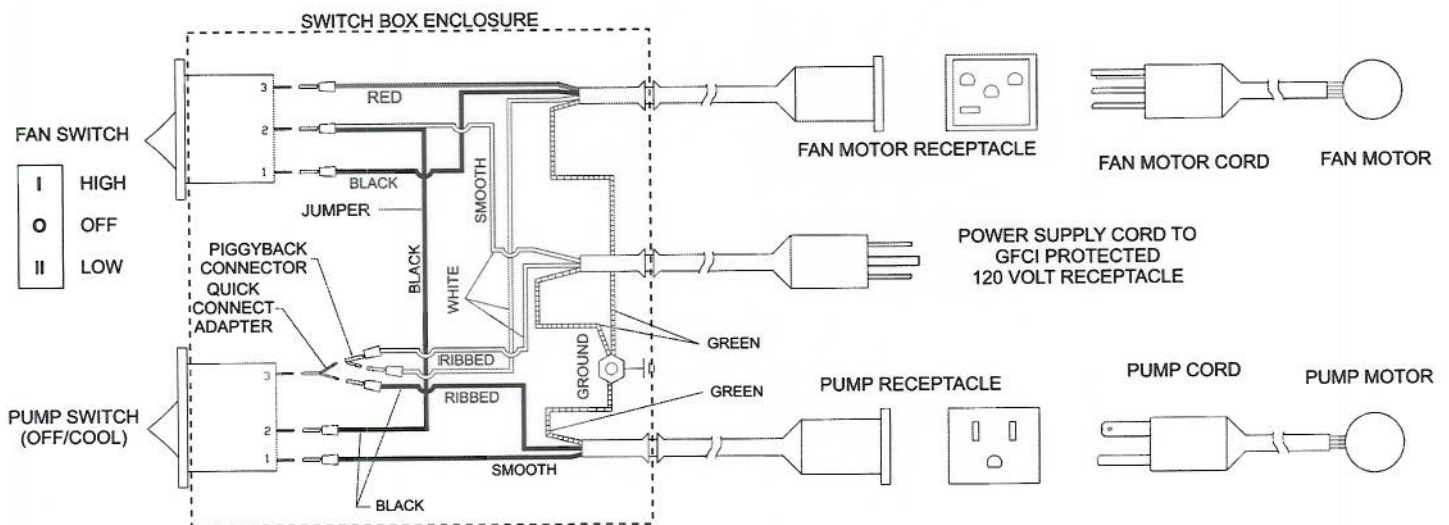
When ordering replacement parts, always refer to the serial and model number of your cooler. Use the part numbers listed in the accompanying parts list, as illustrated in the diagrams for your model.

## TROUBLESHOOTING GUIDE:

Should an obvious problem occur with your cooler consult the following table. If you cannot correct the problem, or if it persists, contact qualified service personnel.

PROBLEM / SYMPTOM	POSSIBLE CAUSE	CORRECTIVE ACTION
Water draining from unit	Float valve out of adjustment	Adjust float to 2 1/2" water depth
	Float movement obstructed	Free float from obstruction
	Float valve non-functional	Replace float assembly
Dry pads	Pump intake clogged	Remove obstruction
	Water pump non-functional	Replace water pump
	Clogged water line	Locate and free obstruction
	Pad trough clogged	Clear debris from trough
	Switch non-functional	Replace switch
	Wiring non-functional	Repair or replace non-functional wiring
	Water turned off to cooler	Turn on water supply
Motor does not start or no air delivery	Electrical power disconnected	Check power receptacle and cord
	Belt too loose or too tight	Adjust belt tension
	Defective motor	Replace motor
	Defective switch	Replace switch
	Broken belt	Replace belt
Inadequate air delivery	Insufficient air exhaust	Open windows to increase air flow
	Belt too loose	Adjust belt tension or replace is needed
	Pads plugged	Replace pads
Motor cycles on & off	Low voltage	Check voltage
	Excessive belt tension	Adjust belt tension
	Blower shaft tight or locked	Oil or replace bearings
	Bearings dry	Oil bearings
	Non-functional motor	Replace motor
Noisy operation	Blower rubbing on housing	Reposition wheel
	Motor sheave or blower set screws loose	Tighten set screws
Excessive humidity in house	Inadequate exhaust	Open doors and windows to increase ventilation

## WIRING DIAGRAM



# Exhaust Fan





# CANARM®



## INDUSTRIAL/COMMERCIAL PRODUCT CATALOGUE

CANARM.... PROVIDING CUSTOMERS WITH VALUE, KNOWLEDGE AND QUALITY PRODUCTS

## MODEL: SD - STANDARD WALL EXHAUST FANS

MODEL #	FAN SIZE	H.P.	OPERATION SPEED	RPM	CURRENT LOAD AMPS		INPUT WATTS	FRAMING DIMENSIONS	SHIPPING WEIGHT	
					Ⓢ115V	Ⓢ230V				
S8-E2	8"	1/20	2	HIGH LOW	1550 1300	0.95 0.45	-	190	11" X 11"	12 lbs
S10-E2	10"	1/20	2	HIGH LOW	1550 1300	1.2 0.7	-	125	13" X 13"	13 lbs
S12-E1	12"	1/4	1		1750	3.5	-	245	15" X 15"	28 lbs
S12-E2	12"	1/4	2	HIGH LOW	1760 1180	3.4 2.3	-	230 132	15" X 15"	32 lbs
S12-EV	12"	1/4	VARIABLE	MAX MIN	1625 600	2.2	1.1	205	15" X 15"	32 lbs
S14-E1	14"	1/4	1		1740	3.6	-	257	17" X 17"	30 lbs
S14-E2	14"	1/4	2	HIGH LOW	1740 1170	3.8 2.2	-	253 137	17" X 17"	34 lbs
S16-E1	16"	1/4	1		1740	3.7	-	274	19" X 19"	33 lbs
S16-E2	16"	1/4	2	HIGH LOW	1740 1170	3.7 2.3	-	270 152	19" X 19"	36 lbs
S16-EV	16"	1/4	VARIABLE	MAX MIN	1625 450	2.6	1.3	248	19" X 19"	36 lbs
S18-F1	18"	1/3	1		1700	4.8	-	448	21" X 21"	37 lbs
S18-F2	18"	1/3	2	HIGH LOW	1700 1140	5.7 3.0	-	446 250	21" X 21"	43 lbs
S18-FV	18"	1/3	VARIABLE	MAX MIN	1625 390	3.7	1.9	378	21" X 21"	45 lbs
S20-F1	20"	1/3	1		1735	4.8	-	322	23" X 23"	41 lbs
S20-F2	20"	1/3	2	HIGH LOW	1745 1165	4.3 2.6	-	315 190	23" X 23"	45 lbs
SD24-F1	24"	1/3	1		1075	4.3	-	370	27" X 27"	46 lbs
SD24-GV	24"	1/2	VARIABLE	MAX MIN	1100 310	4.2	2.1	290	27" X 27"	56 lbs
SD30-G1 D	30"	1/2	1		1075	4.6	2.3	600	33" X 33"	72 lbs
SD36-G1 D	36"	1/2	1		850	6.0	3.0	660	39" X 39"	88 lbs

RPM minimum is determined when louvers are opened 1"

NOTE: Wind has a significant effect on exhaust fans. A 10mph wind creates a .05" pressure against the fan. A 20mph wind creates a .20" pressure and 30mph a .45" pressure.

These pressures are in addition to the static pressure in the building. Wind blocks or hoods should be included in all designs where fans will be subjected to winds above 10mph.

## MODEL: SD - STANDARD WALL EXHAUST FANS

Canam LFI's standard wall fans follow a tradition of quality in design, materials and construction. All of our Standard Wall Fans are developed to be efficient and economically priced. All variable speed Standard Wall Fans use an energy efficient variable speed, dual voltage motor and blade combination.

To determine the proper fan for your application, use the following formula:

**# of cubic feet in room / # of minutes per air change = required CFM capacity**

example: A general office (see chart) which requires an air change every 10 minutes, would require the following fan capacity.

**If office is 100' x 40' x 10' = 40,000 cubic feet. 40,000 cubic feet / 10 minutes per air change = 4000 required CFM**

From the chart, you would select a fan that is rated at 4000 CFM at 1.8" static pressure.

APPLICATION	MIN. PER AIR CHANGE	APPLICATION	MIN. PER AIR CHANGE	APPLICATION	MIN. PER AIR CHANGE	APPLICATION	MIN. PER AIR CHANGE
assembly hall	7	corridor	10	garage	5	projection booth	2
auditorium	10	dairy	4	general office	10	school	7
barber shop	6	dance hall	5	gymnasium	8	store	8
basement	8	department store	6	hospital	8	summer cooling	1
battery room	4	dry cleaning	5	laundry	2	tavern	3
boiler room	1	engine room	6	locker room	3	tailor	3
bowling alley	5	factory	6	machine shop	8	transformer room	1
church	15	large room	3	planting room	3	warehouse	12
classroom	6	laundry	4	pressing room	1	welding shop	2

**CFM AIRFLOW CAPACITY**

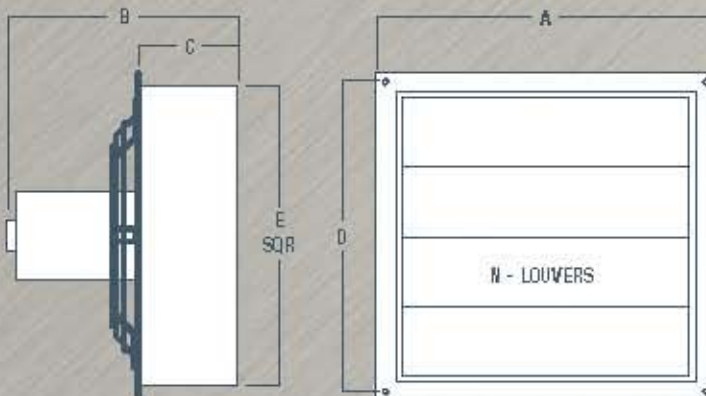
0" SP	.10" SP	.125" SP	.25" SP	CFM WATTS	SOUND LEVEL DECIBEL (A)
360	270	230	0	2.50	48
300	150	110	0		
690	590	570	0	4.72	56
590	460	390	0		
1640	1540	1510	1390	6.00	63
1650	1550	1520	1390	6.74	64
1090	950	930	-		7.31
1650	1540	1510	1390	7.50	60
560	440	420	-		
2170	2070	2030	1860	8.05	67
2180	2080	2060	1890	8.22	65
1350	1190	1160	-		8.69
2370	2270	2210	2060	8.28	68
2380	2280	2230	2070	8.44	69
1640	1490	1430	-		9.80
2370	2270	2210	2063	9.15	63
610	580	570	-		
3200	3090	3040	2920	6.89	73
2380	2280	2230	2070	8.44	69
1640	1490	1430	-		9.80
3150	3050	2980	2860	8.07	74
700	650	630	-		
3420	3220	3170	2920	10.00	77
3440	3240	3180	2930	10.20	67
2300	2000	1950	-		
3420	3220	3170	2920	10.00	77
5050	4500	4810	4400	13.20	72
800	710	650	-		
8000	7000	6000	5000	11.50	82
12000	11000	10500	9500	13.00	72

**AVAILABLE ACCESSORIES**

**Weather Hood**



HFP-18G - fits 8" to 18" fans  
 HFP-24G - fits 20" to 24" fans



**MODEL:**

**SD - STANDARD WALL EXHAUST FANS**

- ▶ **totally enclosed, ball bearing motor with thermal overload protection**
- ▶ **NEW! Heavy duty OSHA motor mount guard**
- ▶ **motor mount is manufactured with heavy welded rods and has a powder coated finish**
- ▶ **fan blades are well balanced, heavy gauge aluminum or galvanized**
- ▶ **steel welded box housing with durable powder coated finish**
- ▶ **aluminum shutters are supported by long life nylon bushings (30" & 36" have PVC shutters)**
- ▶ **shipped completely assembled**



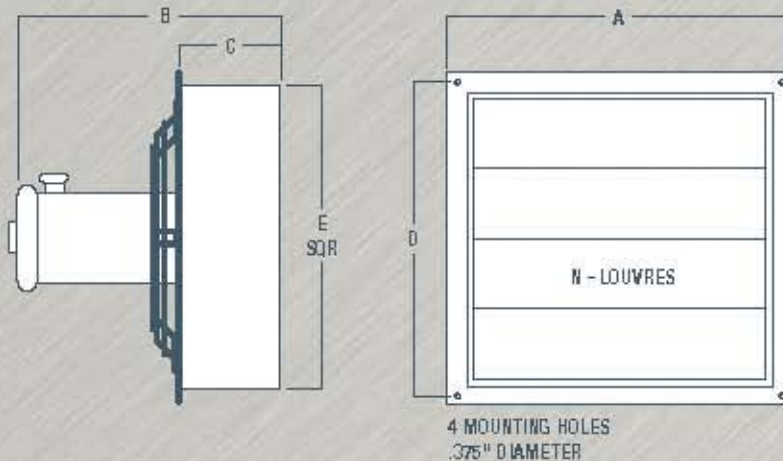
**DIMENSIONS**

FAN SIZE	A	B	C	D o/o	E	N
8"	13 1/4"	10"	4"	12"	10 3/4"	2
10"	15 1/4"	10"	4"	14"	12 3/4"	2
12"	17 1/4"	14"	6"	16"	14 3/4"	3
14"	19 1/4"	14"	6"	18"	16 3/4"	3
16"	21 1/4"	14"	6"	20"	18 3/4"	4
18"	23 1/4"	15"	6"	22"	20 3/4"	4
20"	25 1/4"	16"	6"	24"	22 3/4"	5
24"	29 1/4"	16"	6"	28"	26 3/4"	5
30"	35 1/4"	19"	6"	34"	32 3/4"	16
36"	41 1/4"	16"	6"	40"	38 3/4"	20

# EXPLOSION PROOF STANDARD WALL EXHAUST FANS

Canarm LFI's explosion proof fans follow a tradition of quality in design, materials and construction. Using our quality "Standard Fan" housing and motor mount as the basis for design, we have developed an efficient, economically priced Explosion Proof Fan. All Explosion Proof Fans have a single speed, dual voltage explosion proof motor that meets and conforms to all the standards that are listed below.  
 CLASS I - GROUP C, CLASS I - GROUP D,  
 CLASS II - GROUP F, CLASS II - GROUP G

- ▶ **totally enclosed, ball bearing motor with thermal overload protection**
- ▶ **NEW! heavy duty OSHA motor mount guard**
- ▶ **fan blades are well balanced, heavy gauge aluminum**
- ▶ **steel welded box housing with durable powder coated finish**
- ▶ **aluminum shutters are supported by long life nylon bushing**
- ▶ **shipped completely assembled**



## DIMENSIONS

FAN SIZE	A	B	C	D o/o	E	N
12"	17 1/4"	20 1/2"	6"	16"	14 3/4"	3
18"	23 1/4"	20 1/2"	6"	22"	20 3/4"	4
24"	29 1/4"	20 1/2"	6"	28"	26 3/4"	5

MODEL #	FAN SIZE	MOTOR H.P.	VOLTS	AMPS	OPERATION SPEED	FAN RPM	AIRFLOW CAPACITY - CFM				FRAMING DIMENSIONS
							0" SP	.05" SP	.10" SP	.25" SP	
SD12-XPFF	12"	1.8	115/230	6.6/3.3	single	1625	1640	1600	1540	1390	15" x 15"
SD18-XPFF	18"	1.8	115/230	6.6/3.3	single	1625	3200	3150	3090	2920	21" x 21"
SD24-XPFF	24"	1.8	115/230	6.6/3.3	single	1625	5500	5400	5310	5100	27" x 27"

RPM minimum is determined when louvers are opened 1"

NOTE: Wind has a significant effect on exhaust fans. A 10mph wind creates a .06" pressure against the fan. A 20mph wind creates a .20" pressure and 30mph a .45" pressure. These pressures are in addition to the static pressure in the building. Wind blocks or hoods should be included in all designs where fans will be subjected to winds above 10mph.



**CANARM LTD.**  
Corporate Office  
2157 Parkedale Avenue  
Brockville, Ontario, Canada K6V 5V6  
TEL: (613) 342-5424 • FAX: 1-800-263-4598

**CANARM LTÉE.**  
Distribution Centre  
2555 Rue Bernard Lefebvre  
Laval, Quebec, Canada H7C 0A5  
TEL: (450) 665-2535 • FAX: (450) 665-0910

**CANARM LTD.**  
US Distribution Centre  
808 Commerce Park Drive  
Ogdensburg, New York, USA 13669  
TEL: 1-800-267-4427 • FAX: 1-800-263-4598

[www.canarm.com](http://www.canarm.com)

04/08

Specifications subject to change without notice.  
Due to limitations with the printing process the products illustrated are representative  
only of the actual products.  
Printed in Canada

Model #	Fan Size	Motor HP	Operation		Current Load Amps		Input Watts	Airflow Capacity - CFM				CFM Watts	Sound Level	Framing Dimension	Shipping Weight
			Speed	Fan Speed	@ 115V	@ 230V		0" S.P.	.10" S.P.	.125" S.P.	.25" S.P.				
S-10-B2	10"	1/20	Two	High 1550	0.95/.45		125	690/580	590/460	570/390	0/0	4.72	56/50	13"x13"	13
S-14-E1	14"	1/4	Single	1740	3.6		257	2,170	2,070	2,030	1,860	8	67	17"x17"	30
S-18-F1	18"	1/3	Single	1740	3.7		448	3200	3090	3040	2920	6.89	73	21"x21"	37
S18-FV	18"	1/3	Variable	1625/390	3.7	1.9	378							21"x21"	45
S-20-F1	20"	1/3	Single	1735	4.8		322	3420	3220	3170	2920	10	77	23"x23"	41

NOTE: RPM minimum is determined when louvers are opened one inch

Wind has a significant effect on exhaust fans. A 10 mph wind creates a 0.05" pressure against the fan. A 20 mph wind creates 0.20" pressure and 30 mph a 0.45" pressure. These pressures are in addition to the static pressure in the building. Wind blocks or hoods should be included in all designs where fans will be subjected to winds above 10 mph

Warranty 1 year on all components

CANARM LTD [www.canarm.com](http://www.canarm.com)

# Motorized Intake Shutter

# BACKDRAFT DAMPERS

MODEL 3000, 3100, 3200



**BLADE OPTION:**

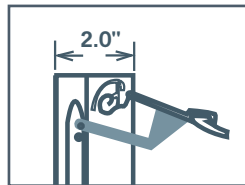
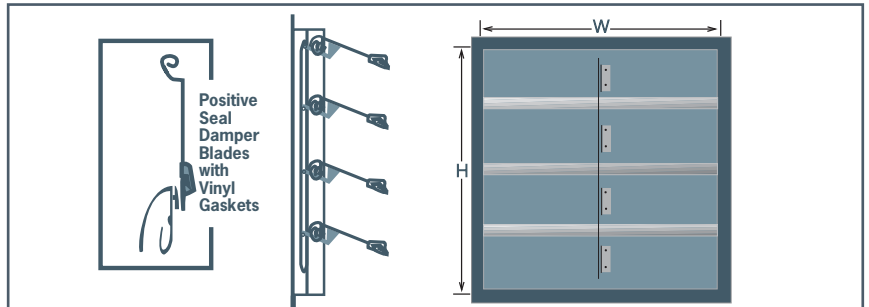
**SR:** 0.016" - 0.020" roll formed aluminum with vinyl gasket - used with fan motors under 1 HP

**SE:** 0.05" extruded aluminum with vinyl gasket - used with fan motors over 1 HP

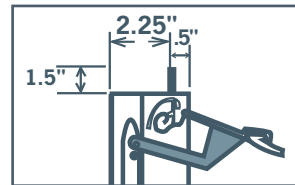
**FEATURES**

- Sturdily constructed from all aluminum extrusions.
- Roll form blades or extruded aluminum blades.
- Available in any combination of width and height.
- Less than 1% leakage.

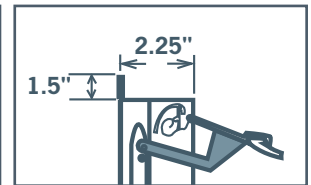
**Note** 3000 & 3100 Series are undercut by 1/4".  
3200 Series is cut exact.



**SERIES 3000**  
SIDE MOUNT - NO FLANGE



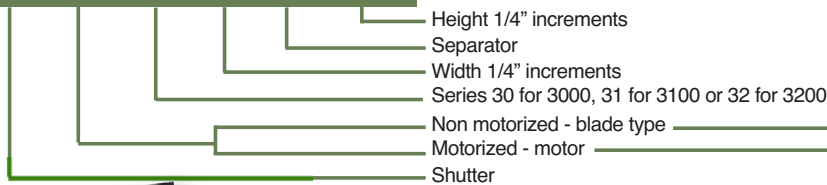
**SERIES 3100**  
INWARD MOUNT



**SERIES 3200**  
OUTWARD MOUNT

## ORDERING METHOD FOR BACKDRAFT & MOTORIZED BACKDRAFT DAMPERS

**S R 32 16 X 16**



- R - for Roll form (fans using under 1 HP motors)
  - E - for Extruded (heavier blades for motors above 1 HP)
  - X - for 115/230V
  - Z - for 24V AC
- Extruded blades with multi products motor is standard*



See page K5 in Controls & Thermostats section for Multi-Products replacement motors.

**Note** Non-standard shutters are non-returnable and cannot be cancelled.

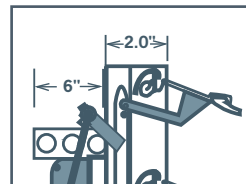
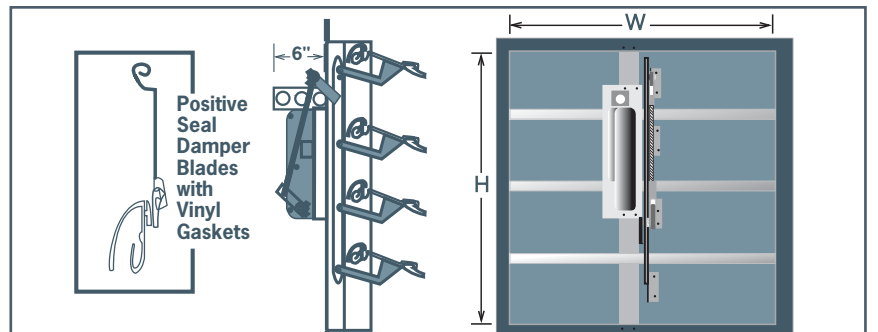
**FEATURES**

- Sturdily constructed from all aluminum extrusions
- Damper motor factory installed (24V, 115/230V - must specify at time of order)
- Maximum 30.25 sq. feet per motor
- Positive seal keeps leakage less than 1%
- Blades are 0.5" extruded aluminum with vinyl gasket
- Double panel available 30" and up
- Standard multi products motor

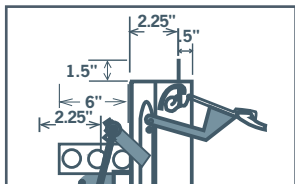
**Note** 3000 & 3100 Series are undercut by 1/4".  
3200 Series is cut exact.

