# ADDENDUM NO. 2
# ISSUED 02-02-21

# MAIN FIREHOUSE FACILITY
# VALLEY COTTAGE FIRE DISTRICT
# PROJECT No. 1901.02

This addendum is hereby made part of the Contract Documents dated December 10, 2020 to the extent as though it was originally included therein. All costs reflected by this addendum shall be included in the contract price.

## PROJECT ADMINISTRATION ITEMS (applies to all bidders/trades):

## GENERAL:

1. The bid deadline due date remains as **Tuesday, February 16, 2021** at 7:00 PM EST.
2. A total of four (4) copies (1 original & 3 duplicate copies) of the bid form shall be provided. Include one (1) original & one (1) duplicate copy of the bid bond.
3. An updated copy of the AIA A107 'Owner/Contractor Agreement' form is made part of this Addendum as **Attachment #1**.
4. A record copy of the contractors attendance sign-in sheet from the following pre-bid site meetings has been added to the **Dropbox** 'Addendum 2' folder as Supplemental Item 1:
   - 01-19-2021
   - 01-28-2021
5. Non-collusive bidding certification is included in the project manual.
6. Anticipated schedule of construction start is estimated to be April 5th, 2021, pending the VCFD Bond vote result, scheduled to take place March 30, 2021.
7. Permitted days/times for all onsite work (per local ordinance) shall be as follows:
   Monday – Friday = 7:00am – 6:00pm
   Saturday = 8:00am – 6:00pm
   Sunday = 11:00am – 5:00pm
8. Each trade is required to have a designated full-time, English-primary speaking project representative on-site during work hours & for the duration of the project.
9. Prevailing wage rate schedule has been added to the **Dropbox** 'Addendum 2' folder as Supplemental Item 2.
10. Payment schedule for the duration of the project shall be as follows (due at weekly job meetings):
    - 1st week of each month – pencil pay requests due (for completed work only)
    - 3rd week of each month – final (approved) payment requests due
    - 4th week of each month – VCFD Board meeting where payments will be completed
11. This project is tax exempt. Tax exemption certificates will be provided by Owner.

12. There are no individual trade allowances to be included in the bid, with the exception of a temporary electric allowance in the amount of $4,000.00, by EC.
13. All trades to provide the following references as part of bid:
    - Three (3) Owner references from past projects completed
    - Three (3) Architect references from past projects completed
14. Local permit & inspection fees shall be paid for by Owner. All necessary Town inspections shall be coordinated by the responsible trade, along with the Owners project site representative (Clerk).
15. Special inspections (by 3rd party) which apply per Chapter 17 of the NYS Building Code will be required on this project. A list of inspections will be provided upon project commencement and it will be the responsibility of each trade to schedule inspections that pertain to their work with the Owners onsite project representative (Clerk). Third party inspections shall be by company selected & paid for by Owner.
16. Temporary utility coordination, preparation & submission of all permit documents shall be by contractor with the associated utility provider. Fees shall be paid for by Owner.
17. Printing format for submitted drawings is 24" x 36".
18. Each trade shall be required to produce and sign-off on their own coordination documents (commencing immediately following contract start), and shall be responsible to notify any other trades of coordination requirements & adjustments which will affect their work. Additional costs for items not coordinated will be the responsibility of the affected trade if there is no written or signed-off coordination document relating to the specific issue.
19. GC shall commence with producing a fully detailed construction schedule following contract signing, and shall distribute said schedule to all other trades for review & coordination of their own schedules. Anticipated timeline of schedule review shall be two (2) weeks.

**SITE:**

1. All soil imported & removed from the project site as needed to achieve final grading shall be included in the bid.
2. All trades shall refer to the GC Specification Section 02150 "Test Hole Reports & Data", as needed for any anticipated onsite soils information.
3. Per the original bid form Attachment 'A', Unit Price List: additional backfill/compaction and additional soil removal should be quoted by cubic yard, not square yard.
4. All trades are required to provide their own on-site storage containers as needed, located in coordination with others & overall site staging.
5. Each prime contractor is responsible for their own excavations and backfilling in lifts to 95% compaction. Refer to Cover Drawing 0-0, General Note #7 for other requirements pertaining to sitework.
6. As required for Owner site access & emergency response - the temporary driveway to Lakes Road, as shown on the staging plans, shall not be blocked at any time by any contractor or their workers; including during staging & deliveries. No exceptions.

**EXISTING FACILITY:**

1. For trades review & information; an Owner provided existing building investigation report has been added to the **Dropbox** 'Addendum 2' folder as Supplemental Item 3.
2. Per Owner suggestion, construction sequencing for the existing facility alteration/staging shall be considered by all trades as follows:
   - GC furnish & install a framed dust/construction barrier wall (gyp. board at bay side) approx. 3'-0" from rear bay wall to be demolished, full height from floor to underside of roof deck above. Must be sealed & dust proof. Include tack-pads at any building entrances utilized by all workers.
   - Submittals for any long lead items will be required immediately upon project start. Overhead doors for existing bay alteration shall be addressed ASAP.
   - All associated trades shall coordinate, identify & 'safe-off' all MEP items indicated & associated with their alteration work, in coordination with GC partial demolition of this area.
   - GC to furnish & install outside construction fencing and other required construction barriers between new building construction zone & existing building occupied area.
   - GC shall layout & prepare exterior site so that Owner can safely access & continue response operations in the existing FH for the duration of construction.
   - GC shall layout & prepare exterior site so that FD can transfer existing operations from the existing firehouse to the new firehouse, at completion.

3. Per the drawings labeled "EX-1.1 through 1.4"; each trade shall remove, cap, terminate, demolish, etc... any and all devices, circuits, piping, equipment, etc... associated with their respective work as required to alter the existing facility for continued used by the Owner.
4. Final demolition of the existing firehouse facility shall be the responsibility of the GC, including all utility disconnects, without exception.
5. GC shall be responsible for demolition & removal of existing masonry dumpster enclosure (in full) as required for new temporary access road installation. Owner shall designate new temporary location of dumpster.
6. EC shall be responsible for removal/disposal of existing generator unit after successfully disconnecting it, and connecting/start-up of new Owner provided temporary generator.
7. GC shall be responsible for removal/disposal of existing Kitchen & Gear Wash/Dry equipment as part of full existing building demolition.
8. Configuration of the on-site temporary parking shall be per drawing SP-1, and all temporary paving shall be in accordance with drawing SP-1, by GC.
9. Existing building electrical service shall be temporarily relocated during construction by EC. This shall be installed underground, in-lieu of overhead,

to the existing pole with transformers to remain on-site. Service from said pole to existing building shall be above or below ground by EC.