# MOTORIZED BACKDRAFT DAMPERS

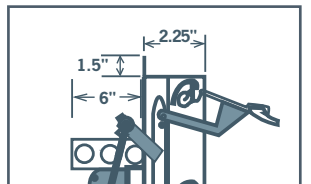
MODEL 3000M, 3100M, 3200M



**SERIES 3000M**  
SIDE MOUNT - NO FLANGE



**SERIES 3100M**  
INWARD MOUNT



**SERIES 3200M**  
OUTWARD MOUNT

**ACCESSORIES**

- Bird screen
- Special coatings
- Insect screen
- End switch



# Motorized Back Draft Dampers User Guide

## INSTALLATION

The motorized back draft dampers are available in 3 different mount options (**Figure 1**):

- Series 3000M Side Mount** (no flange),
- Series 3100M Inward Mount** (flange on outside)
- Series 3200M Outward Mount** (flange on inside).

Installation varies on the chosen mount option and the specific customer application.

## ELECTRICAL CONNECTIONS

**WARNING: All electrical work should be performed by a qualified electrician, following local codes.**

Damper motors are available in the following voltages (must be specified at time of order):

- 115/230 Volt, 60 Hz, Single Phase
- 24 Volt AC

Electrical connections are made in the motor wiring box.

### 115/230 Volt Connection (**Figure 2**)

Connect wires as shown in **Figure 2**.  
Connect ground wire to the green **ground screw** in the wiring box.

### 24 Volt AC Connection (**Figure 3**)

Connect wires as shown in **Figure 3**.  
Connect ground wire to the green **ground screw** in the wiring box.

Shutter opens when power is supplied, and closes tight when power is off.

Motorized shutters can be wired through an on/off switch or using thermostat controls.

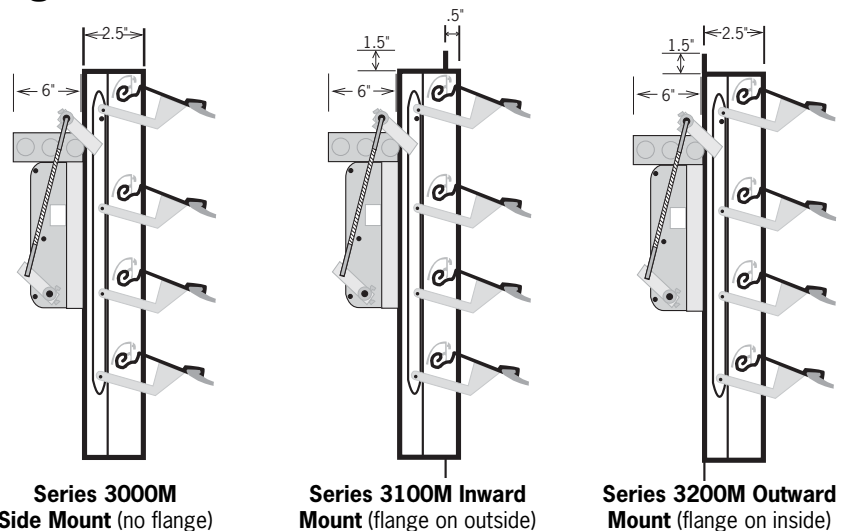
**Never wire a motorized shutter in line with a variable speed fan.**

**This product is not for use in corrosive environments. Do not pressure wash.**

## REPLACEMENT PARTS

- 2W100 - 115/230 (115/230V motor)
- 2W104 24V AC motor
- G1206-KIT motorized shutter lever arm kit
- 2W134 Torque box motor return spring

**Figure 1**

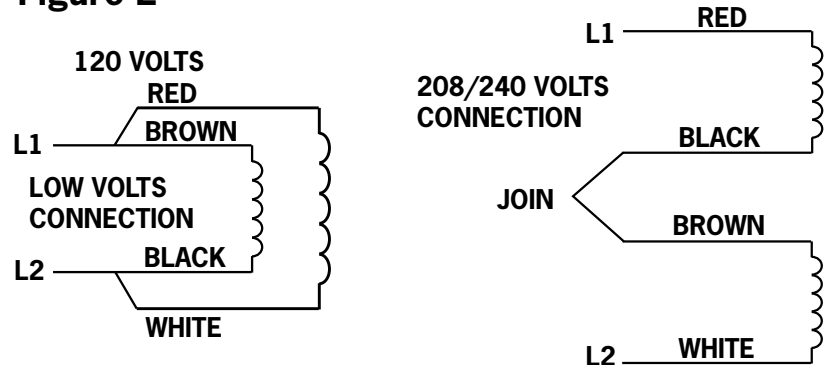


**Series 3000M Side Mount** (no flange)

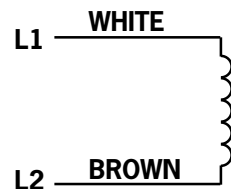
**Series 3100M Inward Mount** (flange on outside)

**Series 3200M Outward Mount** (flange on inside)

**Figure 2**

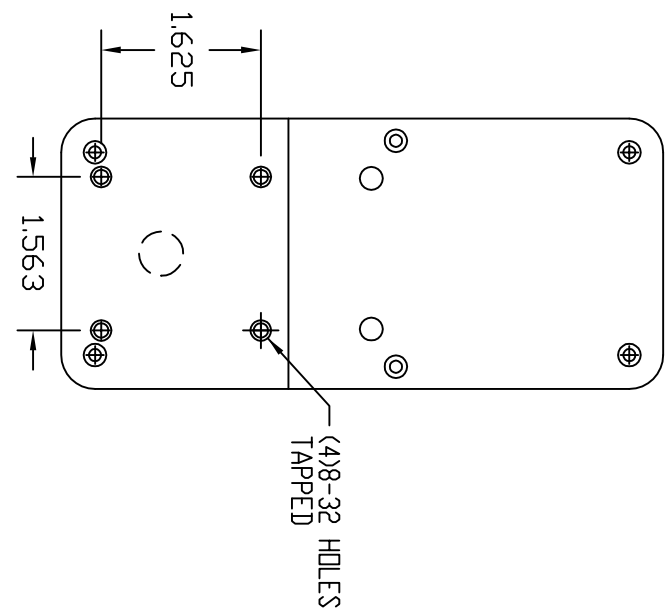
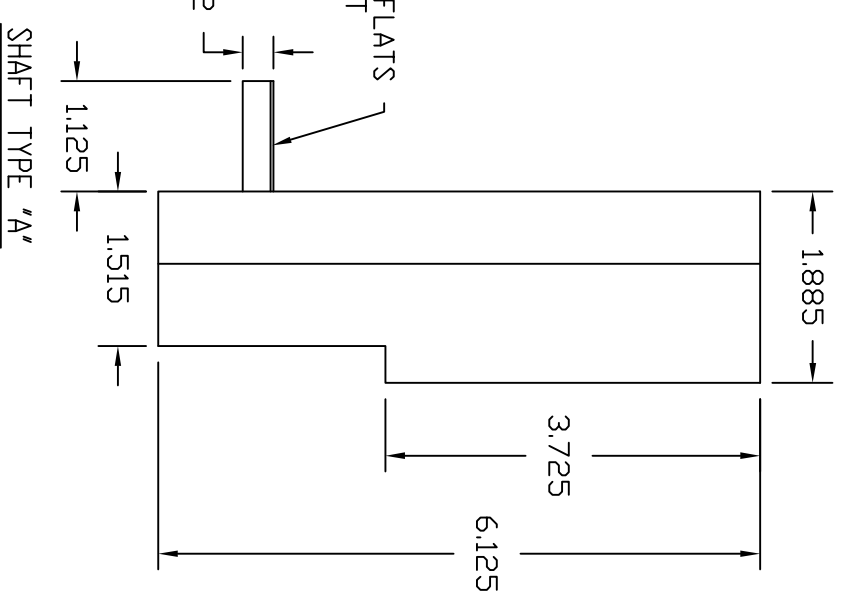
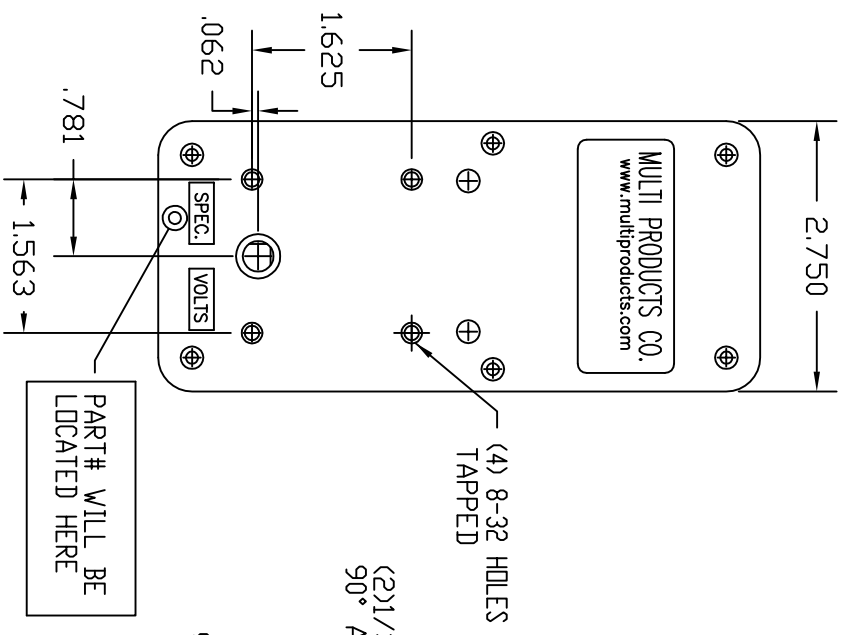


**Figure 3**



**\*\*\* Non-standard shutters are non-returnable and cannot be cancelled. \*\*\***

**Installation or Product problems? Do not return to store of purchase.  
Contact Canarm Service at 1-800-265-1833 (CANADA), 1-800-267-4427 (U.S.A.),  
1-800-567-2513 (EN FRANCAIS) Monday to Friday 8:00 - 5:00 pm e.s.t.**

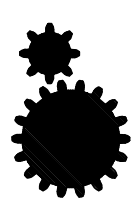


PAGE 1 OF 2

NOTE: ALL DIMENSIONS ARE FOR REFERENCE ONLY.

TYPICAL PERFORMANCE  
 SPEED: 2.0 R.P.M @ 60HZ  
 60 IN-LBS CLASS H INSULATION-UL14 VERSION  
 30 IN-LBS CLASS H INSULATION-UL6, UL12 VERSION

L1 WHITE  
 L2 BLACK  
 WIRING-"BW"

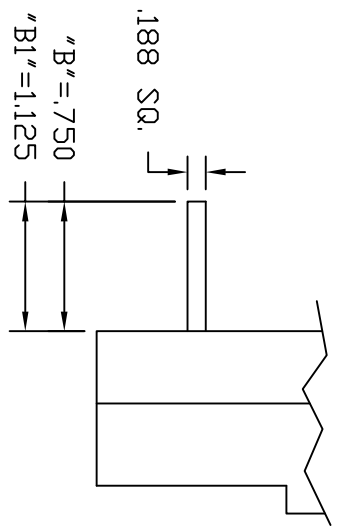


**MULTI PRODUCTS**  
 Company, Inc.

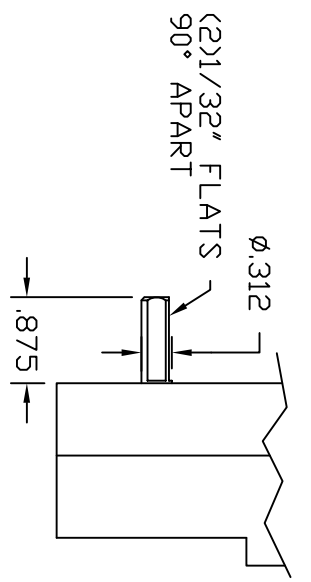
PART NAME/DESCRIPTION  
 TORQUEBOX-OUTLINE

DRAWN BY: PJ	DATE: 3-27-06	SCALE: 1/2	MATERIAL:
CHK'D BY:	DATE:	PART NUMBER:	
APPR'D BY:	DATE:	TB-VARIOUS	

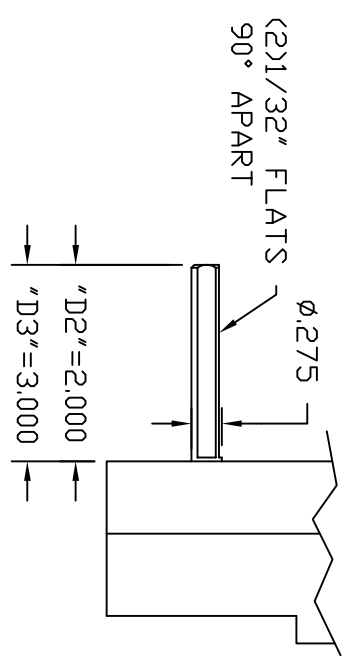
REV	REVISION	DATE	ECO#
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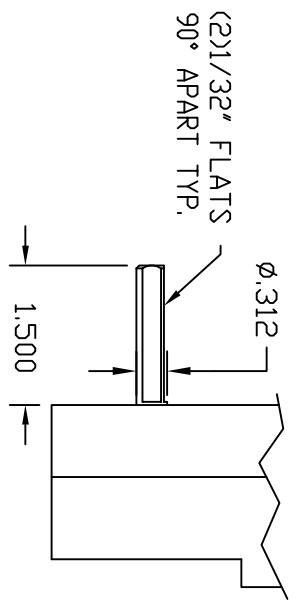
SHAFT TYPE "B"



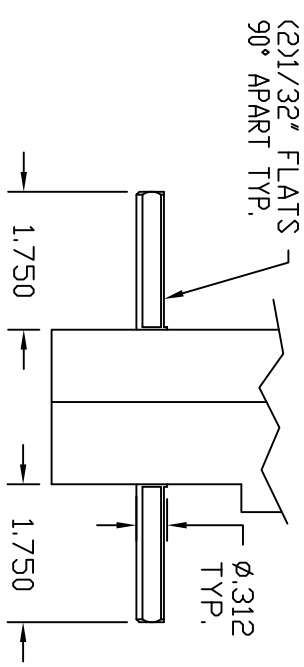
SHAFT TYPE "C"



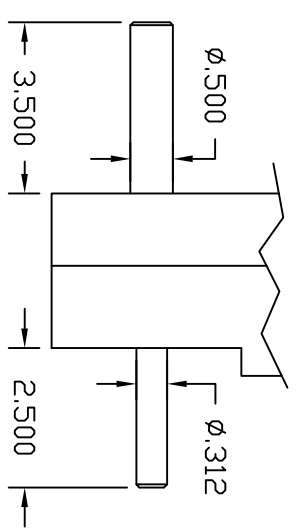
SHAFT TYPE "D"



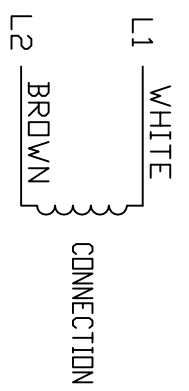
SHAFT TYPE "E"



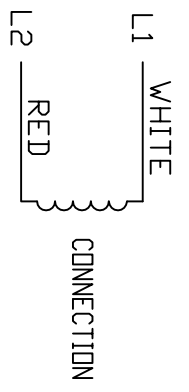
SHAFT TYPE "F"



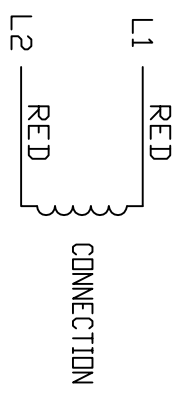
SHAFT TYPE "G"



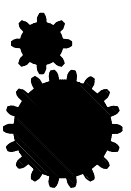
WIRING-"BRW"



WIRING-"RW"



WIRING-"RR"



**MULTI PRODUCTS**  
C o m p a n y, I n c.

TORQUEBOX-OUTLINE

PART NAME/DESCRIPTION

DRAWN BY: PJ DATE: 3-27-06

CHK'D BY: DATE:

APPR'D BY: DATE:

SCALE: 1/2 MATERIAL:

PART NUMBER:

TB-VARIOUS

REV	REVISION	DATE	ECO#

# Grow Light

# SUN SYSTEMS<sup>®</sup>

EST. **US** 1995

## Technical Information Guide



Sunlight Supply, Inc.

National Garden Wholesale<sup>®</sup>

[www.sunlightsupply.com](http://www.sunlightsupply.com) • [www.nationalgardenwholesale.com](http://www.nationalgardenwholesale.com)

# IMPORTANT PRODUCT INFORMATION READ IMMEDIATELY

**KEEP ORIGINAL PACKAGING – ALL RETURNS NEED TO BE IN THE ORIGINAL PACKAGING IN ORDER TO AVOID PRODUCT DAMAGE DURING SHIPPING. ANY DAMAGE TO PRODUCTS NOT IN THEIR ORIGINAL PACKAGING WILL NOT BE COVERED UNDER WARRANTY.**

## SAFETY FIRST!

FAILURE TO OBSERVE THE FOLLOWING SAFETY WARNINGS MAY RESULT IN SERIOUS INJURY. IN ADDITION, FAILURE TO OBSERVE THESE SAFETY WARNINGS WILL RESULT IN A WAIVER OF ALL LIABILITIES ON SUNLIGHT SUPPLY®, INC. AND WILL VOID ALL WARRANTIES.

## WARNING:

- If the exterior of the lamp is damaged, replace lamp immediately.
- Disconnect power before re-lamping.
- When re-lamping, make sure lamp has time to cool before touching.
- Make sure power cord and lamp cord are connected properly.
- Do NOT hang by power cord or lamp cord.
- Do NOT make contact with the interior of the socket while the power is on.
- Do NOT operate the light systems in wet locations.
- Do NOT plug this system into a supply voltage other than what is instructed on the ballast.
- Do NOT attempt to open, rewire or reconfigure any components of the light system. It will void the warranty and could cause serious injury or death.
- These products operate at very high temperatures. Keep away from children.
- Do not plug or unplug a lamp cord while the ballast is turned on.
- Do not use with generators. Warranty will be voided.
- The Lite Pipe™, Sun Tube™ and Digital Fusion™ all need to be air cooled.
- Glass required in reflectors when using metal halide (MH) lamps for UL listing to apply. Not required with high pressure sodium (HPS) lamps.



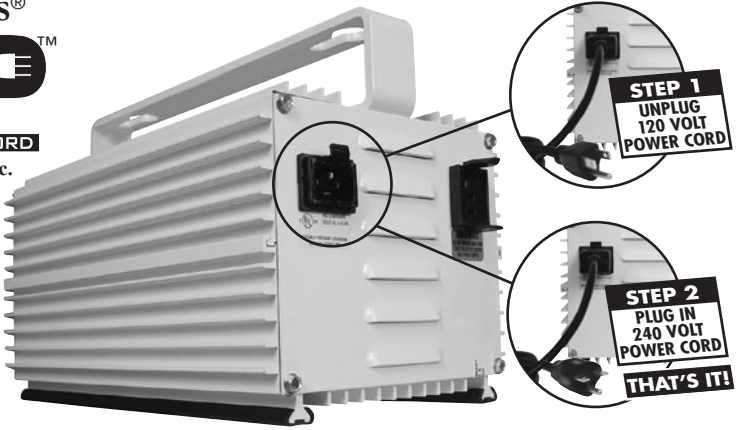
**Fig. 2**

## REMOTE MVP™ SYSTEMS SETUP: (SUN SYSTEM® 1, 6 & 7)

1. Remove the system from the box along with all additional parts.
2. First attach the MVP™ (Multi Volt Powercord) to the system and make sure it properly latches. (See Fig. 1 on next page)
3. **Switchable Units:** When using a SS-6 MH/HPS (Metal Halide/High Pressure Sodium) switchable unit, switch the system to the MH side to run a Metal Halide lamp or HPS to run a High Pressure Sodium lamp. For a SS-6 1000 switchable, select the HPS option of the ballast by pushing the bottom of the switch so that the red part of the switch is visible. Press the top part of the switch for MH. A SS-6 400 switchable is marked HPS400 for the HPS side and MH400 for the MH side.
4. Connect the socket to the hanging reflector (see reflector setup Fig.4). If the lamp cord is included with the reflector, skip this step.

**CAUTION**  
 CONNECT POWER  
 CORD TO SYSTEM  
 BEFORE PLUGGING  
 INTO POWER SOURCE

Fig. 1



## TECHNICAL INFORMATION

The CWA (Constant Wattage Autotransformer) utilizes a single COMMON wire, which is common to all taps on the ballast. Also, when any tap on the ballast is energized, all taps become energized to that potential. For example, when a system is plugged into 120 volt, the unused 240 volt tap is still energized to approximately 240 volt. Rewiring the ballast from 120 volt to 240 volt only requires the change of a single wire. Additionally there is a required change on the opposite side of the power cord, which is changing the plug from a standard 120 volt plug (NEMA 5-15P) to a standard 240 volt plug (NEMA 6-15P). This sounds simple, but in reality it is not that easy. This requires replacing the 120 volt power cord for a 240 volt power cord in most cases. We designed our MVP™ to reduce the hassle, expense and potential safety hazards.

5. Now connect the lamp cord to the remote ballast (Fig.2). Make sure to attach the securement ears to the plug.
6. Carefully screw the proper lamp into the socket. Refer to lamping instructions on the ballast.
7. For SS-6 units make sure to select the proper setting on the ballast to match the lamp that is being used. Make sure the switch is properly set for either MH or HPS type lamp (Fig.3).
8. Lastly, turn the system on by plugging the power cord into the proper NEMA configured receptacle.
9. You must use a properly rated MVP™ cord (120 or 240 volt) for the power that you are using. *If you energize this ballast with 240 volt power while using a 120 volt MVP™ cord (by cutting the plug off), you will “fry” the ballast and void the warranty. If you want to run this ballast with 240 volt power, you must purchase a 240 volt MVP™ cord separately.*



## BULB INFORMATION:

### Proper Bulb Care

Bulbs should be replaced every year to maintain maximum lumen output. If a lamp fails to reach brightness, please contact your retail store.

### Fluorescent fixtures

If there are bulbs that will not fire, try swapping the bulbs around for others that are working. This will help determine if the bulbs are defective.

## REMOTE SMART VOLT™ SYSTEMS SETUP: (SUN SYSTEM® 10, BUDGET GRO™, HARVEST PRO™ & ELITE)

1. Remove the system from the box along with all additional parts.
2. The Smart Volt™ systems come standard with the 120 volt Smart Volt™ power cord. The Harvest Pro™ and Harvest Pro™ Elite have the Power Pointer™ voltage selector. The Sun System® 10 and Budget Gro™ have the Power Slider™ voltage selector. Make sure it is on the 120 volt option to plug in the provided cord. To change the voltage on the Harvest Pro™ & Harvest Pro™ Elite, simply pull out and twist 180° (Fig. 4a). For the Sun System® 10 & Budget Gro™, slide the door to the marked 240 volt side (Fig. 4b). To use the 240 volt you must purchase the 240 volt Smart Volt™ power cord (#903082 or #903084) separately.
3. Follow steps 4 through 6 on the Remote MVP™ Systems Setup.
4. Lastly, turn the system on by plugging the power cord into the proper NEMA configured receptacle.
5. You should use a properly rated Smart Volt™ cord (120 or 240 volt) for the power that you are using. *If you energize this ballast with 240 volt power while the female end of the power cord is plugged into the 120 volt receptacle you will “fry” the ballast and void the warranty. If you want to run this ballast with 240 volt power, you should purchase a 240 volt Smart Volt™ cord separately.*

Fig. 4a



Fig. 4b



## REFLECTOR SETUP:

1. See (Fig. 5) for attaching the socket on reflectors which do not include the socket.
2. Some reflectors will come with a built-in socket assembly, while others you will need to purchase one separately.
3. If the reflector does not have a built in socket, use a socket assembly that is sold separately. Choose from Product No. 903055 or 903060.
4. Some reflectors include glass. For other reflectors it may be purchased separately if you choose to use it. Typically people use glass to control air movement through the reflector during air cooling. This also protects/contains the environment of your grow area. Glass is not required when using HPS lamps for the UL listing to apply. It is required for MH lamps for this listing to apply. The glass installation process will vary by reflector type. It is, although, a very simple process for all Sun System reflectors.
5. Use an eyebolt or some other means of hanging securely from the ceiling.
6. V-Hangers (Fig. 6) are used to hang the reflector.
7. SunLifts, #710125, Grow Yo-Yo, #710129 (Fig. 7) or jack chain may be used to adjust the hanging height.

Fig. 5

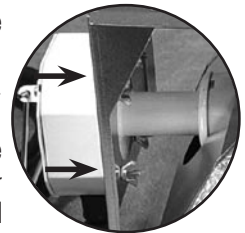
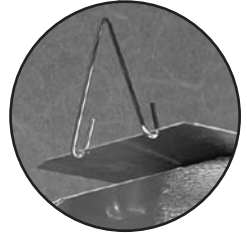


Fig. 6

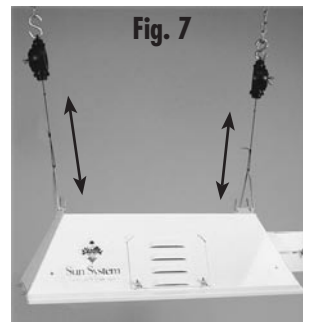


## ENCLOSED SYSTEMS SETUP:

### (SUN SYSTEM® 2, 3 & 4)

1. Remove the system from the box along with all additional parts.
2. These systems do not require much setup. Carefully screw the proper lamp into the socket, refer to lamping instructions on ballast.
3. Hang the fixture using the V-hangers provided.
4. (On/off switch should be in the off position.) Plug the unit into the proper NEMA configured receptacle.
5. Turn the fixture on using the on/off switch. Some systems may not include this feature.

Fig. 7





# COMPACT FLUORESCENT SETUP:

## (SUN SYSTEM<sup>®</sup> 8 & BRIGHT WING<sup>®</sup>)

1. See reflector setup section for hanging instructions.
2. Insert the self-ballasted compact fluorescent lamp.
3. Do NOT screw the lamp in by holding onto the glass tubes, hold onto the plastic base to screw the lamp in.
4. If the unit has *on/off switches* make sure these are in the *off position* before plugging the system into the outlet.

# LINEAR FLUORESCENT SETUP:

## (TEK-LIGHT<sup>™</sup>, NEW WAVE<sup>®</sup>, READY FIT<sup>®</sup> & SUN BLAZE<sup>®</sup>)

1. Remove the system from the box along with all additional parts.
2. Hang the unit using the eye bolts, V-hangers and jack chain provided (Optional cable hanger systems can be purchased separately).
3. Insert lamps (refer to label on product for correct lamp) into the system. To do this, slide both ends of the lamp into the lamp holders and rotate the lamp 90° in either direction (Fig. 8a). For the Ready Fit<sup>®</sup> T5 unscrew the water proof protective plastic cover counter clockwise. The protective cover will have to go directly on to the lamp before inserting into the lamp holder (Fig. 8b). Insert lamp and rotate 90° in either direction and slide the water proof protective cover back on and tighten.
4. Some New Wave<sup>®</sup> & Sun Blaze<sup>®</sup> models have the capability to be daisy chained together. Do not exceed 7.5 amps on any fixtures chained together. Do not daisy chain more fixtures together than what is specified on the fixture. Chaining more fixtures together than specified will void the warranty on all fixtures.

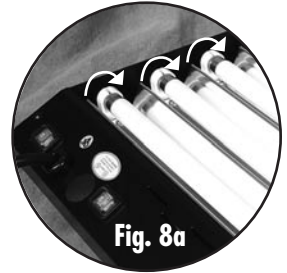


Fig. 8a

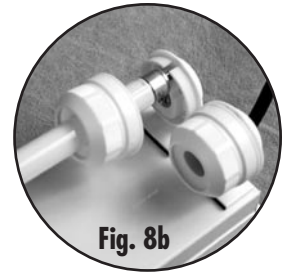


Fig. 8b

Fixture Type	Max # Chained
Sun Blaze <sup>®</sup> 22	12
Sun Blaze <sup>®</sup> 24	6
Sun Blaze <sup>®</sup> 44	5
Sun Blaze <sup>®</sup> 48	3

Fixture Type	Max # Chained @ 120V	Max # Chained @ 240V
New Wave <sup>®</sup> 28	5	9
New Wave <sup>®</sup> 44	5	8
New Wave <sup>®</sup> 48	3	5

# REFLECTOR MOUNTING HEIGHTS

A general guideline for the proper hanging height of an H.I.D. lamp would be 12" - 48" depending on wattage (see below). Make sure to check for excessive heat at the top of your plants by placing your hand (palm down) over your plants. If the top of your hand is hot, you need to move your lamp up higher. If the light source is too close to your plants, you can burn them. Remember that as your plants grow you will need to adjust the height of your lamp.

Please keep in mind that the latest air-cooled reflectors, like the Super Sun<sup>®</sup> 2 allow you to place higher wattage bulbs closer to plants than was possible in the past.

When you raise the light up & away from your plants, you need to be aware that the light levels to your plants will be significantly reduced.

As light moves away from its source (the lamp) it diminishes as follows: 1/Distance<sup>2</sup>. For example: 1 ft. = 1000 FTC, 2 ft. = 250 FTC, 3 ft. = 111 FTC, 4 ft. = 63 FTC, 5 ft. = 40 FTC, & 6 ft. = 28 FTC (FTC = foot candle).

# COVERAGE AREA

A fluorescent fixture can be placed much closer to plants than an H.I.D. fixture because it produces very little heat. You should place your fluorescent lights as close to the tops of your plants as you can without excluding the outside perimeter of your garden.

## H.I.D. AVERAGE COVERAGE AREA BY WATTAGE

150/175 watts covers approximately 2' x 2' area

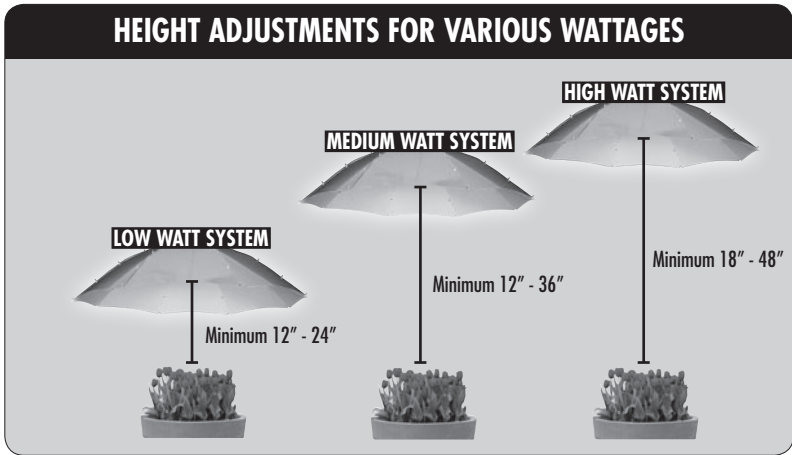
250 watts cover approximately 3' x 3' area

400 watts covers approximately 4' x 4' area

600 watts covers approximately 6.5' x 6.5' area

1000 watts covers approximately 8' x 8' area

**NOTE:** Coverage area may be reduced if this is your primary light source.



## TROUBLESHOOTING... IF YOUR FIXTURE DOES NOT WORK:

1. **CHECK YOUR ELECTRICAL SOURCE:** Make sure the unit is plugged in properly and that the breaker is not tripped or fuse blown.
2. **CHECK THE LAMP:** Make sure the lamp is screwed in all the way.
3. **FOR T5 FLUORESCENT FIXTURES:** Check to ensure lamps are properly locked into place. This is accomplished by turning the lamps ¼ turn in either direction.
4. Try a different lamp if you have one available. Make sure unit is unplugged when changing lamps.
5. Make sure you have the correct lamp for your ballast, i.e. an HPS lamp will not ignite with a MH ballast.
6. MVP™ (Multi Volt PowerCord): When using a MVP™ plug, only use the one distributed with the unit or purchased at one of our Authorized Retailers. DO NOT make any changes to the Power Cord. This will VOID the warranty.

## Potential Fixture FAQ's

**Symptom:** My ballast is humming but the light isn't coming on.

**Solution:** There may be a couple of reasons for this: 1) the lamp is not screwed in tight enough, or 2) the lamp is defective. Please allow 5 - 10 minutes for lamps to initially ignite. If this does not solve the problem, return the unit to the dealer for testing.

**Symptom:** *My ballast makes an excessive amount of noise.*

**Solution:** Keep in mind that the higher the wattage, the louder the humming noise emitted. However, if the noise level is extreme, the transformer may have come loose. In this case, the ballast unit should be returned to Sunlight Supply®, Inc. for repair if it is still under warranty and has been used under normal operating conditions.

**Symptom:** *Every time I turn on the light fixture, the circuit breaker trips.*

**Solution:** You may have too many appliances on this circuit. A normal home's circuit has only 15 amps available. These H.I.D. lights use up to 10 amps per unit. Please make sure you are not overloading the circuit with too many appliances and/or lights. Note: The sticker on the ballast will state the number of amps required by that particular unit. If you do require more lights/appliances to all be run off the same circuit, you should consult an licensed Electrician.

**Symptom:** *I turned off my HID light and now it won't come back on.*

**Solution:** Your lamp may take up to 20 minutes to cool down before it can be fired up again. Fluorescent lamps should be almost immediate.

**Symptom:** *My lamp has small pieces of glass inside of it.*

**Solution:** It is common for small pieces of glass to break loose inside the lamps; this will not affect the lamps output. If there is a crack or hole in the outer glass, it should be replaced.

## **IF NONE OF THE ABOVE PROCEDURES HELP, PLEASE CONTACT THE RETAIL STORE WHERE YOU PURCHASED THE UNIT.**

### **How do I know my lamps are functioning normally?**

#### **FACTS about HID and FLUORESCENT LAMPS:**

- It may take HID or T5 fluorescent 10-15 minutes to come to full brightness.
- HID: During the first few hours of use, the light from the lamp might oscillate.
- HID: The light will decrease in intensity during the life of the lamp.
- HID: During the first hours, intensity of the light may fluctuate somewhat, which is normal. However after it reaches 100 hours of "burn in" time, will continue evenly the remainder of it's life (with normal aging reduction).
- Both: Average life of a MH (metal halide) lamp is 12,000 hours for a 1000 watt lamp and 20,000 hours for a 400 watt lamp. The rated hour life of a HPS lamp is 24,000 hours. Most users choose to replace lamps before they cease to operate due to lumen loss and spectral shift. T5 fluorescent lamps offer a rated hour life of 20,000 hours and have a much slower lumen loss and spectral shift than HID lamps.

#### **POWER USAGE:**

On average, a light system will increase your electricity cost from \$8 to \$20 per month — the exact amount depends on the size of the system and the number of hours operated. However, since these grow lights are so energy efficient, you are getting huge amounts of light (and growing power) for your money! Make sure your grow room's power circuit can handle the power draw. For safety reasons, do not exceed 75% of the rated ability of the fuse/breaker (for example: use no more than 15 amps on a 20 amp circuit). To calculate your cost, multiply the bulb wattage X hours of operation and divide by 1000. This figure is the number of kilowatt hours of electricity consumed. (Example: a 400 watt bulb running for 18 hours will use 7.2 kilowatt hours). Check your power bill for the cost of each kilowatt hour. Then multiply the number of kilowatt hours by the cost of a kilowatt hour (K/hr) to arrive at the cost per month to run the light in your area.

**POWER COST ESTIMATION GUIDE PER MONTH (ASSUMES 30 DAY MONTH)**

COST PER KW/HR	4¢	6¢	8¢	10¢	12¢	14¢	16¢	18¢	20¢	22¢	24¢	26¢
HRS. PER DAY X 30 DAYS	EXAMPLE: 6 HRS X 52 WATTS* ÷ 1000 X \$.04 PER KWH X 30 DAYS = \$.37											
6 HRS X 30 DAYS	\$0.37	\$0.56	\$0.75	\$0.94	\$1.12	\$1.31	\$1.50	\$1.68	\$1.87	\$2.06	\$2.25	\$2.43
8 HRS X 30 DAYS	\$0.50	\$0.75	\$1.00	\$1.25	\$1.50	\$1.75	\$2.00	\$2.25	\$2.50	\$2.75	\$3.00	\$3.24
10 HRS X 30 DAYS	\$0.62	\$0.94	\$1.25	\$1.56	\$1.87	\$2.18	\$2.50	\$2.81	\$3.12	\$3.43	\$3.74	\$4.06
12 HRS X 30 DAYS	\$0.75	\$1.12	\$1.50	\$1.87	\$2.25	\$2.62	\$3.00	\$3.37	\$3.74	\$4.12	\$4.49	\$4.87
14 HRS X 30 DAYS	\$0.87	\$1.31	\$1.75	\$2.18	\$2.62	\$3.06	\$3.49	\$3.93	\$4.37	\$4.80	\$5.24	\$5.68
16 HRS X 30 DAYS	\$1.00	\$1.50	\$2.00	\$2.50	\$3.00	\$3.49	\$3.99	\$4.49	\$4.99	\$5.49	\$5.99	\$6.49
18 HRS X 30 DAYS	\$1.12	\$1.68	\$2.25	\$2.81	\$3.37	\$3.93	\$4.49	\$5.05	\$5.62	\$6.18	\$6.74	\$7.30

\* A 48 watt lighting fixture uses 52 watts per hour. For use with the New Wave® 22, Sun Blaze® 22 & Ready Fit® 2 ft.

**POWER COST ESTIMATION GUIDE PER MONTH (ASSUMES 30 DAY MONTH)**

COST PER KW/HR	4¢	6¢	8¢	10¢	12¢	14¢	16¢	18¢	20¢	22¢	24¢	26¢
HRS. PER DAY X 30 DAYS	EXAMPLE: 6 HRS X 104 WATTS* ÷ 1000 X \$.04 PER KWH X 30 DAYS = \$.75											
6 HRS X 30 DAYS	\$0.75	\$1.12	\$1.50	\$1.87	\$2.25	\$2.62	\$3.00	\$3.37	\$3.74	\$4.12	\$4.49	\$4.87
8 HRS X 30 DAYS	\$1.00	\$1.50	\$2.00	\$2.50	\$3.00	\$3.49	\$3.99	\$4.49	\$4.99	\$5.49	\$5.99	\$6.49
10 HRS X 30 DAYS	\$1.25	\$1.87	\$2.50	\$3.12	\$3.74	\$4.37	\$4.99	\$5.62	\$6.24	\$6.86	\$7.49	\$8.11
12 HRS X 30 DAYS	\$1.50	\$2.25	\$3.00	\$3.74	\$4.49	\$5.24	\$5.99	\$6.74	\$7.49	\$8.24	\$8.99	\$9.73
14 HRS X 30 DAYS	\$1.75	\$2.62	\$3.49	\$4.37	\$5.24	\$6.12	\$6.99	\$7.86	\$8.74	\$9.61	\$10.48	\$11.36
16 HRS X 30 DAYS	\$2.00	\$3.00	\$3.99	\$4.99	\$5.99	\$6.99	\$7.99	\$8.99	\$9.98	\$10.98	\$11.98	\$12.98
18 HRS X 30 DAYS	\$2.25	\$3.37	\$4.49	\$5.62	\$6.74	\$7.86	\$8.99	\$10.11	\$11.23	\$12.36	\$13.48	\$14.60

\* A 96 watt lighting fixture uses 104 watts per hour. For use with the New Wave® 24 & Sun Blaze® 24.

**POWER COST ESTIMATION GUIDE PER MONTH (ASSUMES 30 DAY MONTH)**

COST PER KW/HR	4¢	6¢	8¢	10¢	12¢	14¢	16¢	18¢	20¢	22¢	24¢	26¢
HRS. PER DAY X 30 DAYS	EXAMPLE: 6 HRS X 117 WATTS* ÷ 1000 X \$.04 PER KWH X 30 DAYS = \$.84											
6 HRS X 30 DAYS	\$0.84	\$1.26	\$1.68	\$2.11	\$2.53	\$2.95	\$3.37	\$3.79	\$4.21	\$4.63	\$5.05	\$5.48
8 HRS X 30 DAYS	\$1.12	\$1.68	\$2.25	\$2.81	\$3.37	\$3.93	\$4.49	\$5.05	\$5.62	\$6.18	\$6.74	\$7.30
10 HRS X 30 DAYS	\$1.40	\$2.11	\$2.81	\$3.51	\$4.21	\$4.91	\$5.62	\$6.32	\$7.02	\$7.72	\$8.42	\$9.13
12 HRS X 30 DAYS	\$1.68	\$2.53	\$3.37	\$4.21	\$5.05	\$5.90	\$6.74	\$7.58	\$8.42	\$9.27	\$10.11	\$10.95
14 HRS X 30 DAYS	\$1.97	\$2.95	\$3.93	\$4.91	\$5.90	\$6.88	\$7.86	\$8.85	\$9.83	\$10.81	\$11.79	\$12.78
16 HRS X 30 DAYS	\$2.25	\$3.37	\$4.49	\$5.62	\$6.74	\$7.86	\$8.99	\$10.11	\$11.23	\$12.36	\$13.48	\$14.60
18 HRS X 30 DAYS	\$2.53	\$3.79	\$5.05	\$6.32	\$7.58	\$8.85	\$10.11	\$11.37	\$12.64	\$13.90	\$15.16	\$16.43

\* A 108 watt lighting fixture uses 117 watts per hour. For use with the Tek-Light™ 42, New Wave® 42 & Ready Fit® 4 ft.

**POWER COST ESTIMATION GUIDE PER MONTH (ASSUMES 30 DAY MONTH)**

COST PER KW/HR	4¢	6¢	8¢	10¢	12¢	14¢	16¢	18¢	20¢	22¢	24¢	26¢
HRS. PER DAY X 30 DAYS	EXAMPLE: 6 HRS X 165 WATTS* ÷ 1000 X \$.04 PER KWH X 30 DAYS = \$ 1.19											
6 HRS X 30 DAYS	\$1.19	\$1.78	\$2.38	\$2.97	\$3.56	\$4.16	\$4.75	\$5.35	\$5.94	\$6.53	\$7.13	\$7.72
8 HRS X 30 DAYS	\$1.58	\$2.38	\$3.17	\$3.96	\$4.75	\$5.54	\$6.34	\$7.13	\$7.92	\$8.71	\$9.50	\$10.30
10 HRS X 30 DAYS	\$1.98	\$2.97	\$3.96	\$4.95	\$5.94	\$6.93	\$7.92	\$8.91	\$9.90	\$10.89	\$11.88	\$12.87
12 HRS X 30 DAYS	\$2.38	\$3.56	\$4.75	\$5.94	\$7.13	\$8.32	\$9.50	\$10.69	\$11.88	\$13.07	\$14.26	\$15.44
14 HRS X 30 DAYS	\$2.77	\$4.16	\$5.54	\$6.93	\$8.32	\$9.70	\$11.09	\$12.47	\$13.86	\$15.25	\$16.63	\$18.02
16 HRS X 30 DAYS	\$3.17	\$4.75	\$6.34	\$7.92	\$9.50	\$11.09	\$12.67	\$14.26	\$15.84	\$17.42	\$19.01	\$20.59
18 HRS X 30 DAYS	\$3.56	\$5.35	\$7.13	\$8.91	\$10.69	\$12.47	\$14.26	\$16.04	\$17.82	\$19.60	\$21.38	\$23.17

\* A 150 watt lighting fixture uses 165 watts per hour. For use with the Sun System® 4 & Sun System HPS 150.