**NEW FACILITY:**

1. Each trade is responsible for their own daily materials & broom clean-up at the end of the work day, including proper disposal into their own provided on-site dumpster.
2. Any & all concrete or masonry sleeves/inserts/louvers/vents/etc.. shall be included on the coordination drawings and furnished by its applicable prime contractor. Said items shall be installed by GC & coordinated as needed by the furnishing prime, in coordination with the project schedule.
3. **The following items shall apply to the installation of Oldcastle (or equal) concrete plank installations (applies to all trades):**
   - Plank manufacturer shall provide any and all engineering and certifications of concrete planks.
   - The general contractor shall coordinate all openings in planks with other trades per the coordination drawings and the plank manufacturer. There shall be an on site pre-installation conference with the manufacturers project manager and all trades prior to installation.
   - Upon delivery of planks to the job site, the manufacturers project manager shall attend an on-site job meeting to answer any questions regarding installation. All trades shall be in attendance.
   - Upon completion of plank installations all trades shall mark out their required openings, and the manufacturers project manager and project engineer shall meet with all trades on site to field review and verify all openings. Said coordination shall be recorded on the plank shop drawings and signed-off by all trades.
   - After field coordination review, any and all openings in excess of 10” x 10” shall be cut into the planks by the manufacturer in accordance with the coordination drawings.
   - The manufacturer shall provide a 4’-0” x 4” plank template for use on-site, for contractors use for openings smaller than 10” x 10” using the template and manufacturers instructions as a guide. Any openings that do not fall within the parameters of the template shall be confirmed by the responsible trade with the manufacturer, prior to installation.
   - All penetrations shall be cut prior to installation of concrete topping.
   - Upon completion of roughing, the manufacturers project manager and engineer shall provide an on-site review of all installations and provide a list of corrections if any.
   - Concrete topping shall be installed after perimeter masonry is in place. Topping shall include 4 x 4 6/6 wire mesh throughout.
   - Fasteners shall be as follows embedded into the concrete plank;

- Threaded hangers will be installed with Hilti Kwik HUS-EZ (E or I) ¼" hanger rod installation.
- Small "U" type fasteners or brackets for conduit, etc. shall be installed using Hilti Kwik-Con+ 316-114 THH.
- GC shall perform a 'pull-test' mock-up of said fasteners with manufacturers project manager & all trades in attendance, to confirm correct installation methods.

4. All First Floor & Mezzanine supports/hangers utilized by all trades shall be per the concrete plank specifications above. All Second Floor supports/hangers shall be attached to the steel framing above.
5. All trades are required to complete their own fire caulking of all wall/floor/ceiling/etc.. penetrations associated with their work, as necessary for final building inspection.
6. All Kitchen cookline & refrigeration equipment (excluding walk-in cooler) shall be provided and installed by separate contract (by Owner). PC & EC shall complete all necessary connections in the field (power/control, water, gas). Start-up & testing shall be by Owners vendor in coordination with responsible trade should adjustments be necessary.
7. Per drawing A-1.4; the room with door 'A-05' shown directly adjacent to the elevator shaft shall be utilized for any equipment necessary for the complete elevator installation by GC & EC.

## GENERAL CONSTRUCTION (GC)

**SITE ITEMS:**

1. All field surveying & layout during construction shall be the responsibility of the GC. Owners provided surveyor shall prepare final as-built survey as required for Certificate of Occupancy.
2. GC is responsible for any tree removal onsite only at locations where existing trees will effect their work (IE: footbridge location from East property).
3. Elevations/contours of temporary driveway/parking at rear of existing building shall be per drawing ESC-6.
4. On drawing CSP-7 - disregard general note #9 for temporary facility pad/parking
5. Masonry retaining wall along Oxford Drive property line shall be as detailed on drawings RW-4 & 5, and includes returns at both ends, per drawing SP-2.
6. Front apron and connector drive shall be bid as indicated on drawing SP-3. Connector drive shall be part of Add Alternate #4. Base bid shall include full paving spec for this portion of apron.
7. Retaining wall & fence at generator/dumpster area shall be per drawing S-1.2 detail '8'.
8. All paved areas shall be per the "Travelled Way" paving detail on drawing SD-3.
9. Finish grading as indicated on drawing SDP-2 shall be utilized for bidding.

10. Piping layout for roof gutter/leader system is indicated on drawing SP-3 and discharges to indicated catch basin. Refer to drainage plans for overall site drainage layout.
11. Trench drain shall be temporarily tied into the East temporary storm drain shown on drawing SP-1, during construction phasing.
12. Upon completion & Owner transfer/occupancy of new building, GC shall provide & maintain temporary parking areas near new facility for FD personnel & maintain safety boundaries as required for final demolition of the existing firehouse facility.
13. All lawn areas on the main project site shall be sodded as part of finish sitework completion, with exception of the rear lawn area North of the rear parking, which shall be seeded as per the seeding specification. Any disturbance to the adjacent East site for GC storage/staging/alternate pad work shall be restored to original by means of finish grading/topsoil & seeding.
14. Per drawing SP-4 Landscaping plan, quantity of all plantings shall be per the planting schedule. Final location to be field confirmed with Owner/Site Engineer.
15. Size of plantings per the landscaping schedule at installation shall be as follows:
    - Red Maple (2) = 6'-0"' height
    - Atlantic White Cedar (12) = 6'-0" height
    - Red Chokeberry (22) = 34"-36" height
    - Inkberry (16) = 24"-36" spread
16. Footbridge handrails shall be 42" high. Base bid to be per the detail made part of this Addendum as **Attachment #2.**

**EXISTING BUILDING ITEMS:**

1. Drawing EX-1.1 note referring to SK-1.2/1.3 shall be corrected to refer to EX-1.2/1.3.
2. For existing firehouse demolition purposes – existing slab on grade shall be assumed to be 10" thick reinforced (minimum). Existing concrete generator base shall be assumed to be solid, integral with slab.
3. The three new 14'x12' sectional overhead doors at the existing firehouse bay (furnished & installed by GC) can be 20 or 22 gauge, in-lieu of 16 gauge.
4. Temporary stair referenced on drawing EX-1.3 Construction Note C-5 can be wood constructed. Risers, treads & rail shall be installed per code.
5. New hollow metal door referenced on drawing EX-1.3 Construction Note C-5 shall receive standard closer, hinges & storeroom lockset hardware.
6. Existing trophy cases at existing firehouse Meeting Room shall be partially dismantled, moved, & re-installed by GC to Owner designated location within new building following substantial completion.

**NEW BUILDING ITEMS:**

**DIV. 1 – GENERAL**

1. Minimum submittals that are required to be provided directly following project start are as follows:
    - Concrete/Foundation work
    - Concrete Plank (refer to plank clarification in this addendum)
    - Structural steel
    - Elevator
2. Add Alternates GC-1 & GC-2 refer to the construction of the rear patio canopy & upper terrace. Should these alternates not be accepted, then the general layout for the rear entry/elevation shall be as shown on the drawing made part of this addendum as **Attachment #3**, and included as part of the base bid design.
3. Layout for Shower/Bathroom #110 shall be per enlarged plan from A-8.2. Sink at this Restroom is wall hung style by PC, not vanity built-in.
4. Stair section 'A' on drawing A-5.1 shall be corrected as 1/4"=1'-0"
5. Stair treads shall be 11" typical.
6. Handrails for stairs shall be per the A-5/1/5.2 plans & details.
7. Miscellaneous details referring to drawing A-6 shall be corrected to refer to drawings A-6.1/6.2.
8. Drawing A-9.2 'Mezzanine Floor Plan' is at 1/8" scale.

**DIV. 2 – SITEWORK**

1. East site chain-link fence (at training pad) shall remain as noted on drawing SP-2.
2. Retaining wall reference note on drawing SP-4 shall refer to drawing RW-4.
3. GC shall furnish & install per manufacturer requirements, a full and complete CertainTeed - Simtek "Ashland" style (or equal) composite privacy fencing system at the main project site, with locations & heights as indicated on drawing SP-4. Color to be selected by Owner. *Note*: fencing at retaining wall location shall be 4'-0" height, not 3'-6" as previously shown. Remainder of site fencing to remain as 6'-0" height.

**DIV. 3 – CONCRETE**

1. Specification section 3300 (pg. 12) sect. 6 shall be corrected to read "curing" liquid.
2. Bottom of foundation footing elevations are indicated on drawing S-1.1, and vary at overall depths from 5'-0" to 8'-0" (to be field verified based on conditions).