**POWER COST ESTIMATION GUIDE PER MONTH (ASSUMES 30 DAY MONTH)**

COST PER KW/HR	4¢	6¢	8¢	10¢	12¢	14¢	16¢	18¢	20¢	22¢	24¢	26¢
HRS. PER DAY X 30 DAYS	EXAMPLE: 6 HRS X 196 WATTS* ÷ 1000 X \$.04 PER KWH X 30 DAYS = \$1.41											
6 HRS X 30 DAYS	\$1.41	\$2.12	\$2.82	\$3.53	\$4.23	\$4.94	\$5.64	\$6.35	\$7.06	\$7.76	\$8.47	\$9.17
8 HRS X 30 DAYS	\$1.88	\$2.82	\$3.76	\$4.70	\$5.64	\$6.59	\$7.53	\$8.47	\$9.41	\$10.35	\$11.29	\$12.23
10 HRS X 30 DAYS	\$2.35	\$3.53	\$4.70	\$5.88	\$7.06	\$8.23	\$9.41	\$10.58	\$11.76	\$12.94	\$14.11	\$15.29
12 HRS X 30 DAYS	\$2.82	\$4.23	\$5.64	\$7.06	\$8.47	\$9.88	\$11.29	\$12.70	\$14.11	\$15.52	\$16.93	\$18.35
14 HRS X 30 DAYS	\$3.29	\$4.94	\$6.59	\$8.23	\$9.88	\$11.52	\$13.17	\$14.82	\$16.46	\$18.11	\$19.76	\$21.40
16 HRS X 30 DAYS	\$3.76	\$5.64	\$7.53	\$9.41	\$11.29	\$13.17	\$15.05	\$16.93	\$18.82	\$20.70	\$22.58	\$24.46
18 HRS X 30 DAYS	\$4.23	\$6.35	\$8.47	\$10.58	\$12.70	\$14.82	\$16.93	\$19.05	\$21.17	\$23.28	\$25.40	\$27.52

\* A 175 watt lighting fixture uses 196 watts per hour. *For use with the Sun System® 4*

**POWER COST ESTIMATION GUIDE PER MONTH (ASSUMES 30 DAY MONTH)**

COST PER KW/HR	4¢	6¢	8¢	10¢	12¢	14¢	16¢	18¢	20¢	22¢	24¢	26¢
HRS. PER DAY X 30 DAYS	EXAMPLE: 6 HRS X 234 WATTS* ÷ 1000 X \$.04 PER KWH X 30 DAYS = \$ 1.68											
6 HRS X 30 DAYS	\$1.68	\$2.53	\$3.37	\$4.21	\$5.05	\$5.90	\$6.74	\$7.58	\$8.42	\$9.27	\$10.11	\$10.95
8 HRS X 30 DAYS	\$2.25	\$3.37	\$4.49	\$5.62	\$6.74	\$7.86	\$8.99	\$10.11	\$11.23	\$12.36	\$13.48	\$14.60
10 HRS X 30 DAYS	\$2.81	\$4.21	\$5.62	\$7.02	\$8.42	\$9.83	\$11.23	\$12.64	\$14.04	\$15.44	\$16.85	\$18.25
12 HRS X 30 DAYS	\$3.37	\$5.05	\$6.74	\$8.42	\$10.11	\$11.79	\$13.48	\$15.16	\$16.85	\$18.53	\$20.22	\$21.90
14 HRS X 30 DAYS	\$3.93	\$5.90	\$7.86	\$9.83	\$11.79	\$13.76	\$15.72	\$17.69	\$19.66	\$21.62	\$23.59	\$25.55
16 HRS X 30 DAYS	\$4.49	\$6.74	\$8.99	\$11.23	\$13.48	\$15.72	\$17.97	\$20.22	\$22.46	\$24.71	\$26.96	\$29.20
18 HRS X 30 DAYS	\$5.05	\$7.58	\$10.11	\$12.64	\$15.16	\$17.69	\$20.22	\$22.74	\$25.27	\$27.80	\$30.33	\$32.85

\* A 216 watt lighting fixture uses 234 watts per hour. *For use with Tek-Light™ 44, New Wave™ 44 & Sun Blaze® 44.*

**POWER COST ESTIMATION GUIDE PER MONTH (ASSUMES 30 DAY MONTH)**

COST PER KW/HR	4¢	6¢	8¢	10¢	12¢	14¢	16¢	18¢	20¢	22¢	24¢	26¢
HRS. PER DAY X 30 DAYS	EXAMPLE: 6 HRS X 275 WATTS* ÷ 1000 X \$.04 PER KWH X 30 DAYS = \$ 1.98											
6 HRS X 30 DAYS	\$1.98	\$2.97	\$3.96	\$4.95	\$5.94	\$6.93	\$7.92	\$8.91	\$9.90	\$10.89	\$11.88	\$12.87
8 HRS X 30 DAYS	\$2.64	\$3.96	\$5.28	\$6.60	\$7.92	\$9.24	\$10.56	\$11.88	\$13.20	\$14.52	\$15.84	\$17.16
10 HRS X 30 DAYS	\$3.30	\$4.95	\$6.60	\$8.25	\$9.90	\$11.55	\$13.20	\$14.85	\$16.50	\$18.15	\$19.80	\$21.45
12 HRS X 30 DAYS	\$3.96	\$5.94	\$7.92	\$9.90	\$11.88	\$13.86	\$15.84	\$17.82	\$19.80	\$21.78	\$23.76	\$25.74
14 HRS X 30 DAYS	\$4.62	\$6.93	\$9.24	\$11.55	\$13.86	\$16.17	\$18.48	\$20.79	\$23.10	\$25.41	\$27.72	\$30.03
16 HRS X 30 DAYS	\$5.28	\$7.92	\$10.56	\$13.20	\$15.84	\$18.48	\$21.12	\$23.76	\$26.40	\$29.04	\$31.68	\$34.32
18 HRS X 30 DAYS	\$5.94	\$8.91	\$11.88	\$14.85	\$17.82	\$20.79	\$23.76	\$26.73	\$29.70	\$32.67	\$35.64	\$38.61

\* A 250 watt lighting fixture uses 275 watts per hour. *For use with Sun System® 2 & 4.*

**POWER COST ESTIMATION GUIDE PER MONTH (ASSUMES 30 DAY MONTH)**

COST PER KW/HR	4¢	6¢	8¢	10¢	12¢	14¢	16¢	18¢	20¢	22¢	24¢	26¢
HRS. PER DAY X 30 DAYS	EXAMPLE: 6 HRS X 460 WATTS* ÷ 1000 X \$.04 PER KWH X 30 DAYS = \$ 3.31											
6 HRS X 30 DAYS	\$3.31	\$4.97	\$6.62	\$8.28	\$9.94	\$11.59	\$13.25	\$14.90	\$16.56	\$18.22	\$19.87	\$21.53
8 HRS X 30 DAYS	\$4.42	\$6.62	\$8.83	\$11.04	\$13.25	\$15.46	\$17.66	\$19.87	\$22.08	\$24.29	\$26.50	\$28.70
10 HRS X 30 DAYS	\$5.52	\$8.28	\$11.04	\$13.80	\$16.56	\$19.32	\$22.08	\$24.84	\$27.60	\$30.36	\$33.12	\$35.88
12 HRS X 30 DAYS	\$6.62	\$9.94	\$13.25	\$16.56	\$19.87	\$23.18	\$26.50	\$29.81	\$33.12	\$36.43	\$39.74	\$43.06
14 HRS X 30 DAYS	\$7.73	\$11.59	\$15.46	\$19.32	\$23.18	\$27.05	\$30.91	\$34.78	\$38.64	\$42.50	\$46.37	\$50.23
16 HRS X 30 DAYS	\$8.83	\$13.25	\$17.66	\$22.08	\$26.50	\$30.91	\$35.33	\$39.74	\$44.16	\$48.58	\$52.99	\$57.41
18 HRS X 30 DAYS	\$9.94	\$14.90	\$19.87	\$24.84	\$29.81	\$34.78	\$39.74	\$44.71	\$49.68	\$54.65	\$59.62	\$64.58

\* A 400 watt lighting fixture uses 460 watts per hour. *For use with Sun System® 1, 2, 4, 6, 10 Harvest Pro™ & Harvest Pro™ Elite.*

**POWER COST ESTIMATION GUIDE PER MONTH (ASSUMES 30 DAY MONTH)**

COST PER KW/HR	4¢	6¢	8¢	10¢	12¢	14¢	16¢	18¢	20¢	22¢	24¢	26¢
HRS. PER DAY X 30 DAYS	EXAMPLE: 6 HRS X 468 WATTS* ÷ 1000 X \$.04 PER KWH X 30 DAYS = \$ 3.37											
6 HRS X 30 DAYS	\$3.37	\$5.05	\$6.74	\$8.42	\$10.11	\$11.79	\$13.48	\$15.16	\$16.85	\$18.53	\$20.22	\$21.90
8 HRS X 30 DAYS	\$4.49	\$6.74	\$8.99	\$11.23	\$13.48	\$15.72	\$17.97	\$20.22	\$22.46	\$24.71	\$26.96	\$29.20
10 HRS X 30 DAYS	\$5.62	\$8.42	\$11.23	\$14.04	\$16.85	\$19.66	\$22.46	\$25.27	\$28.08	\$30.89	\$33.70	\$36.50
12 HRS X 30 DAYS	\$6.74	\$10.11	\$13.48	\$16.85	\$20.22	\$23.59	\$26.96	\$30.33	\$33.70	\$37.07	\$40.44	\$43.80
14 HRS X 30 DAYS	\$7.86	\$11.79	\$15.72	\$19.66	\$23.59	\$27.52	\$31.45	\$35.38	\$39.31	\$43.24	\$47.17	\$51.11
16 HRS X 30 DAYS	\$8.99	\$13.48	\$17.97	\$22.46	\$26.96	\$31.45	\$35.94	\$40.44	\$44.93	\$49.42	\$53.91	\$58.41
18 HRS X 30 DAYS	\$10.11	\$15.16	\$20.22	\$25.27	\$30.33	\$35.38	\$40.44	\$45.49	\$50.54	\$55.60	\$60.65	\$65.71

\* A 432 watt lighting fixture uses 468 watts per hour. For use with Tek-Light™ 48, New Wave® 48 & Sun Blaze® 48.

**POWER COST ESTIMATION GUIDE PER MONTH (ASSUMES 30 DAY MONTH)**

COST PER KW/HR	4¢	6¢	8¢	10¢	12¢	14¢	16¢	18¢	20¢	22¢	24¢	26¢
HRS. PER DAY X 30 DAYS	EXAMPLE: 6 HRS X 680 WATTS* ÷ 1000 X \$.04 PER KWH X 30 DAYS = \$ 4.90											
6 HRS X 30 DAYS	\$4.90	\$7.34	\$9.79	\$12.24	\$14.69	\$17.14	\$19.58	\$22.03	\$24.48	\$26.93	\$29.38	\$31.82
8 HRS X 30 DAYS	\$6.53	\$9.79	\$13.06	\$16.32	\$19.58	\$22.85	\$26.11	\$29.38	\$32.64	\$35.90	\$39.17	\$42.43
10 HRS X 30 DAYS	\$8.16	\$12.24	\$16.32	\$20.40	\$24.48	\$28.56	\$32.64	\$36.72	\$40.80	\$44.88	\$48.96	\$53.04
12 HRS X 30 DAYS	\$9.79	\$14.69	\$19.58	\$24.48	\$29.38	\$34.27	\$39.17	\$44.06	\$48.96	\$53.86	\$58.75	\$63.65
14 HRS X 30 DAYS	\$11.42	\$17.14	\$22.85	\$28.56	\$34.27	\$39.98	\$45.70	\$51.41	\$57.12	\$62.83	\$68.54	\$74.26
16 HRS X 30 DAYS	\$13.06	\$19.58	\$26.11	\$32.64	\$39.17	\$45.70	\$52.22	\$58.75	\$65.28	\$71.81	\$78.34	\$84.86
18 HRS X 30 DAYS	\$14.69	\$22.03	\$29.38	\$36.72	\$44.06	\$51.41	\$58.75	\$66.10	\$73.44	\$80.78	\$88.13	\$95.47

\* A 600 watt lighting fixture uses 680 watts per hour. For use with Sun System® 1, 10, Harvest Pro™ & Harvest Pro™ Elite.

**POWER COST ESTIMATION GUIDE PER MONTH (ASSUMES 30 DAY MONTH)**

COST PER KW/HR	4¢	6¢	8¢	10¢	12¢	14¢	16¢	18¢	20¢	22¢	24¢	26¢
HRS. PER DAY X 30 DAYS	EXAMPLE: 6 HRS X 1100 WATTS* ÷ 1000 X \$.04 PER KWH X 30 DAYS = \$ 7.92											
6 HRS X 30 DAYS	\$7.92	\$11.88	\$15.84	\$19.80	\$23.76	\$27.72	\$31.68	\$35.64	\$39.60	\$43.56	\$47.52	\$51.48
8 HRS X 30 DAYS	\$10.56	\$15.84	\$21.12	\$26.40	\$31.68	\$36.96	\$42.24	\$47.52	\$52.80	\$58.08	\$63.36	\$68.64
10 HRS X 30 DAYS	\$13.20	\$19.80	\$26.40	\$33.00	\$39.60	\$46.20	\$52.80	\$59.40	\$66.00	\$72.60	\$79.20	\$85.80
12 HRS X 30 DAYS	\$15.84	\$23.76	\$31.68	\$39.60	\$47.52	\$55.44	\$63.36	\$71.28	\$79.20	\$87.12	\$95.04	\$102.96
14 HRS X 30 DAYS	\$18.48	\$27.72	\$36.96	\$46.20	\$55.44	\$64.68	\$73.92	\$83.16	\$92.40	\$101.64	\$110.88	\$120.12
16 HRS X 30 DAYS	\$21.12	\$31.68	\$42.24	\$52.80	\$63.36	\$73.92	\$84.48	\$95.04	\$105.60	\$116.16	\$126.72	\$137.28
18 HRS X 30 DAYS	\$23.76	\$35.64	\$47.52	\$59.40	\$71.28	\$83.16	\$95.04	\$106.92	\$118.80	\$130.68	\$142.56	\$154.44

\* A 1000 watt lighting fixture uses 1100 watts per hour. For use with Sun System® 1, 6, 10, Harvest Pro™ & Harvest Pro™ Elite.

## **Returning Units: Please contact your retail store for returns.**

## **WARRANTY SERVICE: Please read warranty information first**

If after reviewing the troubleshooting tips the light will still not work, you should return the light to the dealer where you purchased it. They will be able to further evaluate the light and test its various components and quite possibly will be able to identify and/or fix any problems. Often the problem is as simple as a defective lamp. If the dealer is unable to fix the light, they will return it to us for factory repair. Many dealers have loaner ballasts that you may check out until yours is returned (usually not more than 7-10 days).

If there are no dealers in your area, you may contact us directly for technical support. If we cannot help you resolve the problem over the phone, we will issue you a RMA # (return merchandise authorization) authorizing you to return the system to us for factory reconditioning (if the unit is under warranty). Contact a Sunlight Supply® service center closest to you for a RMA and shipping address. Complete the form below and include it with your lighting fixture. Also please write the RMA # on the outside of the box.

Please package the light carefully in its original packaging. If it is damaged in shipment we cannot be responsible.

Once we receive the light back, we will repair it within 48 hours (business) and return it to you freight prepaid via FedEx or UPS ground shipment.

Include the following if returning directly to Sunlight Supply®, Inc.

- Proof of purchase
- This completed form
- RMA # on the outside of the box

Return Merchandise Authorization Number **(Required):** \_\_\_\_\_

Company Name: \_\_\_\_\_

Contact Name: \_\_\_\_\_

Address: \_\_\_\_\_

Phone #: \_\_\_\_\_

Email address: \_\_\_\_\_

What is the nature of the problem? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Send to your nearest location – shipping address will be given when the RMA # is issued:

Technical Support Numbers: West 888.582.2762

East 888.583.2762

Pompano Beach, FL 877.649.3567

# **IMPORTANT: PROOF OF PURCHASE REQUIRED FOR RETURNS**

**SUN SYSTEM® SERIES = 5 Year Warranty  
SUN SYSTEM® 3, BUDGET GRO™, TEK-LIGHT™  
& NEW WAVE® = 2 Year Warranty  
READY FIT® = 1 Year Warranty**

**Returning Units: Please contact your retail store for returns.**

## **WARRANTY INFORMATION:**

Sunlight Supply®, Inc. warrants to the original purchaser of this product against defects in material and workmanship under normal use for five (5) years on any SUN SYSTEM®, two (2) years on SUN SYSTEM® 3, BUDGET GRO™, TEK-LIGHT™ & NEW WAVE® and one (1) year on READY FIT® from the date of purchase. During the warranty period, Sunlight Supply® will, at our option, and without charge, repair or replace this product if the unit or any of its components fail or malfunction.

This warranty is expressly in lieu of all other warranties, expressed or implied, including the warranties of merchantability and fitness for use and of all other obligations or liabilities on the part of the seller. This warranty shall not apply to this product or any part thereof which has been damaged by accident, abuse, misuse, modification, negligence, alteration or misapplication. Sunlight Supply® makes no warranty whatsoever in respect to accessories or parts not supplied by Sunlight Supply®. This warranty shall apply only to the United States, including Alaska, Hawaii and territories of the United States.

*NOTE: Sunlight Supply®, Inc. is a manufacturer of supplementary lighting systems. All sales offerings to the public are done through a nationwide group of dealers. No sales offerings will be made directly to the general public.*



# D I V I S I O N 15

Applicable Portions Of The Conditions  
Of The Contract And Division 1 General  
Requirements Apply To The Work Of  
This Division.

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## SECTION 15010 - GENERAL MECHANICAL

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Work under Division 15 shall include furnishing of all labor, accessories, tools, equipment and material required to completely execute installation of the entire heating, ventilating and air conditioning systems, plumbing systems and fire protection systems as shown on the drawings and as specified. Work shall include but not be limited to the furnishing, unloading, handling distribution, setting, supporting and installation of all components required for the mechanical systems.
- B. Mechanical specification Sections 15000 through 15299 generally apply to all mechanical trades. Sections 15300 through 15399 apply generally to fire protection work. Sections 15400 through 15499 apply generally to plumbing work. Sections 15500 through 15999 apply generally to HVAC work.

#### 1.02 REFERENCES

- A. FM P7825 - Approval Guide; Factory Mutual.
- B. NFPA 70 - National Electrical Code.
- C. SSPC-Paint 15 - Steel Joist Shop Paint; Steel Structures Painting Council.
- D. ASME American Society of Mechanical Engineers
- E. ASTM American Society for Testing Materials
- F. NEMA National Electrical Manufacturers Association
- G. NFPA National Fire Protection Association
- H. OSHA Occupational Safety and Health Act
- I. SMACNA Sheet Metal and Air Conditioning Contractors National Association, Inc.
- J. IBC International Building Code
- K. IMC International Mechanical Code
- L. IPC International Plumbing Code
- M. IFC International Fire Code

#### 1.03 Interpretation of Contract Documents:

- A. Except where modified by a specific notation to the contrary, it shall be understood that the indication and/or description of any item, in the drawings or specifications or both, carries with it the instruction to furnish and install the item, regardless of whether or not this instruction is explicitly stated as part of the indication or description.
- B. It shall be understood that the specifications and drawings are complimentary and are to be taken together for a complete interpretation of the work.
- C. No exclusions from, or limitations in, the language used in the drawings or specifications shall be interpreted as meaning that the appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted

- D. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed in accordance with the diagrammatic intent expressed on the drawings, and in conformity with the dimensions indicated on final architectural and structural working drawings and on equipment shop drawings.
- E. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.
- F. Certain details appear on the drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the intended work.
- G. Information as to the general construction shall be derived from structural and architectural drawings and specifications only.
- H. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Work shall be installed to conform with any City or State law, regulation, code, ordinance, ruling or Fire Underwriters requirement applicable to this class of work.
- B. All installations for construction purposes shall conform with the Department of Labor "Safety and Health Regulations for Construction".
- C. All equipment with electrical components shall bear the UL label.

#### 1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements for submittal procedures.

#### PART 2 PRODUCTS

**END OF SECTION**

## SECTION 15080 - MECHANICAL INSULATION

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Piping insulation.

#### 1.02 SCOPE OF WORK:

- A. Provide insulation as specified for domestic hot and cold water piping systems, including valves, fittings, flanges, strainers, and mechanical couplings.

### PART 2 PRODUCTS

#### 2.01 PIPE INSULATION

- A. Insulation shall have composite (insulation jacket or facing, and adhesive used to adhere the facing or jacket to the insulation) fire and smoke hazard ratings as tested by procedure ASTM E84, NFPA 255 or UL 723 not exceeding:
  - 1. Flame Spread: 25.
  - 2. Smoke Developed: 50.
- B. Insulation shall be glass fiber with a maximum K factor of .24 at 75 degrees F mean temperature with factory applied fire resistant vapor barrier jacket, for cold piping and fire retardant jacket for hot water. Insulation for outdoor piping shall be rigid foam urethane, Armalok II or equal.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that equipment has been tested before applying insulation materials.
- C. Verify that surfaces are clean, foreign material removed, and dry.

#### 3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. PIPE INSULATION
  - 1. Longitudinal lap and 4" wide vapor barrier joint seal strips shall be adhered neatly in place with BF 85-20 adhesive or approved equal and banded.
  - 2. The ends of pipe insulation shall be sealed off with BF 30-35 coatings at all flanges, valves and fittings and at intervals of not more than 21 feet on continuous runs or pipes.

#### 3.03 SCHEDULES

- A. PIPING INSULATION
  - 1. Domestic hot, hot water recirculating and cold water piping (above ground):
    - a. Pipe sizes 1/2 - 3 inches: 1-inch Glass fiber insulation.

**END OF SECTION**

## SECTION 15145 - PLUMBING PIPING

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Pipe, pipe fittings, valves, and connections for piping systems.
  - 1. Domestic water.
  - 2. Gas.

#### 1.02 RELATED REQUIREMENTS

- A. Section 15082 - Piping Insulation.

#### 1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; The American Society of Mechanical Engineers; 1996 (Reaffirmed 2003).
- B. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers (ANSI B16.18).
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings; The American Society of Mechanical Engineers.
- E. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; The American Society of Mechanical Engineers.
- F. ASME B31.2 - Fuel Gas Piping; The American Society of Mechanical Engineers.
- G. Pipe.ASTM B 32 - Standard Specification for Solder Metal.
- H. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
- I. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.
- J. ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
- K. ASTM F441/F441M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
- L. ASTM F442/F442M - Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).
- M. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- N. ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
- O. NFPA 54 - National Fuel Gas Code; National Fire Protection Association.

#### 1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.
- C. Project Record Documents: Record actual locations of valves.
- D. Shop drawings and product data

#### 1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with State of South Carolina, standards.
  - 1. Maintain one copy on project site.
- B. Valves: Manufacturer's name and pressure rating marked on valve body.
- C. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

#### 1.06 REGULATORY REQUIREMENTS

- A. Perform Work in accordance with State of South Carolina plumbing code.

#### 1.07

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

### PART 2 PRODUCTS

#### 2.01 WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

- A. Copper Pipe: ASTM B 88, type K hard drawn.
  - 1. Fittings: ASME B16.22 wrought copper and bronze.
  - 2. Joints: ASTM B 32, alloy Sn95 solder. Maximum lead content 0.10%.

#### 2.02 WATER PIPING, ABOVE GRADE

- A. CPVC Pipe: SCHED. 40 ASTM D2846/D2846M, ASTM F441/F441M, or ASTM F442/F442M.
  - 1. Fittings: CPVC; ASTM D2846/D2846M, ASTM F437, ASTM F438, or ASTM F439.
  - 2. Joints: ASTM D2846/D2846M, solvent weld with ASTM F493 solvent cement.

#### 2.03 NATURAL GAS PIPING, ABOVE GRADE

- A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
  - 1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
  - 2. Joints: NFPA 54, threaded or welded to ASME B31.1.

#### 2.04 FLANGES, UNIONS, AND COUPLINGS

- A. Unions for Pipe Sizes 3 Inches and Under:
  - 1. Copper tube and pipe: Class 150 bronze unions with soldered joints.

## 2.05 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
  - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
  - 2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
  - 3. Trapeze Hangers: Welded steel channel frames attached to structure.
  - 4. Vertical Pipe Support: Steel riser clamp.
- B. Plumbing Piping - Water:
  - 1. Conform to ASME B31.9.
  - 2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.

## 2.06 BALL VALVES

- A. Manufacturers:
  - 1. Allied Healthcare Products: [www.alliedhpi.com/index.html](http://www.alliedhpi.com/index.html)
  - 2. Apollo
  - 3. Conbraco Industries: [www.conbraco.com](http://www.conbraco.com).
  - 4. Grinnell Mechanical Products, a Tyco International Company: [www.grinnell.com](http://www.grinnell.com).
  - 5. Grinnell: [www.grinnell.com](http://www.grinnell.com)
  - 6. Guardian Equipment: [www.gesafety.com](http://www.gesafety.com)
  - 7. Nibco, Inc: [www.nibco.com](http://www.nibco.com).
  - 8. Milwaukee Valve Company: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  - 9. Victaulic: [www.victaulic.com](http://www.victaulic.com)
  - 10. Watts Regulator Co.: [www.wattsreg.com](http://www.wattsreg.com)
  - 11. Substitutions: See Section 01600 - Product Requirements.
- B. Construction 2 Inches and Smaller: Meets the intent of MSS SP-110, 300 psi CWP, forged brass body, two piece, chrome plated brass ball and stem, standard port, Teflon seats, blow-out proof stem, lever handle, Vic Press 304™ ends.

## 2.07 PLUG VALVES

- A. Manufacturers:
  - 1. Armstrong International: [www.armstrong-intl.com](http://www.armstrong-intl.com)
  - 2. Grinnell: [www.grinnell.com](http://www.grinnell.com)
  - 3. Strahman Valves: [www.strahmanvalves.com](http://www.strahmanvalves.com)
  - 4. Victaulic Company of America: [www.victaulic.com](http://www.victaulic.com)
  - 5. Substitutions: See Section 01600 - Product Requirements.

## 2.08 SEISMIC GAS SHUTOFF VALVE

- A. Manufacturers:
  - 1. Tyco Flow Control: [www.tycoflowcontrol.com](http://www.tycoflowcontrol.com).
  - 2. California Valves
  - 3. Hammond Valve: [www.hammondvalve.com](http://www.hammondvalve.com).
  - 4. Milwaukee Valve Company: [www.milwaukeevalve.com](http://www.milwaukeevalve.com).
  - 5. Pacific Seismic
  - 6. Substitutions: See Section 01600 - Product Requirements.

## 2.09 STRAINERS

- A. Manufacturers:
  - 1. Armstrong International, Inc: [www.armstronginternational.com](http://www.armstronginternational.com).
  - 2. Grinnell: [www.grinnell.com](http://www.grinnell.com)
  - 3. ITT Fluid Handling: <http://fhs.ittind.com/>
  - 4. Green Country Filter Manufacturing: [www.greencountryfilter.com](http://www.greencountryfilter.com).
  - 5. Victaulic Company of America: [www.victaulic.com](http://www.victaulic.com)
  - 6. Watts Regulator: [www.wattsreg.com](http://www.wattsreg.com)
  - 7. WEAMCO: [www.weamco.com](http://www.weamco.com).
  - 8. Substitutions: See Section 01600 - Product Requirements.
- B. Size 2 inch and Under:
  - 1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
  - 2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that excavations are to required grade, dry, and not over-excavated.

### 3.02 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel or groove plain end ferrous pipe.
- B. Remove scale and dirt, on inside and outside, before assembly.
- C. Prepare piping connections to equipment with flanges, grooved joint couplings or unions.

### 3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.
- C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
- D. Install piping to maintain headroom, conserve space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 15082.
- G. Provide support for utility meters in accordance with requirements of utility companies.
- H. Install valves with stems upright or horizontal, not inverted.
- I. Install water piping to ASME B31.9.
- J. Sleeve pipes passing through partitions, walls and floors.
- K. Inserts:
  - 1. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.



2. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

L. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Support horizontal piping as scheduled.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Prime coat exposed steel hangers and supports. Refer to Section 09900. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

M. Test the Domestic Water system with 125 PSIG for 48 hours.

N. Test the Natural Gas system with 50 PSIG for 36 hours

### 3.04 APPLICATION

A. Provide plug valves in natural gas systems for shut-off service.

### 3.05 TOLERANCES

A. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

### 3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

- A. Disinfect water distribution system in accordance with Section 02515.
- B. Prior to starting work, verify system is complete, flushed and clean.
- C. Ensure Ph of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
- D. Inject disinfectant, free chlorine in liquid, powder, tablet or gas form, throughout system to obtain 50 to 80 mg/L residual.
- E. Maintain disinfectant in system for 24 hours.
- F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.
- G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.
- H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

### 3.07 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:
  - a. Pipe size: 1/2 inches to 1-1/4 inches:
    - 1) Maximum hanger spacing: 6.5 ft.
    - 2) Hanger rod diameter: 3/8 inches.
2. Plastic Piping:
  - a. All Sizes:

- 1) Maximum hanger spacing: 6 ft.
- 2) Hanger rod diameter: 3/8 inch.

**END OF SECTION**

## SECTION 15146 - PLUMBING SPECIALTIES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Hydrants.
- B. Backflow preventers.

#### 1.02 RELATED REQUIREMENTS

- A. Section 15145 - Plumbing Piping.

#### 1.03 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.
- C. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.
- D. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.
- E. Operation and Maintenance Manuals: Include in manuals the information listed below. For information on how to prepare and submit manuals see section 1780 (Closeout Submittals).
- F. Operating instructions
- G. Maintenance instructions, including preventative and corrective maintenance.
- H. Copies of warranties
- I. Shop drawings and product data

#### 1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Accept specialties on site in original factory packaging. Inspect for damage.

### PART 2 PRODUCTS

#### 2.01 HOSE BIBBS

- A. Manufacturers:
  - 1. Jay R. Smith Manufacturing Company: [www.jayrsmith.com](http://www.jayrsmith.com).
  - 2. Watts Regulator Company: [www.wattsregulator.com](http://www.wattsregulator.com).
  - 3. Zurn Industries, Inc: [www.zurn.com](http://www.zurn.com).
  - 4. Woodford
  - 5. Substitutions: See Section 01600 - Product Requirements.

#### 2.02 DOUBLE CHECK VALVE ASSEMBLIES

- A. Manufacturers:

1. Ames
  2. Conbraco Industries: [www.conbraco.com](http://www.conbraco.com).
  3. Watts Regulator Company: [www.wattsregulator.com](http://www.wattsregulator.com).
  4. Substitutions: See Section 01600 - Product Requirements.
- B. Double Check Valve Assemblies:
1. ASSE 1012; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.

### 2.03 VACUUM BREAKERS

- A. Manufacturers:
1. T&S Brass
  2. WATERSAVER
  3. Watts Regulator Company: [www.wattsregulator.com](http://www.wattsregulator.com).
  4. Substitutions: See Section 01600 - Product Requirements.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

**END OF SECTION**

# D I V I S I O N 16

Applicable Portions Of The Conditions  
Of The Contract And Division 1 General  
Requirements Apply To The Work Of  
This Division.

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**GENERAL PROVISIONS**

**SECTION 16010**

**PART 1 - GENERAL**

**1.01 RELATED DOCUMENTS:**

A. Drawings and specifications including General Conditions, Supplementary Conditions and Division 1 specification sections, apply to work of this and all sections in Division 16. Division 16 General Provisions described in this section apply to all sections of Division 16.

B. It is recognized that separate sub-contracts may be instituted by the General Contractor or the Division 16 Contractor with other contractors and/or suppliers. It is the responsibility of the Division 16 Contractor to completely inform, coordinate and advise those subs as to all of the other requirements, conditions and information associated with providing and installing the total job.

**1.02 WORK INCLUDED:**

A. Work included in these specifications and included on the drawings shall include furnishing all labor, materials, supplies, and equipment to perform all work required including cutting, channeling, chasing, excavating and backfilling, demolition (if any) to install a complete and working electrical system(s) in accordance with these sections of the specifications and the accompanying drawings. This shall include all required preparation work, demolition, raceways, coordination, etc. required to install the electrical system.

B. The electrical work shall include, but in no way be limited to the following:

1. Raceways (To include raceways for conductors and cables)
2. Electrical Distribution System.
3. Exterior and Interior Lighting Systems.
4. Exterior and Interior Power Systems.
5. Wiring Devices.
6. Connection and installation of Equipment Furnished Under Other Divisions of the Specification.

**1.03 COORDINATION OF WORK IN OTHER SECTIONS:**

A. The Division 16000 contractor is responsible for including any and all work related to the electrical that is noted in any part of the specifications or any part of the drawings, including Divisions 1, 15 and any other sections.

B. If any piece of equipment is shown on any part of the drawings ("A" (Architectural) drawings, "M" (Mechanical) drawings, "P" (Plumbing) drawings, or "E" (Electrical) drawings), it is the responsibility of the

Division 16 Contractor to furnish and install electrical service as required to that equipment. Electrical service shall comply with all requirements of the equipment shop drawings and all codes.

C. The Division 16 Contractor will supply power to equipment at the voltage indicated on the Division 16 drawings. The Division 16 Contractor and all other contractors will be held responsible for coordinating the equipment voltages, control equipment, wiring, and locations and type of terminations/connections and/or disconnects required to comply with the National Electrical Code, International Building Code, all local codes, and the equipment manufacturer's requirements. If equipment is furnished to the project at a voltage other than that shown on the Division 16 drawings, the contractor supplying the equipment and all other subcontractors will be held responsible for making any necessary adjustments to correct the conflict, to the satisfaction of the Electrical Engineer.

1.04 INTERPRETATION OF THE DRAWINGS AND SPECIFICATIONS (CONTRACT DOCUMENTS):

A. Refer to the section of the specifications which cover General Conditions, Division 1, and Instructions to bidders. These sections and their requirements are a part of this contract and are binding on this section of the work.

B. Electrical Drawings are diagrammatic in nature except where specific dimensions, or specific details are shown on the electrical, mechanical, or architectural drawings. The Electrical Contractor shall refer to other drawings for exact locations of equipment, building dimensions, architectural details and conditions affecting the electrical work; however, field measurements take precedence over dimensioned drawings. The Electrical Contractor shall provide all labor and materials and all incidental elements; junction and pull boxes, filters, pull wires, connectors, support materials, fuses, disconnect switches, lamps, and labels, to install, connect, start-up and result in a complete and working system in accordance with the drawings and specifications. Unless noted otherwise on the plans or in these specifications, all final connections are the responsibility of the Division 16 Contractor.

C. In order to show on the drawings the electrical work required under this contract, it is necessary to utilize symbols and schematic diagrams/details. These symbols and schematic diagrams/details do not have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed in accordance with the intent diagrammatically expressed on the drawings, and in conformity with the dimensions indicated on the final architectural and structural working drawings and on equipment shop drawings. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded.

D. When the details of specific and/or general installation requirements show specific dimensioning and/or positioning requirements of the items to be installed, these dimensions shall be field coordinated and followed. It is the intent of these details to only establish the general feasibility of the work required. These details in no way delete, reduce, or substitute the requirement of field coordination for the indicated work.

E. The contractor is responsible for coordinating the installation of all electrical work with the work of other contractors and/or trades. This contractor shall refer to the other drawings (demolition, site, architectural, structural, plumbing, mechanical, etc.) to assure that the installed electrical work is installed in a coordinated fashion. Conflicts on installation work due to the lack of proper coordination of this contractor shall result in

the work being removed and coordinated and properly reinstalled at no increase cost to the Owner. Report to the Engineer any and all discrepancies that the contractor(s) find in the field between the electrical drawings and the other drawings.

F. The installation of any and all equipment/systems is subject to clarification as indicated in the review comments of the Engineer on the shop drawings. The contractor shall be aware that if the equipment of an approved equal manufacturer is to be installed, the equipment, controls, functions, conduit routing, power requirements, etc. may be different. It is the responsibility of the electrical contractor to coordinate the installation requirements of the equipment to be installed with the electrical plans of the specified. If there are any additional equipment, power service, conduit, conductors, controls, etc. required to install the approved equal equipment, these additional requirements shall be furnished and installed at no additional cost to the Owner.

G. The electrical drawings are such that the electrical service to equipment furnished and installed under other sections of the contract documents (examples, but not limited to: HVAC equipment, pumps, motors, etc) is coordinated for the specified equipment only. If the equipment installed under other divisions of the contract documents is not the specified equipment and is an approved equal to the specified equipment, it is possible that the equipment will require different electrical service/interface than that shown on the electrical plans for the specified equipment. In this case, it is the responsibility of the approved equal installing contractor / manufacturer to coordinate the electrical service/interface requirements with the electrical contractor. If the electrical service/interface requirements of the substituted equipment are greater than the specified equipment and result in an increased electrical cost, it is the responsibility of the furnishing/installing contractor to pay the electrical contractor for the increase in electrical cost.

H. Submission of a proposal and ultimate acceptance of an agreement or contract for execution of this section of work will be construed as evidence that the Electrical Contractor and each interested Subcontractor and/or vendor has carefully read and accepts all conditions set forth in each Division under specification Divisions titled "Instructions To Bidders" and Division 1, "General Conditions", in so far as such conditions may affect both the bidding for and execution of this section of work.

#### 1.05 ELECTRICAL SYSTEMS:

A. All electrical systems shown on the plans or specified in the specifications shall have equipment furnished and installed so that the system is a complete and functioning system that complies with the intent of the specifications, whether each and every element of each and every system is specified or not. Any and all equipment, options, and system elements necessary for proper operation shall be furnished and installed, whether specifically called for (specified by name or catalog number) or not.

B. The wiring, connections, and support elements shown on the plans or noted in the specifications is for a complete and workable system(s). Any deviations from the wiring shown due to a particular manufacturer's requirements shall be made at no cost to either the contract or to the Owner. Changes in electrical service to equipment due to substitutions of equipment by any contractors shall be at the cost of that contractor.

#### 1.06 EQUIPMENT DELIVERY, STORAGE, INSTALLATION:



- A. Where equipment is purchased by the electrical contractor to be installed in conformance with the contract documents, the contractor shall follow the following procedure as it relates to delivery, storage, and installation:
1. Coordinate any and all information with any and all contractors who are to do work to accommodate the division 16 equipment/work.
  2. Coordinate delivery of equipment.
  3. Unload the equipment from delivery trucks.
  4. Inspect the equipment to assure correct make, model number, voltage, etc.
  5. Provide for safe handling and field storage up to the time of permanent placement in the project.
  6. Provide for any and all field assembly and internal connection as may be necessary for proper operation.
  7. Install in place including any and all required mounting supports, connectors, fittings, connections, and accessories required for complete system operation.
- B. Where equipment is purchased by the Owner and is to be installed by the Division 16 contractor, the Division 16 contractor shall follow the following procedure as it relates to delivery, storage, and installation:
1. Coordinate equipment shop drawings with any and all contractors who are to do work to accommodate the Division 16 equipment /work.
  2. Coordinate delivery of equipment.
  3. Unload the equipment from delivery trucks.
  4. Inspect the equipment to assure correct make, model number, voltage, etc.
  5. Inspect the equipment for any damage or corrosion. Claims that any of these items have been received in such condition that their installation will require work beyond the reasonable scope of the work will be considered only if presented in writing to the Architect/Engineer within 10 days of delivery.
  6. Provide for safe handling and field storage up to the time of permanent placement in the project.
  7. Provide for any and all field assembly and internal connection as may be necessary for proper operation.
  8. Install in place including any and all required mounting supports, connectors, fittings, connections, controls, and accessories required for complete system operation.

#### 1.07 SPECIAL ELECTRICAL REQUIREMENTS:

- A. Provide all wiring, connectors, fittings, connections, and all accessories for the complete installation of, and final connections to, equipment furnished under other divisions of the specifications and where indicated on the electrical drawings or otherwise specified.
- B. The Electrical Contractor shall coordinate with all other contractors the electrical service provided as shown on the electrical plans with respect to voltage, phase, and ampacity. This coordination shall take place before any equipment is ordered and is for the purpose of the contractor providing equipment that requires electrical connection ordering the correct equipment to match the electrical service provided. Any changes in the characteristics of the circuits that serve any electrically operated equipment shall be made at no additional cost to the Owner.
- C. Make all final connections to all equipment, provided under the electrical contract and equipment provided under other sections, except where noted on the plans to provide "rough-in only". Where connections are to

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be made by someone other than the Division 16 contractor, coordinate with the equipment supplier to determine the rough-in requirements. In the case where rough-in is installed now but equipment unknown or is to be installed in the future, install outlet box sized for the conductors installed, install conductors and leave 8" of pigtails for each conductor. Tape all conductors, leave a note in the box as to the panel the circuit is connected, and install a cover plate over the outlet box. In the panel that the circuit terminates, do not connect the circuit to a breaker, tag the circuit with information as to the location of the outlet box, and leave enough pigtail in the panel so that connection can be made to any breaker space in the panel.

D. The Electrical Contractor is hereby alerted that certain features of control, other functions, or systems may be specified in this division by performance, and as such, all elements of wiring or other materials and devices for the complete installation may not be shown on the drawings. The Electrical Contractor shall provide for the final and complete installation of all features called for by drawings or specifications.

E. Where equipment is prewired, the power wiring shall extend to the power terminals of the pre-wired equipment. Control wiring for all equipment and temperature control wiring is covered under Division 16 unless specifically noted.

**1.08 COMPLIANCE WITH CODES AND REGULATIONS:**

A. The Contractor is responsible for obtaining all required permits and complying with all National (NEC, IBC, NFPA), State, County, and Municipal codes and regulations. This shall include, but not be limited to, the following:

1. Federal Occupational Safety and Health Act (OSHA)
2. NFPA 70 (National Electrical Code)
3. NFPA 72D (Proprietary Protective Signaling Systems)
4. Americans with Disabilities Act (ADA).
5. International Building Code (IBC).
6. International Fire Code.

B. Unless noted otherwise, the contractor shall comply with the latest edition and update of any and all codes and standards.

C. Compliance with Underwriters Laboratories - All products installed under the contract shall have the Underwriters Laboratories (UL) label where such marking is available. Products which are not UL labeled will not be acceptable if labeled products are available from another approved manufacturer.

D. The above listed requirements are required of the electrical contractor by this contract whether these requirements are shown on the drawings, mentioned in the specifications or not.

E. All work and equipment installed that does not comply with the codes and standards noted above shall be corrected and/or replaced (at engineer's option) at no cost to the Owner.

F. The contractor(s) shall submit all items necessary to obtain all required permits to the appropriate Federal/State/County/City agencies, obtain all required permits, and pay for any and all required fees.

1.09 SUBSTITUTIONS AND THE "OR EQUAL" CLAUSE:

A. Where a manufacturer and/or model number is noted in a specification, that manufacturer and/or model number shall be the equipment used on the project. Substitutions may be allowed for some/all of the specified equipment where approved by the Architect/Engineer per the process as outlined in this section of the specifications. When an item, piece of equipment, method, etc. is specified or called for on the drawings or in the specifications, it shall establish a standard of quality which shall be used to evaluate all substitutions. It is not the intent of this specification to limit competition in any way, however; in some evaluations the decision of equality comes down to personal opinion. In all evaluations, the opinion and decision of the engineer shall be final and binding to all parties.

B. All substitutions to the specified equipment manufacturer, make, or model, shall be approved before bid. Request to substitute and material, item, or method for a specified material, item, or method shall be made in writing and submitted so as to be received by the engineer at least ten (10) days before bid date. All approved request shall be noted in an addendum. Only the specified materials and items noted in the addendum as approved equals shall be used on the project.

C. All submittals to request to substitute shall clearly describe the product. Request to substitute shall include catalog descriptive material, engineering data, and also list areas where the requested material exceeds or falls short of the specification for the specified material. Include samples (To be retained in the project file by the Engineer) of the item.

D. Incomplete submittals, or submittals that require the Engineer to spend considerable time researching the item, will not be considered for approval. The burden of proof that an item is equal to the specified item is on the party requesting the substitution. In all evaluations, the opinion and decision of the engineer shall be final and binding to all parties.

E. Request to substitute or obtain approval to substitute for an item or material that has been previously turned down, will not be considered.

F. When approval to substitute an item for the specified item is granted, the approval does not relieve the contractor from compliance with all system functions or equipment characteristics.

G. When a substituted item requires additional work for another contractor or subcontractor to adjust his work to accommodate the substituted item, the contractor who made the substitution shall pay all cost for accommodation of the substituted item.

H. As with any substituted item, it is the responsibility of the contractor making the substitution to make the item fit, function, and act as the specified item. If, in the opinion of the engineer, the substituted item does not comply, function, fit, or perform to the standards of the specified item, the contractor shall remove the substituted item and install the specified item, at no cost to the Owner.

I. Contractor prices shall be based on only the specified items, materials, or methods (or approved equals). There shall be no increase in contract cost when a non-approved item is used in pricing and is not approved by the engineer.

**1.10 DIMENSIONS ON DRAWINGS, IN FIELD, VERIFICATION:**

A. The contractor shall be responsible for visiting the site in order to become familiar with existing conditions and coordinating the required work as needed. No increase in contract cost will be considered due to the contractor not being aware of existing conditions.

B. Do not scale drawings. Confirm all dimensions in the field. Coordinate all installations with shop drawings and other contractors work. Where discrepancies are found on the contract documents, the contractor shall include in the project cost any and all materials, items and labor required to make any and all changes required to install the work correctly. Where discrepancies are found on the project the contractor shall stop work in that area and contact the engineer.

**1.11 CHANGE ORDERS:**

A. Change orders will not be issued for relocating electrical equipment or rerouting conduit and wiring. This section of the electrical specifications require that relocating of electrical equipment or rerouting of conduit/wiring be done at no additional cost to the Owner.

B. When change orders are required for electrical work, the unit material and unit labor method shall be used. Unit values for material shall be contractors' net cost from distributor. Unit values for labor hours shall not be greater than those listed in the latest addition of Means mechanical/electrical cost data. Sales tax is to be added to materials and workman's compensation insurance is to be added to labor. Overhead and profit markup is to be added to the materials and labor subtotal per the instructions in Division 1..

C. To calculate a credit for deleted work, the identical method of calculations shall be used for deleted work that is used for new work. No money will be allowed for lost scheduling time or estimation time. The Engineer agrees to expedite change orders as rapidly as possible to avoid construction delay. The contractor may be required to estimate a number of alternatives for change orders in order to arrive at the lowest cost for change orders.

D. There shall be no additional cost for the contractor to estimate multiple alternatives for consideration.

**1.12 SUBMITTALS:**

A. Unless otherwise noted, Submittals (formerly/also referred to as "shop drawings") shall be made in accordance with requirements as stated in Division 1. Submittals shall be submitted to the Engineer on all equipment within thirty (30) days of contract award. If submittals are not received within the thirty day time limit the specified equipment shall be used (no exceptions).

B. The Contractor shall not purchase any materials or equipment prior to the receipt of approved submittals from the Engineer. Any commitment to purchase or contract to purchase equipment or materials made between the Contractor and an equipment supplier and/or manufacturer before the receipt of approved submittals from the Engineer shall be at the risk of the Contractor. If submittals are not approved, any restocking charge or cancellation charge by a manufacturer and/or supplier shall be the responsibility of the Contractor and not reflect as an increase cost to the Owner

C. Submittals shall contain all the necessary information required to prove that the equipment will fit and function correctly. Submittals shall be bound together and submitted as a complete package for each section. The Contractor shall review each submittal to confirm that the submittal meets the Contractor's requirements before the submittal is made to the Engineer.

D. For some equipment/systems (examples: control wiring etc.), the drawings only show the system elements and do not show the interconnection of these elements on a riser diagram. For equipment/systems such as these, the manufacturer shall include with the submittals a wiring/conduit riser diagram for the system.

E. It is not unreasonable to expect a 14 to 21 day (or possibly longer) submittal turnaround from the Engineer. Therefore it is imperative that the Contractor comply with the 30 day requirement outlined in paragraph A. If the project is a "Fast Track" type project, it may be necessary to have submittals reviewed in a very short time period. In such cases, the contractor shall note on the cover sheet of the submittal the date in which submittals must be returned. Every effort will be made to comply with this date, but close coordination between Contractor and Engineer shall be required.

F. The engineer reserves the right to refuse any equipment that in his opinion will not function as well as the specified equipment. The opinion of the engineer shall be final and shall bind all parties. The Engineer has the right to require the contractor to use the specified equipment if the second shop drawing submittal is not approved.