**DIV. 5 – METALS**

1. Metal framing for walls shall be as indicated on the plans, size/construction as specified on the A-1.3 wall types schedule.
2. Precast terrazzo shower bases are by PC, GC to coordinate shower wall framing & layout of base with PC.
3. GC to provide back-up blocking for any bathroom accessories, plumbing fixtures as needed for other trades completions.
4. GC shall provide & install L-angle steel at elevator door saddle locations as part of concrete plank installation, to be in place prior to 2" concrete topping pour. Coordinate with plank manufacturer.
5. Roof framing for alternate patio roof shall be structural steel tubing as shown on drawing A-2.3.
6. In regards to alternate patio canopy framing; notes on drawings S-1.1/S-2.1 refer to A-2.3 drawing which has the structural layout for this alternate.
7. On drawing S-3 Column Schedule – columns shown for 'Add Alternate' & 'Overhangs & Alternate Base Bid Entry Framing' are W8X31's.
8. Additional fireproofing is not required for structural steel members.

**DIV. 6 – WOODS & PLASTICS**

1. All cabinetry work furnished & installed by GC shall be standard red oak, and will receive stained finish (color to be selected by Owner).
2. Radio Room, Standby Room and Workbench built-ins shall be per the cabinetry specification. Radio & Standby Rooms shall get Corian countertop, Workbench shall be Stainless Steel. Kitchen remains as cabinetry with quartz countertop.
3. Millwork built-in for Kitchen alcove opposite roll-up window to Meeting Room shall be counter-top with supports to match surrounding Kitchen counter/cabinet finish & heights, and will be open below (no storage cabinets).
4. Underside/ceiling of exterior entries to be painted wood plank finish with aluminum wrap soffits as shown on reflected ceiling plans.

**DIV. 7 – THERMAL/MOISTURE PROTECTION**

1. Roll-on water proofing membrane shall be applied to full height of elevator pit foundation walls.
2. GC base bid shall include furnishing & installing the complete 'Garland' flat roof system. A 'Siplast' flat roof system shall be bid as a deduct alternate using the alternate bid form made part of this Addendum as **Attachment #4.**
3. Roof vents shown on the accessory garage shown on the GAR-1, provide shingled ridge vent (typical) in-lieu of roof vents.
4. Drawing A-3.1, note #5 for snowguards shall apply to all roof areas including low framed roofs at all building entrances. Also shall apply to accessory garage roof (should that alternate be chosen).
5. Drawing S-2.3 showing EIFS along the elevator wall shall be corrected as Hardi-plank siding finish. Refer to Hardi-Plank specification attached made part of this Addendum as **Attachment #5.**

## DIV. 8 – DOORS & WINDOWS

1. Windows shall be as specified on drawing A-3.3.
2. The ten (10) Andersen windows specified on drawing A-4.1 shall be 400 Series Awning windows, measuring 17" height X 24" width.
3. Storefront entry doors as detailed on A-3.4 shall be per the specification note #17 on drawing A-3.1 (Kawneer 500T Insulpour system). Same manufacturer (Kawneer) applies towards A-7.1 door details A & B.
4. Door 1-05 as detailed on drawing A-7.1 shall receive "Pilkington Pyrostop" 90-minute fire rated glass.
5. Thermal doors & storefront doors shall receive 70% Kynar finish.
6. Skylight to be by "Velux" model CG2-3737 curb skylight. Coordinate locations as shown on A-2.1 with the structural steel locations of drawing S-2.3.
7. Vision panels at door types B, D & E shall be insulated/tempered glass typical. Door glass shall include a 90-minute fire rating if it exceeds 100 square inches in any location. Doors into egress stairwells or ancillary apparatus bay areas shall received fire rated glass typical.
8. Roll-up fire shutters for the Kitchen (counter), Storage Mezzanine & Delivery Area shall be as specified under GC Spec 08330.
9. "FF" designation on the A-7.1 door schedule for Doors 2-12 and 2-E1 indicates factory finish, as these doors are to be aluminum storefront style door/sidelight units. Same shall apply towards other exterior & interior aluminum storefront units. Finish for these doors to be clear anodized.
10. Door 2-12 shall be an aluminum door & side light unit. Refer to drawing A-7.1 detail.
11. Template for the 30"x36" fire department emblem to be etched on to glass of doors EX-1.1/1.2 shall be provided by Owner. For bidding purposes, GC bid shall account for a logo style that is similar to terrazzo emblem at lobby floor, allow for up to four (4) colors as part of logo design.
12. All new overhead doors shown for the new firehouse facility as well as the GAR-1 alternate garage shall be Raynor TM300 Series sectional overhead doors (color white, embossed texture).
13. Add/Alt. Door #2E-1 that leads to the alternate terrace shall be same make/model/size as door EX-1.1, but shall include archtop windows as shown.

## DIV. 9 – FINISHES

1. GC Specification Section 0900-4000 shall serve as the specification for the required multi-part seamless epoxy floor system furnished & installed by GC. Locations to receive this flooring system are designated as "FHF" on the A-8.1 Room Finish Schedule.
2. Refer to drawing A-8.1 'Finish Schedule' for correct room numbers at the following locations:
    - Meeting Room
    - Stage
    - A/V Media
    - Storage (Table/Chair)
    - Storage

3. Items noted as being color/finish selected by Owner shall be from manufacturer standard finish options for that specific item.
4. Items noted as "SS" refers to Stainless Steel finish.
5. Carpet Spec shall be Mohawk – Mindful Stripe – BT447" as specified on drawing A-8.1.
6. Floor tile accent inset for Second Floor Mens/Womens Restrooms shall be same accent tale as indicated on walls. Field verify with Architect for final layout prior to install.
7. Mosaic wall tile for Kitchenette/Casework built-ins shall be by Daltile "Crystal Shores", color selected by Owner.
8. Vanity tops at Restrooms & Kitchenette built-ins shall be solid Corian, coordinate with PC for sink & faucet layout where applicable. Finish for front & sides of Restroom vanity built-ins shall be Formica/HP laminate as detailed on A-8.2 "Vanity Detail".
9. All fans shown in the reflected ceiling plans are provided & installed by other trades (not GC scope). GC shall coordinate surrounding ceiling work with applicable trades.
10. Armstrong ceiling tile systems furnished & installed by GC shall be as follows:
    - Layouts & tile sizes (2x2 vs. 2x4) shall be per the A-9.1/9.2/9.3 Reflected Ceiling Plans.
    - All lay-in ceilings to include Fireguard option & Prelude XL grid.
    - Areas to receive the 'Fine Fissured - Unperforated Ceramaguard' style ceilings include:
        - Janitors Closets
        - Bathrooms (with shower)
        - Kitchen
        - Pantry
    - Storage Rooms & AV/Media Room within the Second Floor Meeting Room shall get the 'Fine Fissured – Tegular' style ceiling.
    - All other locations shall get the 'Cirrus Tegular – Fine Texture' ceiling.

**DIV. 10 – SPECIALTIES**

1. Gear Grid lockers that are to be furnished & installed by GC shall be as follows:
    - Wall mount lockers to be "Gear Grid – Standard Fire Station Wall Mount"- 20" wide version,
    - Freestanding lockers to be "Gear Grid – Standard Fire Station Mobile (caster) Lockers" - 20" wide version.
2 GC shall furnish & install all stainless steel (SS) tables, shelving, hooks, pot racks indicated in the drawings. Manufacturer shall be Advanced Tabco or equal.
3. Tool pegboard at Work Bench wall location shall be galvanized steel type "PegBoardMX" by Diamond Life Gear, or equal. Include standard hooks/mounting accessories as part of finishing.
4. Specification section "10 2116 – Plastic Toilet Compartments" shall replace the "Metal Toilet Compartments" title in the Table of Contents.

5. Fabric awnings shall be by “Rainier Awnings” (or equal). To be metal fame with solid color fabric (color selected by Owner). GC shall furnish & install one (1) additional 8’-0” long awning for the rear entry door EX-4, should the terrace/patio alternate be rejected.
6. Meeting Room coat rack alcove shall not be per the detail ‘3’ on A-1.3, but shall be REI Rigid Rak 450 Series COAT RACK per Section 10914.
7. 48”x48” custom Maltese Terrazzo Emblem indicated on drawing A-1.1 shall include up to four (4) colors, as selected by Owner. Owner shall provide Department emblem artwork for terrazzo vendors use.
8. SV Special Single Leaf Fire Vent specified in section 07720 no longer applies. Omit from scope.

**DIV. 11 – EQUIPMENT**

1. Coffee/Toaster/Microwave equipment as indicated on enlarged Kitchen plan drawing A-8.4 are Owner provided (not in contract).
2. Kitchen Walk-In Cooler shall be furnished & installed by GC. Manufacturer to be Koplak (or equal) remote system style.

**DIV. 12 – FURNISHINGS**

1. All interior signage is by Owner (not in contract).
2. All relocated items in Specification Section 12100 are required to be properly taken down by the GC, safely stored by the GC, and then reinstalled in the new facility by the GC, and at locations that will be designated by Owner/Architect.
3. Alternate GC-6 includes only the 36 linear feet of Meeting Room display case. The display case at the Entrance Lobby shall be in the base bid.

**DIV. 13 – CONVEYING SYSTEMS (ELEVATOR)**

1. GC shall furnish a sufficient temporary generator (if needed based on overall schedule) in order to complete elevator start-up/load testing. Coordinate with EC as needed for power completion at elevator.
2. GC to furnish & install one (1) steel ladder full height of elevator pit, coordinate with elevator manufacturer requirements. Currently shown on A-5.1.
3. GC to coordinate location of elevator sum-pump pit with his own elevator manufacturers requirements, as well as plumber & electricians work.

# ELECTRICAL (EC)

## SITE:

1. All temporary & permanent electrical service required shall be per Note #19 on dwg E-1.
2. EC shall disconnect existing electric sign at Lake Road, and reconnect at a later date, in coordination with GC masonry sign base.
3. Existing precast lamp pole at Lake Road/Oxford Drive corner of site is to be removed, retained & reinstalled by EC as part of site lighting work.
4. All electrical items on east site shall be permanently connected to panel TPP, which shall be served from Lake Road main service.
5. Panel 'GPP' is the panel indicated as 'PNL' on the alternate garage plan.

## EXISTING BUILDING:

1. Existing electric reels at existing apparatus bay shall be moved & re-fed with power by EC, to opposite side of garage door track from current. New location will be towards back portion of existing bay as the trucks will be turned around 180-degrees. Field verify with Owner & existing truck connections.
2. A portable generator provided by Owner shall be connected to existing power & generator transfer switch by EC to make fully active. The new portable generator shall have a maximum overcurrent device for the generator set replaced with a maximum overcurrent device to match the generator to be removed systems protection. The mocp shall not exceed the portable generators rating.
3. EC to disconnect/remove power supply to Owner gear washer & dryer at existing facility Apparatus Bay, and re-install power supply/outlet at existing Kitchen stove area for Owners continued use of gear washer. Coordinate with PC.
4. Existing phone/cable/etc.. to remain during construction. Only electric service to be relocated.
5. EC to disconnect existing siren prior to O&R pole removal at back of building. EC shall re-install siren on to existing building & re-connect to siren system to make active. Leave in place for complete demolition of existing building at end.
6. Power/control wiring for door openers of new overhead doors at rear of existing firehouse bay are by EC. Supply off existing power/panel.

## NEW BUILDING:

1. EC Specification 16721E, Section 1.04, Item 'C' shall read "Rockland County and Town of Clarkstown".
2. EC to coordinate location of power/control supply for elevator sum-pump pit with GC, elevator manufacturers requirements & plumbers work.
3. EC shall furnish & install the new generator and all associated controls, switches, etc.. to make full & serving the new building as outlined in the Electrical drawings/specifications. An alternate generator package may be issued as part of a further clarification in a future Addendum (to be verified).

4. All work associated with covered terrace shall be included as part of add alternate E-2.
5. Alternate 1901E3 BMS shall include supplying & installing the entire system.
6. The Electrical Contractor to supply and install any & all fire alarm, CO2, smoke detection & sprinkler monitoring.
7. EC shall provide six (6) additional smoke detectors, and two (2) additional heat detectors as spares for Owners future use.
8. There is no requirement for use of an existing fire alarm vendor for EC required fire alarm installation.
9. Any & all wiring including fire alarm, data, surveillance, phone, etc.. at ceilings in exposed areas shall be in conduit installed flush to ceiling. All wire in concealed areas & plenums can be run with plenum rated cable within the enclosed areas. All cables shall be run parallel & perpendicular, bundled & strapped to structural framing.
10. EC shall provide power wiring from local panel to all Gear Grid gear locker racks indicated on drawing A-1.1. Provide & install linear outlets in Gear Grid power bar cavity within the racks.
11. Location of cable TV outlet at Secretary/Data Room shall be coordinated by EC with GC, and adjusted as needed for casework detail on A-1.3
12. EC refer to drawing A-8.4 for additional power & cable TV outlets to be installed at the Ready Room casework.
13. EC shall supply/install line voltage wiring to ceiling 'VF' fans in apparatus bay. EC shall also tie in these fans to the fire alarm system.
14. EC to install all line voltage wiring associated with Mechanical controls, including line voltage for thermostats at unit heaters.
15. EC shall wire equipment of all other trades. Disconnects shall be provided by respective trade contractor.
16. EC is responsible for supplying/installing and setting all light pole bases.
17. "K" fixtures at rear covered patio area are to be include as an alternate to the bid. These will be required to be provided/installed by EC as detailed, if the rear patio canopy alternate is accepted.
18. 1'x4' fixture at GAR-2 shall be Type 8 surface mounted LED fixture.
19. EC shall furnish & install/connect the electric reels (E.R.) indicated on drawing E-2. Make/model to be per drawing E-2
20. Refer to 2-gang floor box cut sheet made part of this Addendum as **Attachment #6,** to be used by EC for any locations that call for floor box.
21. EC shall furnish & install one (1) 4" diameter schedule 40 galvanized pole 12'-0" long with four (4) 3/8" u bolts at center of rear (north) parapet wall (coordinate blocking with GC) and install siren minimum 4'-0" above top of parapet. Wire siren power and controls back to IT room at Mezzanine.
22. EC shall furnish & install two (2) (tandem side by side) 84" x 21" x 21" Legrand IT model 19-84-T4SDA2132 racks in IT room with ground bar to building steel per drawing E-24.
23. EC shall furnish & install all Cat6 wire (and 18/4 for radio system) for LAN, data, surveillance, radio and phone systems with boxes and plates at room locations. All wire to be terminated and punched down at IT racks and tested and certified. Install ends at all surveillance locations where no box or plate is required for testing and leave for owner vendor to modify for camera installation.