G. Submittal review is only for verifying the conformance with the design concept of the project and compliance with the information given in the Contract Documents. The contractor is responsible for dimensions to be confirmed and correlated at the job site; for information that pertains solely to the fabrication processes or to techniques of construction; and for coordination of the work of all trades.

H. The Contractor shall review the submittals and make note of all dimensions of the equipment and shall make the necessary adjustments in equipment locations as required to install the equipment. **THE CONTRACTOR SHALL NOT INSTALL ANY EQUIPMENT OR PROVIDE ELECTRICAL ROUGH-INS BEFORE APPROVED SUBMITTALS ARE RETURNED BY THE ENGINEER AND DIMENSIONS ARE APPROVED.**

I. Approval to substitute material, equipment, devices, processes, or any item as an "as/an equal" to the specified item does not relieve the Contractor of the full responsibility to make the substituted material, fit, function or appear as required in the Drawings and Specifications. Contractor shall assume full responsibility for the satisfactory adaptability of a substituted item to those items specified or shown on the drawings.

J. Required submittals are listed with each section of the electrical specifications.

#### 1.13 RECORD DRAWINGS:

A. The electrical contractor shall keep a set of construction drawings during the length of the project on which he shall note any and all changes from the original drawings. This record set of drawings shall be updated daily.

B. After the "RECORD DRAWINGS" have been approved by the Engineer, the contractor shall have one set

of blueprints made from the "Record Drawings" sepias. The contractor shall wall mount a 4" PVC tube with screw on cap in the main electrical room and place the set of blueprints in this tube.

**1.14 COORDINATION OF WORK WITH OTHER CONTRACTORS:**

A. All work shall be coordinated to avoid conflict with other contractors. The contractor shall be responsible for checking to insure that the equipment to be installed will fit in the space shown on the drawings. If there is a conflict, the contractor shall notify the Engineer before bid. By submitting a bid the contractor assures that the equipment to be installed will fit or that provisions have been included in the bid to move the equipment to a location where it can be installed without conflict.

**1.15 GUARANTEE OF WORK, EQUIPMENT AND MATERIALS:**

A. All work, equipment, and materials shall be new and without defects or blemishes, and guaranteed to be free from defects for a period of one (1) year after the final date of project acceptance as defined by the Architect (NOT THE DATE OF INSTALLATION OR START-UP). All installation and installation materials shall also be guaranteed for the one (1) year period. This shall cover such items as equipment pads, supports, leaks from around equipment installation, etc and is intended to cover everything installed or provided under this division of the contract.

B. Manufactured pieces of equipment shall have their guarantee also backed by the equipment manufacturer.

C. During the guarantee period there shall be no charge to the Owner for items and work done under the guarantee clause (Service calls). This shall apply to replacement equipment, equipment shipping charges, mileage, labor, all taxes, etc.

**1.16 OPERATING AND MAINTENANCE MANUALS:**

A. Provide manuals as specified under Division 1. Use multiple binders if a single binder would exceed 2.5" in thickness; arrange the data in the same sequence as the specification section; delete or mark through unapplicable data.

B. Provide tab pages to separate each major item or closely related group of items with typed item names on the tabs. Supply a table of contents at the beginning of each volume listing all items, the manufacturers and the name, address and phone number of the nearest authorized service representative.

C. Manuals shall include the following, in addition to operation, maintenance and lubrication instructions and parts lists:

1. Light Fixture Cut Sheets.
2. Wiring Devices

**1.17 QUALITY OF WORK / WORKMANSHIP:**

A. The contractor performing the electrical work shall employ craftsmen who are thoroughly experienced and

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trained in the installation of electrical systems and general installation coordination. All work shall be done in the highest level of standards for the trade. Any work installed at a level that is less than the highest level of standards for the trade shall be removed and reinstalled in the manner described above at NO additional cost to the Owner.

B. All equipment shall be installed in compliance with the manufacturer's published installation recommendations and requirements, with any and all required accessories and mounting hardware, and/or as approved by the Engineer. The manufacturer's published installation requirements and recommendations shall become a part of the Owner's Manual (See Paragraph 1.15)

**1.18 DEFINITIONS:**

A. Concealed - Embedded in masonry or other construction. Installed under floor slabs, crawl spaces, above ceilings, in walls, in chases, or shafts. Not visible.

B. Exposed - Installed in such a manner that it can be seen. All exposed materials shall be installed in a neat manner. If in the engineer's opinion the installed materials are not installed in a neat manner, it shall be removed and reinstalled (at the Contractor's expense) to the satisfaction of the engineer, all at no increase cost to the Owner.

C. Furnish - When used in the Division 16 plans and/or specifications the word "furnish" shall mean to purchase a piece of equipment or material and to have said equipment/material transported to the project site (or other location if so directed). All items to be furnished shall include any and all mounting hardware, support, and accessory required for installation and proper operation. Unless otherwise noted, when a piece of equipment or material is to be furnished by the contractor, it shall also be installed.

D. Provide - When used in the Division 16 plans and/or specifications the word "provide" shall mean to furnish and install complete and ready for use. This shall include any and all options, accessories, and mounting/installation hardware required for a complete and operating system element of the electrical system.

E. Install - When used in the Division 16 plans and/or specifications the word "install" shall mean to unload and transport to the installation point of the job site the equipment/material. Any and all mounting hardware (whether specified or called for by name / model number, or not) shall be included. Perform every operation necessary, including any and all final adjustments, etc. required for proper operation.

F. Controlled – When used in the Division 16 plans and/or specifications, the word “controlled” shall mean to provide operating voltage by means of, but not limited to, feeders, disconnect, breakers, etc. to make the equipment/system operate and/or controlled.

**1.19 MANUFACTURER’S VERIFICATION OF EQUIPMENT INSTALLATION AND START-UP:**

A. Noted equipment that is purchased and installed/connected by the Division 16 contractor shall have an authorized manufacturer’s representative inspect the installation to verify that the installation meets or exceeds all manufacturer’s requirements and recommendations for proper operation.

- B. The authorized manufacturer's representative shall also start/energize the equipment and verify that the equipment/system is operating and functioning as required by these specifications and the manufacturer's requirements.
- C. The authorized manufacturer's representative shall also complete a form indicating that the equipment/system is operating and functioning as required by these specifications and the manufacturer's requirements. The form to be completed shall be furnished to the authorized manufacturer's representative by the Architect/Engineer.
- D. The requirements noted in this paragraph shall apply to the following equipment/systems:
1. All equipment provided by Greenhouse manufacturer

## **PART 2 - PRODUCTS**

### **2.01 GENERAL:**

- A. All products shall be of new manufacturer (unless the plans and/or other sections of this specification call for existing or other identified products to be used), age of less than one year, and the latest model of a manufacturer. A new product shall not be used if the manufacturer has introduced a product as a replacement. All materials and apparatus for the work shall be furnished, delivered, erected, connected and finished in every detail, and shall be so selected and arranged as to fit into the building spaces in compliance with all code requirements.
- B. All equipment that is provided by the contractor, subcontractors, or specialty subcontractor to be installed at the project site, shall be purchased, installed and maintained by the local (to the project site) authorized, licensed, factory distributor/installer/supplier. The contractor shall include with the submittals, verification in writing from the manufacturer, that the supplier and/or distributor is a factory authorized and licensed by the manufacturer to provide, install, and maintain (throughout the entire length of the warranty period) the equipment. **THERE SHALL BE NO EXCEPTIONS TO THIS REQUIREMENT.**
- C. By providing equipment to the project, a manufacturer guarantees to provide replacement parts for the equipment for a period of ten (10) years, even if the item provided goes out of manufacture.
- D. Manufacturer's catalog numbers listed are not necessarily complete. Products provided shall be a standard product which has a history of successful installation and operation for a minimum period of two years. Prototype or custom made equipment is not acceptable unless so specified herein. Equipment shall be as described on the drawings or specifications, and shall include all accessories for a complete installation.
- E. Manufacturer's instructions shall be obtained by the Contractor and used for the installation of all equipment and devices where such manufacturer's instructions are available.
- F. Where a substituted product is used instead of the specified product, the contractor will assume any and all responsibility for the product to fit, function and perform as well as the specified product. The opinion of the engineer will be binding and shall govern all parties as to a substituted product performing as well as the



G. Completeness: Provide all boxes, off-sets, bends, raceways, devices, raceway supports, installation brackets and supports, flexible connections, wiring connectors, labels and terminals for the complete installation and operation of all products. Each unit of product shall be assembled and installed and all surfaces shall be clean and free of dents, scratches, and abrasions or marred areas.

#### 2.02 MATERIAL IDENTIFICATION:

- A. All equipment shall be marked and/or identified so that maintenance crews can locate equipment.
- B. All equipment items; distribution, power, receptacle and lighting panelboards, switches, of the electrical system shall be labeled. Each distribution switch and circuit breaker in a switchboard, or individually mounted, shall be labeled. These labels shall be engraved, black laminated plastic labels, with 1/2 inch white letters. Attach the labels to the equipment with two sheet metal screws or rivets.
- C. Circuit breakers in distribution panels (panels with hinged doors) shall be labeled by means of a typed circuit breaker directory. For all breakers serving lighting, receptacle, and HVAC circuits, the contractor shall include on the panel schedule by the breaker number the room number(s) served by the circuit. The room number(s) shall be the same number(s) as the room number(s) on the door, not the space number as shown on the plans. See Section 16160.
- D. Wire and cable identification shall be made so that all wire and cable can be identified by means of color coding as noted in Section 16120. Wiring marker for use in wire and terminal identification shall be white cloth backed with a rubber based, pressure sensitive adhesive labels. Each wire or cable in a feeder at its terminal points, and in each pull-box, junction box, and panel gutter through which it passes shall be identified. Where two or more feeders enter or leave a device or enclosure, the cable shall be tagged to indicate destination of cable run. Each common wire, common circuit or common loop of a system shall be identified.
- E. Where used with an empty raceway for wires of a future system, each box or cabinet shall be identified on the inside by means of indelible markings indicating the system for which it is installed. Label any junction box, which includes wiring, with indelible markings on the outside showing system and voltage.

### PART 3 - INSTALLATION

#### 3.01 GENERAL:

- A. Before any work is started, the electrical contractor shall coordinate the work of other contractors that will affect the work of the electrical contractor. The electrical contractor shall inspect the work of all other trades to determine if the other work is ready for the electrical contractor to start his work.
- B. Any and all electrical installation shall be coordinated with other trades, contractors and the Owner.
- C. The contractor shall make himself familiar with existing conditions, site information, etc. so that conflicts

D. All work shall be installed per all applicable code, rules, regulations, shop drawings and manufacturer's installation recommendations.

E. The electrical contractor shall be responsible for returning to original, pre-construction condition, any paved areas, sidewalks, planting, walls, and other areas disturbed during electrical installation work.

F. The electrical equipment shall be installed as close as possible to the location as shown on the plans. If during the installation, it is required to install equipment in locations other than the one shown on the plans, the contractor shall make a sketch of the proposed changes, submit it to the Engineer, and after the Engineer has given approval, then proceed with the installation.

G. Working spaces and clearances shall not be less than the required minimums in the National Electric Code (NEC) or as shown on the plans.

### 3.02 LOCATIONS OF EQUIPMENT REQUIRING ELECTRICAL SERVICE AND CONNECTIONS:

A. Coordinate the exact installed location of equipment that requires electrical connections that is furnished and installed by other contractors. The electrical drawings try to show the correct location of all of these items, but it is the responsibility of the electrical contractor to coordinate with all other contractors to determine the exact installed location of all equipment furnished and installed by other contractors and wired by the electrical contractor. Such coordination shall include, but not limited to exact location, location of electrical connection, type of connection required, and electrical characteristics.

### 3.03 OPENINGS, CUTTING AND PATCHING:

A. Contractor shall arrange for openings in the building components to allow for admission of electrical work as the project progresses.

B. Any cut portion of the building, wall, sidewalk, paved drives, ceiling, floors, roofs, etc., to admit/install any raceway or apparatus, shall be restored in a manner such that the end product complies with the specification for that type of work. Where existing work is cut, restore to the original (pre-construction) condition. The electrical contractor shall be responsible for returning to original, pre-construction condition, any of the above noted areas or other areas disturbed during electrical installation work.

C. Structural, load bearing, or supporting device shall not be cut without approval in writing from the Architect.

### 3.04 EXAMINATION OF EXISTING CONDITIONS:

A. The Electrical Contractor is responsible for visiting and examining the site to determine those portions of the site affected by this work so as to become familiar with existing conditions and difficulties that will attend

the execution of the work, before submitting proposals.

B. Submission of a proposal will be considered as evidence that such examination has been made and later claims for labor, equipment, or materials because of difficulties encountered, which could have been foreseen had such examination been made, will not be recognized.

### 3.05 LOCATIONS OF OUTLET BOXES FOR EQUIPMENT AND GENERAL WIRING:

A. All outlets for lighting, power, and equipment, not specifically dimensioned are located diagrammatically on the drawings.

B. Lighting fixtures shall be located in accordance with reflected ceiling plans. Lighting fixtures shall be symmetrical within the space in which they are located. The Contractor shall be responsible for coordinating with the architectural and mechanical plans and to the shop drawing of the equipment to be installed for the exact location of the outlets required for equipment installation.

C. Lighting fixtures and convenience outlets shall be located so that they will be symmetrical with architectural details.

D. Equipment outlets shall be located so as to serve the equipment directly. It is the Contractor's responsibility to coordinate outlet location with equipment so that all outlets are accessible and disconnect switches have clearance for operation.

### 3.06 PAINTING:

A. Exposed conduit, ungalvanized troughs, metal frames and support racks shall be painted. Paint color shall match and be the same paint as the room finish paint unless noted elsewhere on the plans or in the specifications. Clean surfaces completely of all oil, wax, rust and old paint prior to repainting. Paint shall be applied to backup boards before switches, troughs, and devices are installed. Paint shall include a primer and two coats of finished paint. Touch-up scratched, or marred surfaces of lighting fixtures and equipment with paint obtained from the equipment manufacturer especially for that purpose.

### 3.07 ELECTRICAL SYSTEM TESTING:

A. At the time of the final inspection, or at such times as parts of the system may be completed, all electrical systems shall be tested for compliance with the specifications. The Contractor shall provide all personnel and equipment; current, voltage and resistance measuring instruments, ladders and lights to assist the Engineer in conducting the tests. Authorized representatives of the manufacturer of each system shall be present to demonstrate compliance with the specifications of their specific system.

B. The Contractor shall remove equipment covers as directed for inspection of internal wiring. After inspection and correction of any problems found, the Contractor shall replace all cover plates and access plates.

3.08 CLEANING:

A. At completion of the work the Contractor shall clean all exposed elements of the electrical system so that all markings deteriorating the original finish appearance are removed. All lighting fixtures, lenses, and reflectors shall be cleaned inside and out and all lamps shall be left clear of dust, dirt, and grime.

B. The Contractor shall specifically examine the interiors of panelboard cans, equipment cabinets, lighting fixtures, junction boxes, and like components where conduit and wire connections have been made, and all resulting wire ends, insulation cuttings, knock-out plugs, metal filings and any other trash shall be removed so that interiors and exteriors are left free of all debris.

**END OF SECTION 16010**

**WIRE AND CABLE - 600 VOLTS AND LESS**

**SECTION 16120**

**PART 1 - GENERAL**

**1.01 WORK UNDER THIS SECTION:**

A. Work under this section shall include the furnishing of all labor, materials, and equipment necessary to properly install of all required wire and cable rated 600 volt to complete the wiring and electrical system. This shall include, but not be limited to the following:

1. Building wire.
2. Wiring connections and terminations.

**1.02 RELATED WORK:**

A. Refer to other applicable Sections for requirements for special purpose cables and conductors used as part of Special Systems, such as Fire Alarm, etc. as applicable to Project.

B. Related work shall include the following:

1. All division 16000 sections.
2. Division 1.
3. Grounding.

**1.03 REFERENCES:**

A. NEMA WC 3 - Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

B. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

**1.04 SUBMITTALS:**

A. Furnish submittals and product data under the provisions of Section 16010.

B. Submittals for modular wiring system including layout of distribution devices, branch circuit conduit and cables, circuiting arrangement, and outlet devices.

C. Submit manufacturer's instructions.

D. Submit manufacturer's instructions for splicing and terminating aluminum conductors.

1.05 DELIVERY, STORAGE, AND HANDLING:

A. Deliver in new standard coils or reels with approved tag indicating length, size, type, insulation, and manufacturer's name. Store protected from the weather and physical damage. Do not install damaged materials.

1.06 QUALITY ASSURANCE:

A. Conductor manufacturer shall be Cablec, Essex, General Cable, Rome, Southwire, Pirelli, or Triangle.

B. Connector manufacturer shall be American Insulated Wire Corporation, Amp, Burndy, Ideal, OZ/Gedney, Scotch, 3M, or Thomas and Betts.

**PART 2 - PRODUCTS**

2.01 BUILDING WIRE:

A. All sizes shall be given in American Wire Gauge (AWG) or in thousand circular mils (MCM).

B. Thermoplastic-insulated Building Wire: NEMA WC 5.

C. Rubber-insulated Building Wire: NEMA WC 3.

D. Branch circuit conductors shall be not smaller than No. 12 AWG except that conductors for branch circuits whose length from panel to center of load exceeds 100 feet for 120/208 volt system shall not be smaller than No. 10 AWG from the panel to the first outlet box in the circuit.

E. Feeders and Branch Circuits Larger Than 6 AWG: Copper, stranded conductor, 600 volt insulation, THHN. Aluminum is not acceptable.

F. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600 volt insulation, THHN. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, solid conductor. MINIMUM SIZE SHALL BE #12 FOR ALL WIRING ABOVE 48 VOLTS. Aluminum is not acceptable

G. Control Circuits: Copper, stranded conductor 600 volt insulations, THW. For control and signal circuits above 50 VAC, conductors shall be #14 AWG minimum size, Type XHHW or THWN-THNN as permitted by NFPA 70, within voltage drop limits, increased to #12 AWG as necessary for proper operation. For control and signal circuits 50 VAC and below, conductors, at the Contractor's option, may be #16 AWG, 300

volt rated, PVC insulated, except where specifically instructed otherwise by equipment manufacturer.

**2.02 COLOR CODE:**

A. All conductors for grounded power and light system shall be color coded in accordance with the following table. Verify with Local NEC Inspection Authority prior to securing materials. Color coding shall be as follows:

208/120 Volt	Phase
Black	A
Red	B
Blue	C
White	Neutral
Green	Ground

NOTE: Neutral shall have white stripe or marking when required by NEC 200-6(d).

B. Per NEC 310-12, grounded or grounding conductors number 6 AWG and smaller shall be purchased with the proper insulation color. Wires number 4 AWG and larger may be identified with proper colored tape. Conductors passing through boxes containing other circuits shall be identified by vinyl-cloth self-adhesive markers. Markers shall be of manufactured type for this use, of wrap-around types. These shall be either pre-numbered or write-on types with clear plastic cover. Numbering shall indicate circuit designation.

**2.03 SPLICES:**

A. All connectors shall be rated for 600 volts, shall have a mechanical strength and insulation equal or superior to the conductor, and shall be taped.

B. Splicing of #8, #6, and #4 AWG or larger conductors shall be made with mechanical connectors covered by rubber tape, friction tape, and plastic tape. At the Contractor's option, solderless mechanical type connectors with insulated covers may be used.

C. Splicing of conductors #3 AWG and larger shall be done with conductor power distribution blocks with screw terminals on input and output. Termination block shall be manufactured by IlSCO ([www.ilsco.com](http://www.ilsco.com)).

D. Splicing of branch circuit conductors to leads from a light fixture shall be made with connectors rated 90 degrees Centigrade equal to Ideal "Wire-Nuts".

E. Splicing of #10 AWG and smaller solid conductors shall be made with wire or wing nuts, and shall be suitable for applied insulation. Wire nuts shall be Ideal "Wire-Nuts", 3M Co. "Scotchlok", or T & B "Piggy" connectors. "Sta-Kon" or other permanent type crimp connector shall not be used.

**2.04 TERMINATIONS:**

A. Provide an open-ended spade type termination device on any conductor which shall terminate under a

screw or on a terminal block (ie - receptacle, switch, etc., terminals.)

B. #8 AWG and larger cables shall terminate in "indent type" hex-screw, or bolt-clamp type bronze lugs approved equal to Burndy or O-Z. Cast type lugs shall have machined contact surfaces. #250 MCM and larger sizes shall have 2 clamping elements or compression indents.

C. The use of combination copper/aluminum lugs (except where inbuilt in a circuit breaker or switch devices) is not acceptable. Submit samples of proposed cast type lug proposed for use for approval of A/E. Pressed metal copper lugs, and prohibited material units will be cause for rejection of work. All contact surfaces shall have a "ground" (machined) finish and shall be equal to Burndy Co. products of a cast type.

D. The Contractor shall transmit these requirements to panel manufacturers. Nonconforming items shall be replaced.

E. Terminations for motors with No. 10 AWG or smaller conductors shall be a spring type pressure connector. Terminations for motors requiring No. 8 AWG and larger terminations shall be taped connections of spade lugs of motor leads to looped input conductors, using machine bolt and nut arrangement.

#### 2.05 TAPING:

A. The taping of mechanical type connectors shall require 2 layers of rubber tape, 2 layers of friction tape, and 1 layer of plastic tape.

B. Electrical insulating tape shall be Scotch no. 88 or 99, or approved equal. Installed splices shall have equal or better mechanical strength than the factory applied insulation.

#### 2.06 CONDUCTOR / CABLE IDENTIFICATION:

A. Each wire or cable in a feeder at its terminal points, and in each pull-box, junction box, and panel gutter through which it passes shall be identified to show the circuit number of the breaker that it connects to. Each common wire, common circuit to common loop of a system, or any signal system conductor, shall be identified.

### PART 3 - INSTALLATION

#### 3.01 GENERAL:

A. All installation shall be in accordance with the NEC.

B. Where a circuit home run is shown on the plans without any conductor or raceway identification, it shall be a minimum of 2 # 12, 1 # 12 Ground, ½" Conduit, with the exception of circuits over 100 feet for 120 volt and 150 feet for 277 volt. See paragraph 3.02.



**3.02 GENERAL WIRING METHODS:**

- A. All conductors shall be installed in raceway. Do not install more than three phase conductors, one neutral, and one ground conductor in any conduit unless specifically noted.
- B. Conductor sizes indicated on circuit homeruns or in panelboard schedules shall be installed over the entire length of the circuit unless noted otherwise on the drawings, or as specified herein for long runs.
- C. Conductors shall be continuous and unspliced where located within conduit. Splices shall occur only within troughs, wireways, junction boxes, outlet boxes, or equipment enclosures where sufficient additional room is provided for all splices.
- D. Allow adequate conductor lengths in all junction boxes, electrical equipment, pull boxes and terminal cabinets. All termination of conductors in which conductor is in tension will be rejected and shall be replaced with conductors of adequate length. This requirement shall include the providing by the Contractor of sleeve type vertical cable supports in vertical raceway installations provided in pullboxes at proper vertical spacings.
- E. Before installing raceways and pulling wire to any mechanical equipment, verify electrical characteristics with final submittal on equipment to assure proper number and AWG of conductors (such as multiple speed motors, different motor starter arrangements, etc.).
- F. A calibrated torque wrench shall be used for all bolt tightening.
- G. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- H. Make conductor lengths for parallel circuits equal.