24. EC shall install all wire and Cat6 for access system and leave coiled in boxes for owner access vendor.
25. EC to install all RG6 CATV wire to boxes with plate and jack at all room locations. Terminate all in splice box at IT room. Coordinate with cable utility company for system requirements.
26. EC to furnish & install complete A/V system in Meeting Room/Media Closet per drawing E-12, including full installation and demonstration of system functions to Owner. EC shall field coordinate any devices, controls, jacks, speakers, etc.. that must be installed at the Meeting Room and run back to A/V rack & equipment, along with other trades work.

## MECHANICAL (MC)

**NEW BUILDING:**

1. MC is responsible for furnishing, installing & start-up/testing of the full Kitchen cook-line hood & ANSUL system as engineered and indicated in the Mechanical drawings & Specifications. Coordinate with EC/PC/Owner vendor for Kitchen cook-line equipment installations & startup/testing.
2. PC shall provide the HWH-2 equipment, MC shall provide & install the supply & return from boiler unit to HWH-2.
3. There is no preferred vendor for Distech Controls.
4. As per specification section 15510-P, Part 3, 3.01 Preparation, D – Treatment program can be omitted, but all other requirements (flushing/filling/etc..) shall apply.
5. Refer to updated drawing M-18 made part of this Addendum as **Attachment #7** for the riser diagram showing correct quantity of modine heaters. Previous M-18 drawing in the bid documents had a portion or the riser diagram cut off.
6. Refer to the clarification **Attachment #8** made part of this Addendum for Thermostat, 3-way valve & relay information required as part of the Modine heater system.

## PLUMBING (PC)

**SITE:**

1. Drawing P-1 correctly indicates the incoming water service from Lake Road as split with domestic & fire service from street connection to PC provided/installed hotbox, then continuing to building. Water main size at street was not previously provided, but a successful flow test at hydrant was completed.

**EXISTING BUILDING:**

1. PC shall move existing air reels & re-feed air lines at existing facility Apparatus Bay. Move to opposite side of overhead door track, and back towards rear end of bays where the new overhead doors will be installed. Field verify with Owner & existing truck connections.

2. Relocated temporary water service to the existing firehouse shall be 2", material can be soft copper or plastic pipe, protected.
3. PC to disconnect/remove Owners existing gear washer & dryer at the existing Apparatus Bay, and shall re-install at existing Kitchen stove location for Owners continued use of gear washer/dryer. Coordinate with EC.

**NEW BUILDING:**

1. PC shall provide as part of their bid a unit price for standard floor drain fixture & price per linear foot of associated sanitary piping (1st floor level – in slab on grade) should additional floor drain locations be required within the bay & adjacent areas. Hand write this item at bottom of unit price list provided in bid form package.
2. Plumber to coordinate location of piping for elevator sum-pump pit with GC, elevator manufacturers requirements & electricians work.
2. Sink at Shower/Restroom #110 off Apparatus Bay gets wall hung ADA compliant sink furnished & installed by PC along with urinal & toilet fixtures. Sink to be by American Standard or equal.
3. Stainless compartment sinks at the following locations are Advance Tabco (or equal) and shall be furnished & installed/connected by PC:
    - Apparatus Bay (110.1)
    - Gear Wash (110.3)
    - Kitchen (211.1)
    - Ready Room (203.1)
4. All undermount sinks/faucets at millwork/vanity built-ins are furnished & installed by PC in coordination with GC vanity sub.
5. Ice machines/bins are furnished & installed by PC, and shall include associated water filter unit typical.
6. Gear Washer, gear dryer and stacked washer/dry unit are furnished by Owner (based on model specified in documents) and then installed, connected & start-up/tested by PC.
7. PC to furnish & install the Precast terrazzo shower bases. Size to be 36"x36" at Bathroom 210.2, 36"x48" at Shower/Br. 110.
8. Any straight runs of domestic water piping exceeding 100 feet shall include an expansion loop by PC.
9. New compressor as specified on P-3 is part of PC scope of work. PC to furnish & install to make a complete system.

## FIRE SPRINKLER (FSC)

1. Should the alternates for the rear second floor terrace & covered patio be accepted, fire suppression at these locations is not required.

**(END OF ADDENDUM NO.2)**

ATTACHMENT #1

# AIA® Document A101® – 2017

## *Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum*

**AGREEMENT** made as of the 1ST day of APRIL in the year 2021
*(In words, indicate day, month and year.)*

**BETWEEN** the Owner:
*(Name, legal status, address and other information)*
VALLEY COTTAGE FIRE DISTRICT
20 LAKE ROAD
VALLEY COTTAGE, NY 10989

and the Contractor: TBD
*(Name, legal status, address and other information)*

for the following Project:
*(Name, location and detailed description)*
NEW FIREHOUSE FACILITY
20 LAKE ROAD
VALLEY COTTAGE, NY 10989

The Architect:
*(Name, legal status, address and other information)*
SENDLENSKI ARCHITECTS PC
215 ROANOKE AVE.
RIVERHEAD, NY 11901

The Owner and Contractor agree as follows.

**ADDITIONS AND DELETIONS:**
The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101®–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201®–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

TABLE OF ARTICLES



## ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

## ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

## ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

**§ 3.1** The date of commencement of the Work shall be:
*(Check one of the following boxes.)*

[ ] The date of this Agreement.

[ ] A date set forth in a notice to proceed issued by the Owner.

[X] Established as follows:
*(Insert a date or a means to determine the date of commencement of the Work.)*

APRIL 5, 2021

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

**§ 3.2** The Contract Time shall be measured from the date of commencement of the Work.

### § 3.3 Substantial Completion

**§ 3.3.1** Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

*(Check one of the following boxes and complete the necessary information.)*

[ ] Not later than ( ) calendar days from the date of commencement of the Work.

[X] By the following date: TUESDAY SEPTEMBER 27, 2022 (477 DAYS)

**§ 3.3.2** Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

| Portion of Work | Substantial Completion Date |
|---|---|

**§ 3.3.3** If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

## ARTICLE 4 CONTRACT SUM TBD BY BID

**§ 4.1** The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be ($ ), subject to additions and deductions as provided in the Contract Documents.

**§ 4.2 Alternates** SEE ATTACHMENT A - BID FORM

**§ 4.2.1** Alternates, if any, included in the Contract Sum:

| Item | Price |
|---|---|

**§ 4.2.2** Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
*(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)*

| Item | Price | Conditions for Acceptance |
|---|---|---|

**§ 4.3** Allowances, if any, included in the Contract Sum: SEE ATTACHMENT A - BID FORM
*(Identify each allowance.)*

| Item | Price |
|---|---|

**§ 4.4** Unit prices, if any:
*(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)*

| Item | Units and Limitations | Price per Unit ($0.00) |
|---|---|---|

**§ 4.5** Liquidated damages, if any: SEE SUPPLEMENTAL CONDITIONS ITEM 4
*(Insert terms and conditions for liquidated damages, if any.)*

**§ 4.6** Other:
*(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)*

## ARTICLE 5 PAYMENTS

### § 5.1 Progress Payments

**§ 5.1.1** Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

**§ 5.1.2** The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

**§ 5.1.3** Provided that an Application for Payment is received by the Architect not later than the day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the day of the month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than ( ) days after the Architect receives the Application for Payment. L 45

*(Federal, state or local laws may require payment within a certain period of time.)*

**§ 5.1.4** Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

**§ 5.1.5** Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

**§ 5.1.6** In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

**§ 5.1.6.1** The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

**§ 5.1.6.2** The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

### § 5.1.7 Retainage

**§ 5.1.7.1** For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:

*(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)*

FIVE PERCENT (5%)

§ 5.1.7.1.1 The following items are not subject to retainage:
*(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)*

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
*(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)*

N/A

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
*(Insert any other conditions for release of retainage upon Substantial Completion.)*

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

### § 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

### § 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due at the rate stated below, or in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.
*(Insert rate of interest agreed upon, if any.)*

%

## ARTICLE 6 DISPUTE RESOLUTION

### § 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual, not a party to this Agreement, to serve as the Initial Decision Maker.
*(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)*

**§ 6.2 Binding Dispute Resolution**
For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
*(Check the appropriate box.)*

[X] Arbitration pursuant to Section 15.4 of AIA Document A201–2017 AND RIDER PROVISIONS

[ ] Litigation in a court of competent jurisdiction

[ ] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction.

**ARTICLE 7 TERMINATION OR SUSPENSION**
**§ 7.1** The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

**§ 7.1.1** If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
*(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)*

**§ 7.2** The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

**ARTICLE 8 MISCELLANEOUS PROVISIONS**
**§ 8.1** Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

**§ 8.2** The Owner's representative:
*(Name, address, email address, and other information)*

**§ 8.3** The Contractor's representative:
*(Name, address, email address, and other information)*

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

**§ 8.5 Insurance and Bonds**

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:

*(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)*

§ 8.7 Other provisions:

## ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor
.2 AIA Document A101™–2017, Exhibit A, Insurance and Bonds
.3 AIA Document A201™–2017, General Conditions of the Contract for Construction
.4 AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, dated as indicated below:
*(Insert the date of the E203-2013 incorporated into this Agreement.)*

.5 Drawings SEE ATTACHMENT B

| Number | Title | Date |
|---|---|---|

.6 Specifications SEE ATTACHMENT C

| Section | Title | Date | Pages |
|---|---|---|---|

.7 Addenda, if any:

| Number | Date | Pages |
|---|---|---|
| 1 | JAN 20, 2021 | 1 |
| 2 | FEB. 2, 2021 | TBD |

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
*(Check all boxes that apply and include appropriate information identifying the exhibit where required.)*

[ ] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

[ ] The Sustainability Plan:

| Title | Date | Pages |
|---|---|---|

[ ] Supplementary and other Conditions of the Contract:

| Document | Title | Date | Pages |
|---|---|---|---|

.9 Other documents, if any, listed below:
*(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)*

This Agreement entered into as of the day and year first written above.

| | |
|---|---|
| **OWNER** *(Signature)* | **CONTRACTOR** *(Signature)* |
| *(Printed name and title)* | *(Printed name and title)* |

**VALLEY COTTAGE FIRE DISTRICT**
PROPOSED NEW FACILITY
VALLEY COTTAGE, N.Y. 10989

**GENERAL CONSTRUCTION LIST OF DRAWINGS**
GC – PROJECT 1901
ALL DRAWINGS DATED 12-10-2020

## LIST OF DRAWINGS

0-0 COVER SHEET

ECS-1 EXISTING CONDITIONS SURVEY

SDP-2 SITE DEVELOPMENT PLAN

SD-3 SITE DETAILS

RW-4 RETAINING WALL PROFILE & DETAILS

RW-5 RETAINING WALL NOTES

ESC-6 EROSION & SEDIMENT CONTROL PLAN

CSP-7 CONSTRUCTION PHASING

SP-1 STAGING PLAN

SP-2 SITE DEVELOPMENT PLAN

SP-3 CONCRETE APRON & SITE DETAILS

SP-4 LANDSCAPING PLAN

EX-1.1 REVISED STAGING PLAN EXISTING BUILDING

EX-1.2 EXISTING BUILDING PLAN & ELEVATION

EX-1.3 REVISED EXISTING BUILDING PLAN & ELEVATION

EX-1.4 CONSTRUCTION DETAILS

GAR-1 ACCESSORY GARAGE PLANS/ELEVATIONS (ADD ALTERNATE)

GAR-2 ACCESSORY GARAGE MPE PLANS

A-1.1 FIRST FLOOR PLAN & DETAILS

A-1.2 MEZZANINE FLOOR PLAN & DETAILS

A-1.3 SECOND FLOOR PLAN & DETAILS

A-1.4 ATTIC/FLAT ROOF PLAN & DETAILS

A-2.1 ROOF FRAMING PLAN & DETAILS

A-2.2 ROOF FRAMING DETAILS

A-2.1 (ALT.) METAL ROOF ALTERNATE PLAN

A-2.2 (ALT.) METAL ROOF ALTERNATE DETAILS

A-2.3 ALTERNATE PATIO ROOF PLAN & DETAILS

A-3.1 ELEVATIONS (WEST AND SOUTH) & DETAILS

A-3.2 ELEVATIONS (EAST AND NORTH) & DETAILS

A-3.3 ELEVATION DETAILS

A-3.4 WINDOW ELEVATIONS & DETAILS

A-4.1 BUILDING SECTION & DETAILS

A-4.2 BUILDING SECTION & DETAILS

A-4.3 BUILDING SECTION DETAILS

A-5.1 STAIR 'A' PLANS & SECTION

A-5.2 STAIR 'B' PLANS & SECTION

A-5.3 STAIR DETAILS

A-6.1 WALL SECTIONS & DETAILS

A-6.2 WALL SECTIONS & DETAILS

A-7.1 DOOR SCHEDULE & DETAILS

A-8.1 FINISH SCHEDULE & LEGEND

A-8.2 FIRST FL. TOILET PLANS & ELEVATIONS & DETAILS

A-8.3 SECOND FL. TOILET PLANS & ELEVATIONS

A-8.4 KITCHEN PLAN & ELEVATIONS

A-8.5 DISPLAY AND CASEWORK DETAILS

A-9.1 FIRST FLOOR REFLECTED CEILING PLAN

A-9.2 MEZZANINE REFLECTED CEILING PLAN

A-9.3 SECOND FLOOR REFLECTED CEILING PLAN

**VALLEY COTTAGE FIRE DISTRICT**
PROPOSED NEW FACILITY
VALLEY COTTAGE, N.Y. 10989

**MECHANICAL LIST OF DRAWINGS**
HVAC – PROJECT 1901
ALL DRAWINGS DATED 12-10-2020

## LIST OF DRAWINGS

| | |
|---|---|
| 0-0 | COVER SHEET |
| ECS-1 | EXISTING CONDITIONS SURVEY |
| SDP-2 | SITE DEVELOPMENT PLAN |
| ESC-6 | EROSION &SEDIMENT CONTROL PLAN |
| CSP-7 | CONSTRUCTION PHASING |
| SP-1 | STAGING PLAN |
| SP-2 | SITE DEVELOPMENT PLAN |
| GAR-2 | ACCESSROY GARAGE MPE PLANS |
| M-1 | HEAT GAIN AND LOSS CALCULATIONS |
| M-2 | FIRST FLOOR MECHANICAL PLAN |
| M-3 | MEZZANINE MECHANICAL PLAN |
| M-4 | SECOND FLOOR MECHANICAL PLAN |
| M-5 | ATTIC/ROOF MECHANICAL PLAN |
| M-6 | FIRST FLOOR HYDRONIC PLAN |
| M-7 | MEZZANINE HYDRONIC PLAN |
| M-8 | SECOND FLOOR HYDRONIC PLAN |
| M-9 | ATTIC HYDRONIC PLAN |
| M-10 | MECHANICAL EQUIPMENT SCHEDULES |
| M-11 | MECHANICAL EQUIPMENT SCHEDULES (CONT.) |
| M-12 | MECHANICAL VENTILATION INDEX |
| M-13 | MECHANICAL KITCHEN HOOD SCHEDULES |
| M-14 | MECHANICAL KITCHEN HOOD DETAILS |
| M-15 | MECHANICAL KITCHEN MAKEUP AIR AND EXHAUST FAN SCHEDULES AND DETAILS |
| M-16 | MECHANICAL KITCHEN MAKEUP AIR DETAILS |
| M-17 | MECHANICAL KITCHEN EQUIPMENT EXHAUST SYSTEM CONTROLS |
| M-18 | HYDRONIC RISER DIAGRAM |
| M-19 | MECHANICAL DETAILS |
| M-20 | MECHANICAL NOTES |