**3.03 WIRING INSTALLATION IN RACEWAYS:**

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricate for pulling 4 AWG and larger wires.
- B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to damage conductors has been completed.
- C. Completely and thoroughly swab raceway system before installing conductors.
- D. No wire shall be pulled until the conduit system is complete from pull point to pull point and major equipment terminating conduits have been fixed in position.
- E. Mechanical pulling devices shall not be used on conductors sized #8 and smaller. Pulling means which might damage the raceway shall not be used.

F. Use only powdered soapstone or other pulling lubricant acceptable to the Architect/Engineer. Compound or lubricant shall not cause the conductor or insulation to deteriorate.

G. No pulling lubricant shall be used on Isolated Power branch circuits.

H. All conductors to be installed in a common raceway shall be pulled together. The manufacturer's recommended pulling tensions shall not be exceeded.

I. Bending radius of insulated wire or cable shall not be less than the minimum recommended by the manufacturer.

J. Where coaxial type conductors are installed, special requirements shall apply as outlined under that specific system detail specifications.

#### 3.04 VERTICAL RISERS:

A. Provide vertical cable riser supports per Article 300-19 in NFPA 70. Cable supports shall be O-Z/Gedney Type "S" or equal. These shall be located in accessible pullboxes of adequate size. Provide for adequate structural connection of cable supports to pullbox, which will transfer cable weight to building.

#### 3.05 CABLE INSTALLATION:

A. Provide protection for exposed cables where subject to damage.

B. Support cables above accessible ceilings; do not rest on ceiling tiles. Use spring metal clips or plastic cable ties to support cables from structure or ceiling suspension system. Include bridle rings or drive rings.

C. Use suitable cable fittings and connectors.

#### 3.06 WIRING CONNECTIONS AND TERMINATIONS:

A. Thoroughly clean wires before installing lugs and connectors.

B. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

C. Terminate spare conductors with electrical tape.

#### 3.07 FIELD QUALITY CONTROL:

A. Field inspection and testing will be performed under provisions this Section.

- B. Inspect wire and cable for physical damage and proper connection.
- C. Torque test conductor connections and terminations to manufacturer's recommended values.
- D. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

**END OF SECTION 16120**

**WIRE CONNECTIONS AND DEVICES**

**SECTION 16123**

**PART 1 - GENERAL**

**1.01 WORK UNDER THIS SECTION:**

A. Work under this section shall include the furnishing and installing of all required wire and cable connections and devices to make connections/terminations to complete the wiring and electrical system. This shall include, but not be limited to the following:

1. Exothermic Cable Welding.
2. Wiring connections and terminations.

**1.02 RELATED WORK:**

A. Related work shall include the following:

1. All division 16000 sections.
2. Division 1.
3. Grounding (16450).
4. Wire and Cable (16120).

**1.03 SUBMITTALS:**

- A. Furnish submittal drawings and product data under the provisions of Section 16010.
- B. Submit manufacturer's instructions.
- C. Submit manufacturer's instructions for splicing and terminating aluminum conductors.

**PART 2 - PRODUCTS**

**2.01 MATERIAL:**

A. Make cable and wire connections for splicing or terminating with compression deforming type connectors as manufactured by Burndy Corp., Thomas & Betts Co., Inc., Dossert Manufacturing Corp., IlSCO Corp., or accepted substitute.

B. Power connectors for cable sizes 250 MCM and larger shall be the long barrel type for double indentation or welded by the CADWELD(R) Process.

C. Welded connections including welded lugs where required, must be used on grounding cables #6 AWG or larger. Soldered connections will not be permitted.

D. Twist-on insulated connectors, of proper size and resistant to vibration, may be used for wires smaller than #6 AWG. Use twist-on connectors as manufactured by Minnesota Mining & Manufacturing Co., Thomas & Betts Co., Inc., Ideal Industries, Inc., or approved equal.

E. Provide terminal connectors with the hole sizes and spacing in accordance with NEMA standards. Provide terminal connectors with two holes in tongue for use on conductor sizes 250 MCM and larger. Terminal connectors are not required for connections to circuit breakers in the lighting and/or receptacle panels.

F. Insulate connections made with non-insulated connectors. Use three layers of plastic tape, each layer being half lapped. Use No. 35+ plastic tape as manufactured by Minnesota Mining and Manufacturing Co., or similar and equal plastic tape as manufactured by Plymouth Rubber Co.

## 2.02 GROUNDING CONNECTION:

A. Provide CADWELD(R) exothermic welding system for use in making electrical grounding connections of copper to copper or copper to steel for all conductors #6 AWG and larger, including lugged connections.

B. The CADWELD(R) exothermic welding system furnished under these specifications shall meet the applicable requirements of IEEE-80, Chapter 9, Section of conductors and joints. Exothermic connections are approved in NEC 250-81, 250-91, 250-113 and 250-115.

C. Two styles of CADWELD(R) connections shall be available: one primarily for indoor and the other for outdoor application

1. CADWELD(R) connections to be used outdoors shall be suitable for exposure to the elements or direct burial without degradation over the lifetime of the grounding system.
2. CADWELD(R) connections to be made in finished buildings or confined spaces shall use the low smoke, low emission CADWELD(R) EXOLON(R) process which is metallurgically equal to the above connection.

D. Molds shall be made from graphite or other material with standing welding temperatures and shall be designed to provide an average life of not less than 50 exothermic welds under normal conditions. Molds shall bear permanent marking, indicating the name of the manufacturer, the mold model, the type and size of welding mixture compatible with the welding process, and the size of the conductor. Instructions detailing general safety information, and welding procedures shall be provided with each mold.

1. The installer is prohibited from using a mold from one manufacturer with a different manufacturer's welding mixture. This practice can provide an unacceptable finished product.

E. Containers for weld metal shall be moisture resistant and shall be packaged to prevent damage or spillage

during shipping. Weld metal and starting material shall be premeasured and packaged together in a non-absorbing container. The starting material, if used, shall be at the bottom of the container to allow the starting material to be dispersed uniformly over the top of the welding mixture when placed in the crucible for a more uniform ignition and exothermic welding process.

F. Starting material, if used, shall consist of aluminum and copper and iron oxides. It shall not contain phosphorous or any caustic, toxic or explosive substance. Weld metal used for grounding connections shall contain copper oxide, aluminum, and not less than 3 percent tin as the wetting agent. Weld metal used for cathodic connections shall not contain tin, but shall contain vanadium. A minimum of 80 percent of the weld metal shall screen out between 30 and 140 mesh.

1. Weld metal packages shall be identified as to the part number and type of metals to be connected, such as copper to copper or copper to steel. Weld metal tube caps shall be color coded to indicate the alloy of the weld metal.
2. Weld metal packages shall be clearly marked to indicate whether they are for standard outdoor or low emission or cathodic applications.
3. Weld metal shall be controlled at the factory and subjected to routine and rigid quality control inspection procedures. The batch control numbers shall be packaged with the product prior to shipment from the factory.

## **PART 3 - INSTALLATION**

### **3.01 GENERAL:**

- A. All installation shall be in accordance with the NEC.
- B. All splices shall be in junction boxes and shall be electrically and mechanically secure.

### **3.02 INSTALLATION:**

A. Make all electrical power grounding and control connections to equipment furnished under other divisions of the specifications and furnish wiring, conduit, outlet boxes, etc., as required for same. Check General Construction, Controls, Plumbing, Heating and Air Conditioning, etc. plans and specifications to determine the amount of such wiring required and include cost of same in bid. Verify locations, horsepower, voltages, etc. of all equipment as the job progresses. If a conflict arises in wiring, ask the Project Engineer immediately for clarification. All installations must conform to the National Electrical Code (NEC).

B. Provide branch circuits and connections to all motors furnished to this project. Provide all disconnect switches as shown and where required by national or local codes. In general, all wiring shall be in conduit, with a short section of flexible conduit at each motor. Securely attach conduit to flexible conduit. When the motor is an integral part of equipment, isolate with a short section of flexible metal conduit to prevent vibration and/or noise amplification to the building structure. If the motor is adjustable, an additional length of flexible metal conduit shall be installed at the motor. Connect a ground wire from the conduit termination to the motor frame on the inside of the flexible conduit. Use approved grounding lugs or clamps on the

conduit connection.

C. Branch circuits and connections to all electrically operated equipment are included in this contract, whether or not specifically mentioned. Check, on the job, for further details on Plumbing, Heating and Air Conditioning equipment as project progresses. Ground equipment in an approved manner.

D. Major equipment furnished under other sections of the specifications may require different rough in requirements than indicated on the plans due to the "or equal" equipment clause. Secure detailed drawings from the trade furnishing the equipment to determine actual rough-in locations, conduit and conductor requirements.

E. Before connecting equipment, check the nameplate data against the information shown on the drawings. Call any discrepancies to the attention of the Project Engineer.

### 3.03 FIELD QUALITY CONTROL:

A. Field inspection and testing will be performed under provisions this Section. Inspect wire and cable for physical damage and proper connection.

B. Torque test conductor connections and terminations to manufacturer's recommended values.

C. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

**END OF SECTION 16123**

**ELECTRICAL BOXES**

**SECTION 16130**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED:**

- A. Furnish and install the type box for the electrical installation as required for the specific installation condition, whether the exact box is specified or not.
- B. Boxes shall include, but not be limited to the following:
  - 1. Wall and ceiling outlet boxes.
  - 2. Pull and junction boxes.

**1.02 RELATED WORK:**

- A. Section 16140 - Wiring Devices: Service fittings and fire-rated poke-through fittings for floor boxes.

**1.03 REFERENCES:**

- A. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.
- B. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

**1.04 COMPLIANCE:**

- A. Comply with NEC Article 370 (applicable sections), UL 50, UL 514, UL 886, NEMA OS1, NEMA OS2 and NEMA 250.

**1.05 IDENTIFICATION OF BOXES:**

- A. All boxes shall be marked on the outside of the box as to the circuit / system they serve. See Section 16010 for requirements. See the identification detail on Sheet E2.0.

**1.06 SUBMITTALS**



- A. Submit catalog cut of every type of box, conduit body, locknut, bushing, etc.

## **PART 2 - PRODUCTS**

### **2.01 GENERAL:**

- A. All boxes and fittings shall be labeled by Underwriters Laboratories.
- B. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, outlet boxes, and corrosion-resistant knockout closures compatible with outlet boxes being used and meeting requirements of individual wiring situations.
- C. Pull boxes and junction boxes shall be cast metal or nonmetallic with screw-on covers of the type and size to suit each respective location and installation. Boxes shall have continuously welded seams.
- D. All boxes shall be of the size and shape required by NFPA 70 for their respective locations.

### **2.02 LIGHTING FIXTURE OUTLETS:**

- A. Boxes shall be 4 inch octagon, 1-1/2 inches deep, made for connection to surface or pendant mounted lighting fixtures.
- B. Outlet boxes for flush mounted lighting fixtures shall be 4 inch square, 1-1/2 inch deep, with blank cover.

### **2.03 PULL AND JUNCTION BOXES:**

- A. Boxes: ANSI/NEMA OS 1; Cast metal or non-metallic.
- B. Boxes Larger Than 12 Inches in Any Dimension: Hinged enclosure in accordance with Section 16160.
- C. Junction boxes and pull boxes are not shown on the plans, but shall be provided by the Contractor at locations to comply with the NEC and shall be of the type, shape, and size as required for the specific installation.

## **PART 3 - EXECUTION**

### **3.01 GENERAL:**

- A. Comply with applicable portions of the National Electrical Contractor's Association's (NECA) "Standard of Installation".
- B. Install all boxes and fittings in compliance with NFPA 70, the manufacturer's written instructions, and with recognized industry practices.
- C. The Contractor shall coordinate his work with that of the General Contractor so that each electrical box is the type suitable for the wall or ceiling construction provided.
- D. Provide identification markers for multiple feeders or branch circuits through a common box.
- E. Provide knockout closures to cap unused knockout holes where blanks have been removed, and plugs for unused threaded hubs.
- F. Provide conduit locknuts and bushings of the type and size to suit each respective use and installation.
- G. Boxes and conduit bodies shall be located so that all electrical wiring is accessible.
- H. Avoid using round boxes where conduit must enter box through side of box which would result in a difficult and insecure connection with a locknut or bushing on the rounded surface.

### 3.02 COORDINATION OF BOX LOCATIONS:

- A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.
- B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned.
- C. Locate and install boxes to allow access. Where installation is inaccessible, coordinate locations and sizes of required access doors.
- D. Locate and install to maintain headroom and to present a neat appearance.

### 3.03 OUTLET BOX INSTALLATION:

- A. Do not install boxes back-to-back in walls. Provide minimum 6 inch separation, except provide minimum 12 inch separation in acoustic-rated walls.
- B. Provide knockout closures for unused openings.
- C. Support boxes independently of conduit.
- D. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

- E. Install boxes in walls without damaging wall insulation.
- F. Coordinate mounting heights and locations of outlets..
- G. Position outlets to locate luminaries as shown on lighting plans.

**3.03 PULL AND JUNCTION BOX INSTALLATION:**

- A. Support pull and junction boxes independent of conduit.

**END OF SECTION 16130**

## CONDUIT

### SECTION 16131

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Aluminum rigid metal conduit (RMC).
- C. PVC-coated galvanized steel rigid metal conduit (RMC).
- D. Liquidtight flexible metal conduit (LFMC).
- E. Electrical metallic tubing (EMT).
- F. Liquidtight flexible nonmetallic conduit (LFNC).
- G. Conduit fittings.
- H. Conduit, fittings and conduit bodies.

##### 1.02 REFERENCE STANDARDS

- A. ANSI C80.5 - American National Standard for Electrical Rigid Aluminum Conduit (ERAC); 2005.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
- C. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; National Electrical Contractors Association; 2004.
- D. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); National Electrical Contractors Association; 2003.
- E. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; National Electrical Manufacturers Association; 2003.
- F. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; National Electrical Manufacturers Association; 2004.
- G. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- I. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- J. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.
- K. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- L. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- M. UL 651 - Schedule 40 and 80 Rigid PVC Conduit and Fittings; Current Edition, Including All

Revisions.

- N. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- O. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit; Current Edition, Including All Revisions.

### 1.03 ADMINISTRATIVE REQUIREMENTS

#### A. Coordination:

1. Unless otherwise noted on the drawings or specified elsewhere in Division 16, route all conductors in conduit. The electrical plans indicate the general location of circuiting, electrical devices, and/or outlet boxes. If approved by the Engineer, conduit runs may be modified at the time of construction to adapt to the construction conditions, but in no case shall a circuit be combined with another circuit or modified without approval.
2. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
3. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
4. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
5. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
6. Notify Electrical Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

### 1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements for submittals procedures.
- B. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

### 1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- D. Protect PVC conduit from sunlight.

## PART 2 PRODUCTS

### 2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use EMT or GRS as applicable to the conditions.
- C. Underground:
  - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit.
  - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit.
  - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit
  - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.
  - 5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
  - 6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
  - 7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches (100 mm) on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.
- D. Interior, Damp or Wet Locations: Use aluminum rigid metal conduit or PVC-coated galvanized steel rigid metal conduit.
- F. Exposed, Exterior: Use galvanized steel rigid metal conduit or aluminum rigid metal conduit.
- G. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit or aluminum rigid metal conduit.
- H. Connections to Vibrating Equipment:
  - 1. Dry Locations: Use flexible metal conduit.
  - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
  - 3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
  - 4. Vibrating equipment includes, but is not limited to:
    - a. Transformers.
    - b. Motors.

## 2.02 CONDUIT REQUIREMENTS

- A. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- B. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.
- C. Minimum Conduit Size, Unless Otherwise Indicated:
  - 1. Branch Circuits: 1/2 inch (16 mm) trade size.
  - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.

3. Control Circuits: 1/2 inch (16 mm) trade size.
4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
5. Underground, Interior: 3/4 inch (21 mm) trade size.
6. Underground, Exterior: 1 inch (27 mm) trade size.
7. The outside diameter of any conduit buried in concrete shall not exceed 1/3 the thickness of the structural slab, wall or beam in which it is placed. Locate conduit in the middle of the member.

- D. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

#### 2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  2. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
  3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

#### 2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
- B. Fittings:
1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  2. Material: Use aluminum.
  3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

#### 2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- B. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).
- C. PVC-Coated Fittings:
1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
  2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
  3. Material: Use steel or malleable iron.
  4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).
- D. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).

#### 2.06 FLEXIBLE METAL CONDUIT (FMC)

- A. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

- B. Fittings:
  - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 2. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
- C. Description: Interlocked steel construction.
- D. Fittings: NEMA FB 1. Fittings shall be two-screw, double clamp malleable iron, hot dipped galvanized.

#### 2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- B. Fittings:
  - 1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
  - 2. Material: Use steel or malleable iron.
    - a. Do not use die cast zinc fittings.
- C. Description: Interlocked steel construction with PVC jacket.
- D. Fittings: NEMA FB 1.
  - 1. Fittings shall be of the type that uses a threaded grounding cone, a steel, nylon or plastic compression ring, insulated throat, and a gland for tightening. Fittings shall be made of steel, have insulated throats and have a male thread and locknut or male bushing with a ring seal. Each connector shall provide a low resistance ground connection between the flexible conduit and the outlet box, conduit or other equipment to which it is connected.

#### 2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees
- B. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
- C. Description: NEMA TC 2; Schedule 40 PVC.
- D. Fittings and Conduit Bodies: NEMA TC 3.

#### 2.09 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

- A. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.
- B. Fittings:
  - 1. Manufacturer: Same as manufacturer of conduit to be connected.
  - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

### PART 3 EXECUTION

#### 3.01 EXAMINATION



- A. Verify that field measurements are as shown on drawings.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Verify routing and termination locations of conduit prior to rough-in.

### 3.02 PLANNING

- A. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.
- B. Most conduit is shown on the plans as concealed above grade. However it may be necessary or convenient to route some of these conduits either partially or entirely underground because of wall construction, open ceiling areas, other types of building construction or for other practical considerations. Plan conduit routing early in construction to allow for the conditions. Consult with the engineer about changes in conduit routing.
- C. For open ceiling areas in finished areas examine building sections, structural drawings, elevations and other details to determine how to route conduit to be partially concealed or less obtrusive. Route conduit in channels, corners, tops of beams and other elements to present a neat and less visible appearance. Extend conduit underground to natural building chases (walls, column wraps, air duct chases) that will conceal conduit when possible even if conduit runs will be longer. Consult with the engineer about possible voltage drop concerns when conduit runs will exceed reasonable or specified distances.
- D. Keep up with building construction so that access to areas where conduit should be installed is not blocked.

### 3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- G. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
- H. Conduit Routing:
  - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
  - 2. When conduit destination is indicated and routing is not shown, determine exact routing required.
  - 3. Conceal all conduits unless specifically indicated to be exposed.
  - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
    - a. Electrical rooms.
    - b. Mechanical equipment rooms.
    - c. Within joists in areas with no ceiling.
  - 5. Unless otherwise approved, do not route conduits exposed:
    - a. Across floors.
    - b. Across roofs.
    - c. Across top of parapet walls.
    - d. Across building exterior surfaces.
  - 6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or

- perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
  8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
  9. Route conduits above water and drain piping where possible.
  10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
  11. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
  12. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
    - a. Heaters.
    - b. Hot water piping.
    - c. Flues.
    - d. Steam piping.
  13. Group parallel conduits in the same area together on a common rack.
  14. Construct racks using steel channel and provide 25% spare space for future conduits.
- I. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 16070 using suitable supports and methods approved by the authority having jurisdiction.
  2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
  3. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers and split hangers.
  4. Although it is intended that conduit not be attached to ceiling support wires, drops to light fixtures and other ceiling mounted devices remote from the building structure may be acceptable. Endeavor to install the conduit for the main circuit run on or supported to walls, ceiling joists and made supports near the points where drops are to be made. Confer with engineer where any doubt exists.
- J. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
  2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
  3. Use suitable adapters where required to transition from one type of conduit to another.
  4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
  5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
  6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
  7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
  8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
  9. When stub outs from wall or floor mounted outlet boxes are shown, noted or specified as part of an empty raceway system for sound, data, fire alarm and other low-voltage systems for which cable will be installed open in ceiling spaces, plenums, chases and other building elements it shall be understood that access for cable to the outlets, equipment cabinets and devices of the system must be provided through areas of inaccessible ceilings. Provide conduits between accessible ceiling areas or extend outlet box stubouts through inaccessible areas to a point where cable can be installed.

- K. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
  2. Make penetrations perpendicular to surfaces unless otherwise indicated.
  3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
  4. Conceal bends for conduit risers emerging above ground.
  5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
  6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
  7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
    - a. For exterior non-membrane openings, furnish and install cast iron pipe sleeves for conduits passing through non-membrane waterproofed exterior walls, footings, roofs or beams. Sleeves through exterior walls below grade shall have continuously welded center flange buried in construction. Make conduit watertight in sleeve with oakum packing and caulked lead joints on both sides of wall.
    - b. For interior membrane openings, furnish and install cast iron sleeves passing through interior membrane water proofed floors with integral flashing flange and clamping ring. Adjust sleeves to floor construction with galvanized steel or wrought iron pipe nipples top and bottom, extending two inches above finished floor. Clamp sleeves to flashing with clamping device.
    - c. For exterior membrane openings, furnish and install cast iron sleeves passing through exterior membrane waterproofed walls, floors and roof with integral flashing flange and clamping ring, modified for the required thickness. Make conduit watertight in sleeve with oakum packing and caulked lead joint.
  8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
  9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07840.
- L. Underground Installation:
1. Provide trenching and backfilling None-N/A.
  2. Minimum Cover, Unless Otherwise Indicated or Required:
    - a. Underground, Exterior: 24 inches (610 mm).
    - b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.
    - c. Install conduit with minimum grade of 4 inches per 100 feet.
    - d. Terminate conduit in end bell at manhole entries.
  3. Provide underground warning tape in accordance with Section 16075 along entire conduit length for service entrance where not concrete-encased.
- M. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
  2. Install conduits within middle one third of slab thickness.
  3. Secure conduits to prevent floating or movement during pouring of concrete.
- N. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
  2. Where conduits are subject to earth movement by settlement or frost.
- O. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.
  2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
- P. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.
- Q. Provide grounding and bonding in accordance with Section 16060.
- R. Identify conduits in accordance with Section 16075.
- S. If obstructions are encountered which prevent installation of the pull wire and/or conductors, the blocked section of raceway shall be removed and replaced. Any cutting or patching involved in such replacement will be included as a part of the electrical scope of work and included in the contract.