**VALLEY COTTAGE FIRE DISTRICT**
PROPOSED NEW FACILITY
VALLEY COTTAGE, N.Y. 10989

**FIRE SPRINKLER LIST OF DRAWINGS**
FIRE SPRINKLER – PROJECT 1901
ALL DRAWINGS DATED 12-10-2020

## LIST OF DRAWINGS

| | |
|---|---|
| 0-0 | COVER SHEET |
| ECS-1 | EXISTING CONDITIONS SURVEY |
| SDP-2 | SITE DEVELOPMENT PLAN |
| ESC-6 | EROSION &SEDIMENT CONTROL PLAN |
| CSP-7 | CONSTRUCTION PHASING |
| SP-1 | STAGING PLAN |
| SP-2 | SITE DEVELOPMENT PLAN |
| SP-1 | FIRE SPRINKLER/STANDPIPE SYSTEM PLOT PLAN |
| SP-2 | FIRST FLOOR FIRE SPRINKLER/STANDPIPE PLAN |
| SP-3 | APPARATUS BAY & MEZZANINE FIRE SPRINKLER/STANDPIPE PLAN |
| SP-4 | SECOND FLOOR FIRE SPRINKLER/STANDPIPE PLAN |
| SP-5 | ATTIC FIRE SPRINKLER/STANDPIPE PLAN |
| SP-6 | FIRE SPRINKLER/STANDPIPE RISER DIAGRAM |
| SP-7 | FIRE SPRINKLER DETAILS |
| SP-8 | FIRE SPRINKLER DETAILS AND SCHEDULES |
| SP-9 | FIRE SPRINKLER NOTES |

**VALLEY COTTAGE FIRE DISTRICT**
PROPOSED NEW FACILITY
VALLEY COTTAGE, N.Y. 10989

**PLUMBING LIST OF DRAWINGS**
PLUMBING – PROJECT 1901
ALL DRAWINGS DATED 12-10-2020

## LIST OF DRAWINGS

| | |
|---|---|
| 0-0 | COVER SHEET |
| ECS-1 | EXISTING CONDITIONS SURVEY |
| SDP-2 | SITE DEVELOPMENT PLAN |
| ESC-6 | EROSION &SEDIMENT CONTROL PLAN |
| CSP-7 | CONSTRUCTION PHASING |
| SP-1 | STAGING PLAN |
| SP-2 | SITE DEVELOPMENT PLAN |
| EX-1.1 | REVISED STAGING PLAN EXISTING BUILDING |
| EX-1.2 | EXISITNG BUILDING PLAN & ELEVATION |
| P-1 | PLUMBING SITE PLAN |
| P-2 | PLUMBING FIXTURE SCHEDULE |
| P-3 | PLUMBING SPECIALTY SCHEDULE |
| P-4 | FIRST FLOOR DOMESTIC WATER PLAN |
| P-5 | MEZZANINE DOMESTIC WATER PLAN |
| P-6 | SECOND FLOOR DOMESTIC WATER PLAN |
| P-7 | FIRST FLOOR SANITARY PLAN |
| P-8 | MEZZANINE SANITARY PLAN |
| P-9 | SECOND FLOOR SANITARY PLAN |
| P-10 | ATTIC/ROOF SANITARY PLAN |
| P-11 | DOMESTIC WATER RISER DIAGRAM |
| P-12 | SANITARY RISER DIAGRAM |
| P-13 | SANITARY RISER DIAGRAM (CONTINUED) |
| P-14 | NATURAL GAS AND STORM RISER DIAGRAM |
| P-15 | PLUMBING DETAILS |
| P-16 | PLUMBING NOTES |

**VALLEY COTTAGE FIRE DISTRICT**
PROPOSED NEW FACILITY
VALLEY COTTAGE, N.Y. 10989

**ELECTRICAL LIST OF DRAWINGS**
ELECTRICAL – PROJECT 1901
ALL DRAWINGS DATED 12-10-2020

## LIST OF DRAWINGS

| | |
|---|---|
| 0-0 | COVER SHEET |
| ECS-1 | EXISTING CONDITIONS SURVEY |
| SDP-2 | SITE DEVELOPMENT PLAN |
| ESC-6 | EROSION &SEDIMENT CONTROL PLAN |
| CSP-7 | CONSTRUCTION PHASING |
| SP-1 | STAGING PLAN |
| SP-2 | SITE DEVELOPMENT PLAN |
| EX-1.1 | REVISED STAGING PLAN EXISTING BUILDING |
| EX-1.2 | EXISITNG BUILDING PLAN & ELEVATION |
| E-1 | ELECTRICAL SITE PLAN NOTES AND SYMBOLS |
| E-2 | FIRST FLOOR PLAN - POWER |
| E-3 | MEZZANINE PLAN - POWER |
| E-4 | SECOND FLOOR PLAN - POWER |
| E-5 | ATTIC PLAN - POWER |
| E-6 | FIRST FLOOR PLAN - LIGHTING |
| E-7 | MEZZANINE PLAN - LIGHTING |
| E-8 | SECOND FLOOR PLAN - LIGHTING |
| E-9 | ATTIC PLAN - LIGHTING |
| E-10 | FIRST FLOOR MISCELLANEOUS SYSTEMS PLAN |
| E-11 | MEZZANINE MISCELLANEOUS SYSTEMS PLAN |
| E-12 | SECOND FLOOR MISCELLANEOUS SYSTEMS PLAN |
| E-13 | ATTIC MISCELLANEOUS SYSTEMS PLAN |
| E-14 | POWER RISER & SCHEDULE |
| E-15 | PANEL SCHEDULES |
| E-16 | FIRE & SMOKE ALARM RISER DIAGRAMS |
| E-17 | CABLE TV, TELEPHONE RISER DIAGRAMS |
| E-18 | ACCESS SYSTEM RISER DIAGRAM |
| E-19 | COMPUTER AND SURVEILLANCE RISER DIAGRAMS |
| E-20 | MISCELLANEOUS SYSTEM RISER DIAGRAMS |
| E-21 | MISCELLANEOUS DIAGRAMS & SEISMIC SPECS |
| E-22 | LIGHTNING PROTECTION PLAN AND DETAILS |
| E-23 | LIGHTNING PROTECTION DETAILS |
| E-24 | IT ROOM FLOOR PLANS & SECTION VIEWS |

**PROJECT MANUAL INDEX**
**VALLEY COTTAGE FIRE DISTRICT**
**PROPOSED MAINHOUSE FACILITY**
**SPECIFICATION NO. 1901**
**APPLIES TO ALL BIDDERS**
**ATTACHMENT C**