#### 3.04 FIELD QUALITY CONTROL

- A. See Section 01400 - Quality Requirements, for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

#### 3.05 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

#### 3.06 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.
- B. Use hydraulic one-shot conduit bender or factory elbows for bends in conduit larger than 1-1/2 inch size.
- C. Where rigid steel conduit does not terminate in a box or other device, and stubs up, install an insulated metallic bushing.
- D. Where called for on the plans, or if required by code, to provide a positive bonding and grounding of conduit to the enclosure or box, or for bonding and grounding of multiple or single rigid metal conduits, the conduit end shall be equipped with an insulated metallic grounding and bonding bushing.
- E. Where called for on the plans, or if required by code, to provide a grounding bonding jumper inside or outside of a raceway or an enclosure, use a grounding and bonding adapter locknut. Where the installation calls for the bonding jumper to be installed inside the conduit, use an insulated grounding and bonding bushing.
- F. Nylon pull cord shall be rated for minimum 200 pounds of pull force.

END OF SECTION

**WIRING DEVICES**

**SECTION 16140**

**PART 1 - GENERAL**

**1.01 WORK UNDER THIS SECTION:**

A. The work under this section shall include the furnishing and installing of any and all wiring devices in walls, required to make a complete and functioning wiring system. See the drawings for symbols and descriptions of devices.

**1.02 WORK INCLUDED:**

- A. Wall switches.
- B. Device plates and box covers.
- C. Receptacles

**1.03 REFERENCES:**

- A. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet.
- B. FS W-S-896 - Switch, Toggle.
- C. NEMA WD 1 - General-Purpose Wiring Devices.
- D. NEMA WD 5 - Specific-Purpose Wiring Devices.

**1.04 SUBMITTALS:**

- A. Section 16010 shall apply.
- B. Submit product data under provisions of Section 16010.
- C. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

**1.05 RECORD DRAWINGS:**

A. Section 16010 shall apply.

1.06 SUBSTITUTIONS:

A. Request to use equipment and materials other than those specified shall comply with Paragraph 1.09 of Section 16010 as well as with Division 1.

PART 2 - PRODUCTS

2.01 LIGHT SWITCHES:

- A. Units shall be 20 ampere, 120-277 volt. Color shall be grey.
- B. Three-way switches shall be P&S #CS15AC3-GRY with a P&S brushed aluminum cover plate.
- C. Weather proof 3-way switches shall be Cooper #S984-GRAY with a Metal switch cover plate.

2.02 WALL PLATES:

A. Standard Cover Plate: Brushed aluminum.

2.03 DUPLEX RECEPTACLE - 120 VOLT:

- A. All receptacles shall be of standard NEMA configuration, as indicated on the drawings
- B. Duplex receptacles provided for cord and plug attachment of equipment shall be heavy duty NEMA 5-20R, 20A, 125V, 2-pole, 3-wire types with integral U.L. listed self-grounding clips, unless other NEMA configuration is noted for a specific outlet. Receptacles shall be of specified color.
- D. Standard Ground Fault Circuit Interrupter receptacle shall be Cooper #WRVGF15-GY
- E. Outdoor covers outside of the greenhouse shall be Cooper #S2966-GRAY
- F. Indoor covers inside the greenhouse shall be Cooper #WIU-GRAY

PART 3 - INSTALLATION

3.01 INSTALLATION:

- A. Install wall switches 48 inches above floor, OFF position down.
- B. Install plates on outlet boxes and junction boxes in unfinished areas and on surface-mounted outlets.
- C. Install devices and wall plates flush and level.
- D. Install devices and wall plates flush and level.

**END OF SECTION 16140**

**PANELBOARDS**

**SECTION 16160**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED UNDER THIS SECTION:**

A. This section includes furnishing and installing panelboards and related equipment to form a complete and functioning electrical system. This shall include, but not be limited to the following:

1. Lighting and appliance branch circuit panelboard.

**1.02 REFERENCES:**

- A. FS W-C-375 - Circuit Breakers, Molded Case, Branch Circuit and Service.
- B. FS W-F-115 - Power Distribution Panel.
- C. NEMA AB 1 - Molded Case Circuit Breakers.
- D. NEMA PB 1 - Panelboards.
- E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.

**1.03 SUBMITTALS:**

- A. Provide submittals for equipment and component devices under provisions of Section 16010.
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

**1.04 RECORD DRAWINGS:**

- A. Section 16010 applies.

**1.05 SPARE PARTS:**

- A. Keys: Furnish lists of each to Owner.



1.06 SPECIFIED MANUFACTURERS:

- A. General Electric
- B. Eaton
- C. Square D

PART 2 - PRODUCTS

2.01 DISTRIBUTION PANELBOARDS:

- A. Panelboards: NEMA PB 1; circuit breaker type.
- B. Enclosure: NEMA PB 1; Type 1.
- C. Provide cabinet front with concealed trim clamps, and hinged door with flush lock. Finish in manufacturer's standard gray enamel.
- D. Provide panelboards with copper bus, ratings as scheduled. Provide copper ground bus in all panelboards.
- E. Minimum Integrated Short Circuit Rating: See drawings.
- F. Molded Case Circuit Breakers: NEMA AB 1; provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits. All breakers shall be bolt on type.

2.02 BRANCH CIRCUIT PANELBOARDS:

- A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1; circuit breaker type.
- B. Enclosure: NEMA PB 1; Type 1.
- C. Cabinet Size: 6 inches deep; 20 inches wide.
- D. Provide cabinet front with concealed trim clamps, concealed hinge and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- E. Provide panelboards with copper bus, ratings as scheduled on Drawings. Provide copper ground bus in all panelboards.
- F. Minimum Integrated Short Circuit Rating: See Drawings.

G. Molded Case Circuit Breakers: NEMA AB 1; bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on Drawings.

### **PART 3 - INSTALLATION**

#### **3.01 GENERAL:**

A. Furnish and install all required materials to install and mount the panelboards to the wall shown on the drawings. Field verify the location, wall material, and all mounting requirements for panel installation.

#### **3.02 INSTALLATION:**

A. Install panelboards plumb and flush with wall finishes, in conformance with NEMA PB 1.1.

B. Provide filler plates for unused spaces in panelboards.

#### **3.03 PANEL DIRECTORIES:**

A. Provide typed circuit directory for each circuit breaker in each panelboard.

B. The typed directory shall include the room number location of the load served. (EXAMPLE: 36 - Lights: 204,206.....14 - Receptacles:115.....6 - Electric Unit Heater: 173) Room numbers shall be the room numbers as on the room door, not the space numbers as shown on the plans.

#### **3.04 FIELD QUALITY CONTROL:**

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

#### **3.05 PANELBOARD SCHEDULE:**

A. See Drawings.

**END OF SECTION 16160**

**ELECTRICAL SUPPORT DEVICES**

**SECTION 16190**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED:**

A. Work included in this section shall include furnishing and installing any and all electrical support devices to make the electrical system function and perform as specified. This shall include, but not be limited to the following:

1. Conduit and equipment supports.
2. Fastening hardware.

**1.02 RELATED WORK:**

A. Section 03300 Cast-in-Place Concrete. Concrete equipment pads.

**1.03 QUALITY ASSURANCE:**

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

**1.04 SUBMITTALS:**

A. Section 16010 applies.

**1.05 RECORD DRAWINGS:**

A. Section 16010 applies.

**PART 2 - PRODUCTS:**

**2.01 MATERIALS:**

A. Support Channel

B. Hardware: Corrosion resistant.

**PART 3 - INSTALLATION:**

**3.01 GENERAL:**

A. Installation shall be in accordance with the NEC and all other codes and as recommended by the manufacturer.

**3.02 INSTALLATION:**

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure.

B. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces.

C. Do not fasten supports to piping, duct work, mechanical equipment, or conduit.

D. Do not use powder-actuated anchors.

E. Do not drill structural steel members.

F. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

**END OF SECTION 16190**

## SECTION 16412 - ENCLOSED SWITCHES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Enclosed safety switches.
- B. Enclosures
- C. Padlocks

#### 1.02 RELATED REQUIREMENTS

- A. Section 16491 - Fuses.

#### 1.03 SCOPE

- A. All equipment to be installed by any contractor that requires electrical connection, that has an electric motor, or is classified by codes as requiring disconnecting means, shall have a disconnect switch or code approved disconnecting means furnished and installed by the Division 16 Contractor, whether a disconnect is shown on the plans or not.
- B. If the equipment being served is equipped with a code approved factory installed disconnecting means, then the requirement for the Division 16 Contractor to provide a disconnecting means shall be deleted. Coordinate with the equipment provider to determine if the equipment is being provided with a code approved, factory installed disconnecting means.
- C. The Division 16 Contractor shall coordinate the disconnect required and shall furnish and install the disconnect.

#### 1.04 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).
- C. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association.
- D. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association.
- E. NFPA 70 - National Electrical Code; National Fire Protection Association.
- F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations.
- G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations.

#### 1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate the work with other trades. Avoid placement of piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
  - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### 1.06 SUBMITTALS

- A. See Section 01300 - Administrative Requirements and Section 16010 - General Electrical Requirements, for submittal procedures.
- B. Product Data: Provide switch ratings and enclosure dimensions. Ratings shall include but not necessarily be limited to voltage, number of poles, voltage, amperage, horsepower and short-circuit.
- C. Project Record Documents: Record actual locations of enclosed switches.

#### 1.07 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Eaton Corporation; Cutler-Hammer Products: [www.eaton.com](http://www.eaton.com).
- B. General Electric Company: [www.geindustrial.com](http://www.geindustrial.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).

#### 2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break, enclosed safety switches complying with NEMA KS 1, type HD (heavy duty), and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
- B. Provide products listed and labeled by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
  1. Altitude: Less than 6,600 feet.
  2. Ambient Temperature: Between -22 degrees F and 104 degrees F.
- D. Horsepower Rating: Suitable for connected load.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:
  1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
  2. Minimum Ratings:
    - a. General Duty Single Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
    - b. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000

rms symmetrical amperes.

- G. Provide with switch blade contact position that is visible when the cover is open.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
- I. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- J. Enclosures: Comply with NEMA KS 1 and NEMA 250, and list and label as complying with UL 50 and UL 50E.
  - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
- K. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- L. Heavy Duty Switches:
  - 1. Conductor Terminations:
    - a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
  - 2. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
- M. Fusible Switch Assemblies: NEMA KS 1, Type HD, quick-make, quick-break enclosed load interrupter knife switch.
- N. Nonfusible Switch Assemblies: NEMA KS 1, Type HD, quick-make, quick-break, enclosed load interrupter knife switch.

#### 2.03 PADLOCKS:

- A. Each disconnect switch that is accessible from floor or grade level (disconnect switches installed above ceilings do not apply) shall have a padlock. The electrical contractor shall furnish and install a padlock with each disconnect switch that is accessible from floor level or grade. The padlocks shall all be keyed alike and each padlock shall be supplied with a key. Each padlock shall be a minimum of 1.5 inches wide at the base.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install enclosed switches in accordance with manufacturer's instructions.
- B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Install enclosed switches plumb.
- E. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.
- F. coordinate with the supplier of each piece of equipment that requires a disconnect switch to determine the exact rating and type of the switch and the rating and type of fuses (if

required or called for).

- G. Install disconnect switches as near as possible to the spot where indicated on Drawings. Contractor shall field determine the construction conditions and locate the switch in the best possible location.
- H. Install fuses in fusible disconnect switches.

### 3.02 FIELD QUALITY CONTROL

- A. Perform field inspection in accordance with Section 01400.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform inspections and tests listed in NETA STD ATS, Section 7.5.1.1.

**END OF SECTION**



## SECTION 16426 - ENCLOSED CONTACTORS

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. General purpose contactors.

#### 1.02 RELATED REQUIREMENTS

- A. Section 16491 - Fuses.

#### 1.03 REFERENCE STANDARDS

- A. NEMA ICS 2 - Industrial Control and Systems: Controllers, Contactors, and Overload Relays, Rated Not More Than 2000 Volts AC or 750 Volts DC; National Electrical Manufacturers Association.
- B. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; National Electrical Manufacturers Association.
- C. NEMA ICS 6 - Industrial Control and Systems: Enclosures; National Electrical Manufacturers Association.
- D. NEMA KS 1 - Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum); National Electrical Manufacturers Association.
- E. NETA STD ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems; International Electrical Testing Association.
- F. NFPA 70 - National Electrical Code; National Fire Protection Association.

#### 1.04 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide dimensions, size, voltage ratings and current ratings.
- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Maintenance Data: Include instructions for replacing and maintaining coil and contacts.

#### 1.05 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles of Project.
- C. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Allen-Bradley/Rockwell Automation: [www.ab.com](http://www.ab.com).

- B. Eaton Corporation; Cutler-Hammer Products: [www.eaton.com](http://www.eaton.com).
- C. Schneider Electric; Square D Products: [www.schneider-electric.us](http://www.schneider-electric.us).

#### 2.02 GENERAL PURPOSE CONTACTORS

- A. Description: NEMA ICS 2, AC general purpose magnetic contactor rated for continuous duty.
- B. Contact current rating: As scheduled
- C. Contact voltage rating: 120 volts
- D. Coil operating voltage: 120 volts, 60 Hertz.
- E. Poles: As required to match circuit requirements.
- F. Enclosure: NEMA ICS 6, Type 1.
- G. Accessories:
  - 1. Auxiliary Contacts: One, normally open.

#### 2.03 ACCESSORIES

- A. Auxiliary Contacts: NEMA ICS 2, 2 normally open contacts in addition to seal-in contact.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install enclosed contactors where indicated, in accordance with manufacturer's instructions.
- B. Height: 5 ft to operating handle.
- C. Provide fuses for fusible switches; refer to Section 16491 for product requirements.

#### 3.02 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 01400.
- B. Inspect and test in accordance with NETA STD ATS, except Section 4.
- C. Perform applicable inspections and tests listed in NETA STD ATS, Section 7.16.1.

**END OF SECTION**

**SECONDARY GROUNDING**

**SECTION 16450**

**PART 1 - GENERAL**

**1.01 WORK INCLUDED:**

A. Electrical equipment grounding and bonding.

**1.02 SYSTEM DESCRIPTION:**

A. Furnish all labor, materials, services, equipment and appliances required in conjunction with a grounding system as indicated in the Contract Documents.

**1.03 SUBMITTALS:**

A. Manufacturer's Data: Submit copies of the manufacturer's specifications for products to be used as outlined under provisions of Section 16010.

B. Indicate location of system grounding electrode connections, and routing of grounding electrode conductor.

**PART 2 - PRODUCTS**

**2.01 MATERIALS:**

A. All copper to copper and copper to steel connections of #6 AWG and larger shall be made with the CADWELD(R).

B. Provide Burndy Corp., Type NE, Thomas & Betts Co., Inc., Catalog No. 3951, or approved equal, ground fittings for bonding ground cable to encasing metal conduit.

**PART 3 - INSTALLATION**

**3.01 INSTALLATION - GENERAL:**

- A. Ground electrical work in accordance with NEC Article 250, local codes as specified herein, and as shown on the drawings.
- B. Provide a separate, insulated equipment grounding conductor in all feeder and branch circuits. Terminate each end on a grounding lug, bus, or bushing.
- C. Install ground cables continuous between connections. Splices will not be allowed except where indicated on the drawings. Connections made by the CADWELD(R) Process are not considered splices. Where ground cables pass through floor slabs, building walls, etc., and are not in metallic enclosures, provide the sleeves of approved nonmetallic material.
- D. Ground interior lighting fixtures with grounding conductor to rigid metal raceways serving them. Flexible metal conduit shall have a ground wire installed with the power conductors.
- E. Where connections are made to motors or equipment with flexible metal conduit, grounding conductor shall be stranded copper conductor within the conduit, bonded to the equipment and to the rigid metal raceway system. Size conductor in accordance with NEC Table 250-122 or as shown on the plans.
- F. At each convenience outlet, install a grounding clip attached to the outlet box and leave a sufficient length of #12 wire with green colored insulation to connect to the grounding terminal of the receptacle. Grounding clip shall be equal to Steel City Type G.

**3.02 FIELD QUALITY CONTROL:**

- A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.
- B. Measure ground resistance from system neutral connection at service entrance to convenient ground reference point using suitable ground testing equipment. Resistance shall not exceed 5 ohms.

**3.03 COORDINATION:**

- A. Coordinate the work under this section with the work under divisions of the specifications.

**END OF SECTION 16450**

## SECTION 16491 - FUSES

### PART 1 GENERAL

#### 1.01 SECTION INCLUDES

- A. Fuses.

#### 1.02 RELATED REQUIREMENTS

- A. Section 16412 - Enclosed Switches: Fusible switches.

#### 1.03 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses; National Electrical Manufacturers Association.
- B. NFPA 70 - National Electrical Code; National Fire Protection Association.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements.
- D. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses.

#### 1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
    - a. Fusible Enclosed Switches: See Section 16412.
  - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
  - 3. Notify Architect of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

#### 1.05 SUBMITTALS

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

#### 1.06 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Cooper Bussmann, a division of Cooper Industries: [www.cooperindustries.com](http://www.cooperindustries.com).
- B. Substitutions: See Section 01600 - Product Requirements.

#### 2.02 APPLICATIONS

- A. General Purpose Branch Circuits: Class RK1, time-delay.
- B. Individual Motor Branch Circuits: Class RK1, time-delay.

#### 2.03 FUSES

- A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the

purpose indicated.

- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that conditions are satisfactory for installation prior to starting work.

#### **3.02 INSTALLATION**

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

**END OF SECTION**

## **LIGHTING FIXTURES**

### **SECTION 16510**

#### **PART 1 - GENERAL**

##### **1.01 SCOPE:**

A. This section included the furnishing, installation, and connection of light fixtures, conduit, lamps, ballasts, fittings, and boxes to form complete, coordinated, grounded interior lighting systems.

##### **1.02 WORK INCLUDED:**

- A. Interior luminaires and accessories.
- B. Exterior luminaires and accessories.
- C. Lamps.
- D. Ballasts.

##### **1.03 RELATED SECTIONS:**

A. In addition to this section, the Contractor shall refer to other specification sections and drawings to ascertain the extent of work included. This shall include, but not be limited to, the following:

- 1. Division 1.
- 2. All other Division 16000 sections.

B. See section on Substitutions.

##### **1.04 REFERENCES:**

- A. ANSI C82.1 - Specification for Fluorescent Lamp Ballasts.
- B. C. FS W-F-414 - Fixture, Lighting.

##### **1.05 SUBMITTALS:**

- A. Submit product data under provisions of Section 16010.
- B. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
- C. The specific item proposed and its area of application shall be marked on the catalog cuts.
- D. Include outline drawings, lamp and ballast data, support points, weights, and accessory information for each luminaire type.
- E. Submit manufacturer's installation instructions.

1.06 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver products to site.
- B. Store and protect products.
- C. Handle metal poles carefully to prevent breakage and damage to finish.

1.07 EXTRA STOCK:

- A. Provide extra stock as follows:
- B. Lamps: Ten of each type.
- C. Lenses: Three percent of quantity furnished (maximum of 10), minimum of one of each size and type.
- D. Ballasts: Ten of each type.

1.08 RECORD DRAWINGS:

- A. Section 16010 shall apply.

**PART 2 - PRODUCTS**

2.01 LIGHTING FIXTURES:

- A. Shall conform to the drawings and fixture schedule, NEC Article 410 and the UL-57, "Electrical Lighting Fixtures".



**B. Sheet Metal:**

1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true straight (unless intentionally curved), and parallel to each other as designed. Prepainted metal is not acceptable.
2. Wireways and fittings shall be free of burrs and sharp edges and shall accommodate internal and branch circuit wiring without damage to the wiring.
3. When installed any exposed fixture housing surface, trim frame, door frame and lens frame shall be free of light leaks; lens doors shall close in a light tight manner.
4. Hinged door closure frames shall operate smoothly without binding when the fixture is in the installed position, and latches shall function easily by finger action without the use of tools.

C. Ballasts shall be accessible for servicing without removing or dismantling the fixtures. Each fluorescent ballast serving lamps 30 watts and larger shall be bolted to the fixture body or housing with four studs or captive screws.

1. See paragraph on ballast.

**D. Lamp Sockets:**

1. Fluorescent sockets shall be the biting edge type or phosphorous-bronze with silver flash contact surface type and shall conform to the applicable requirements of UL 542 and ANSI C-81. Lamp holders for bi-pin lamps, with the exception of those for "U" type lamps, shall be of the telescoping compression type, or of the single slot entry type requiring a one-quarter turn of the lamp after insertion.
2. Incandescent: Shall have porcelain enclosures and conform to the applicable requirements of UL 496.
3. High Intensity Discharge (HID): Shall have porcelain enclosures and conform to the applicable requirements of ANSI C-81.

E. Fluorescent fixtures and fixtures with louvers or light transmitting panels shall have hinges, latches and safety catches to facilitate safe, convenient cleaning and relamping. Vapor tight fixtures shall have pressure clamping devices in lieu of the latches.

**F. Metal Components:**

1. The manufacturer shall apply his standard finish (unless otherwise specified) over a corrosion resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking.
2. Fixture shall be painted after fabrication. Pre-painted metal is not acceptable.
3. Interior light reflecting finishes shall be white with not less than 85 percent reflectances except where otherwise shown on the drawings.
4. Exterior finishes shall be as shown on the drawings.

**2.02 INTERIOR LUMINAIRES AND ACCESSORIES:**

A. Fluorescent Luminaires: See schedule on Drawings. 0.125" thick virgin acrylic lenses.

**PART 3 - EXECUTION**

**3.01 INSTALLATION:**

- A. Installation shall be in accordance with the NEC, and as shown on the drawings.
- B. Align, mount and level the lighting fixtures uniformly. Install lamps in luminaires and Lamp holders.
- C. For suspended lighting fixtures, the mounting heights shall provide the clearances between the bottoms of the fixtures and the finished floors as shown on the drawings
- D. Lighting Fixture Supports:
  - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
  - 2. Shall maintain the fixture positions after cleaning and relamping.
  - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
- E. In addition to the above the following are required for fixtures exceeding 20 pounds in weight. Note: Ceiling types are defined in ASTM Standard C635-69.
  - 1. Where fixtures mounted in "intermediate" and Heavy Duty" ceilings weigh between 20 pounds and 56 pounds provide two 12 gage safety hangers hung slack between diagonal corners of the fixture and the building structure.
  - 2. Where fixtures weigh over 56 pounds they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.
- F. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.
- G. Outlet boxes for support of lighting fixtures where permitted shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gage wire hanger, and secured by approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.

**3.02 CLEAN-UP AND RE-LAMPING:**

- A. Before final acceptance of the electrical work in all or any part of the building, the Contractor shall clean the bottoms, the trim, the reflecting surfaces, lenses, baffles, reflector cones and lamps of all lighting fixtures. He shall be responsible for masking the trims and bottoms of all lighting fixtures if necessary to protect the fixture during construction. He will ascertain and make sure that all lamps installed are exactly as specified for each fixture type. It shall be the responsibility of the Contractor to replace all burned out or inoperative lamps and inoperative ballasts in all fixtures before the building is accepted by the Owner so that all lighting

fixtures will be in first class operating condition.

**3.03 ADJUSTING AND CLEANING:**

A. Align luminaires and clean lenses and diffusers at completion of Work. Clean paint splatters, dirt, and debris from installed luminaires.

**3.04 COORDINATION:**

A. Contractor shall coordinate between the electrical and ceiling trades to ascertain approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.

**3.05 LIGHT FIXTURE SCHEDULE:**

A. See schedule on the drawings.

**END OF SECTION 16510**