**DIVISION 1 - GENERAL REQUIREMENTS**

**SPECIFICATIONS ATTACHMENT C – GENERAL CONSTRUCTION**

**DIVISION 2 – SITEWORK**



**DIVISION 3 – CONCRETE**



**DIVISION 4 - MASONRY**



**DIVISION 5 - METALS**



**DIVISION 6 - WOODS AND PLASTICS**



**DIVISION 7 - THERMAL & MOISTURE PROTECTION**

**DIVISION 12- FURNISHINGS**



**DIVISION 14 – CONVEYING SYSTEMS**

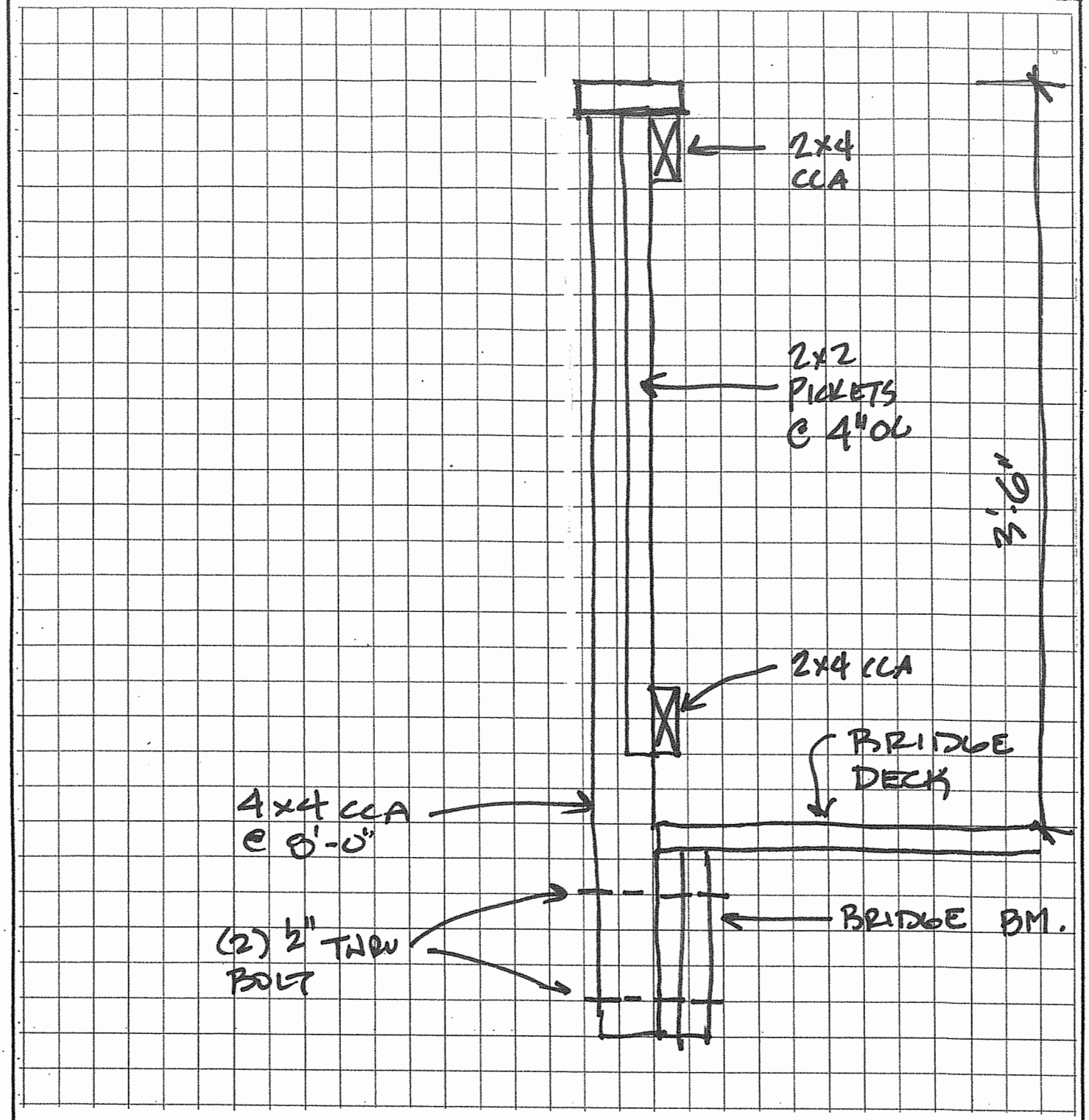
# HVAC ATTACHMENT C

## ATTACHMENT C PLUMBING

## ATTACHMNENT C SPRINKLER

# ATTACHMENT C
# ELECTTICAL

**ATTACHMENT #2**




MARTIN F. SENDLEWSKI, A.I.A.
ARCHITECT - PLANNER
(631) 727-5352

215 ROANOKE AVENUE
RIVERHEAD, NEW YORK 11901

# VALLEY COTTAGE
F.D.

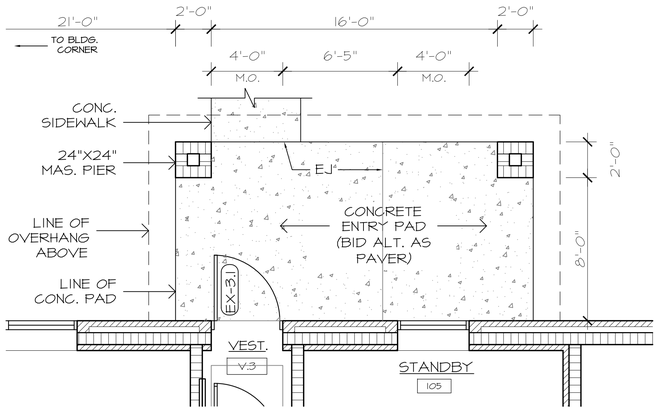
## BRIDGE HANDRAIL DETAIL

PROJECT#:

DRAWING#:

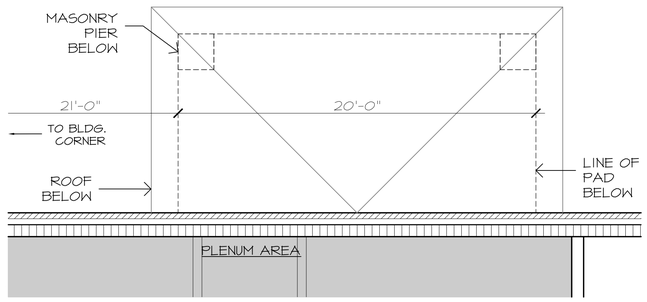
DATE#: 2.2.21

# ATTACHMENT #3



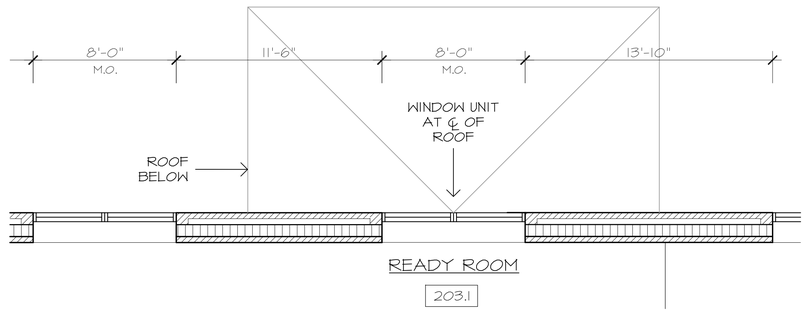

## 1 FIRST FLOOR PLAN - BASE BID

SCALE: 1/4" = 1'-0"




## M MEZZ. FLOOR PLAN - BASE BID

SCALE: 1/4" = 1'-0"




## 2 SECOND FLOOR PLAN - BASE BID

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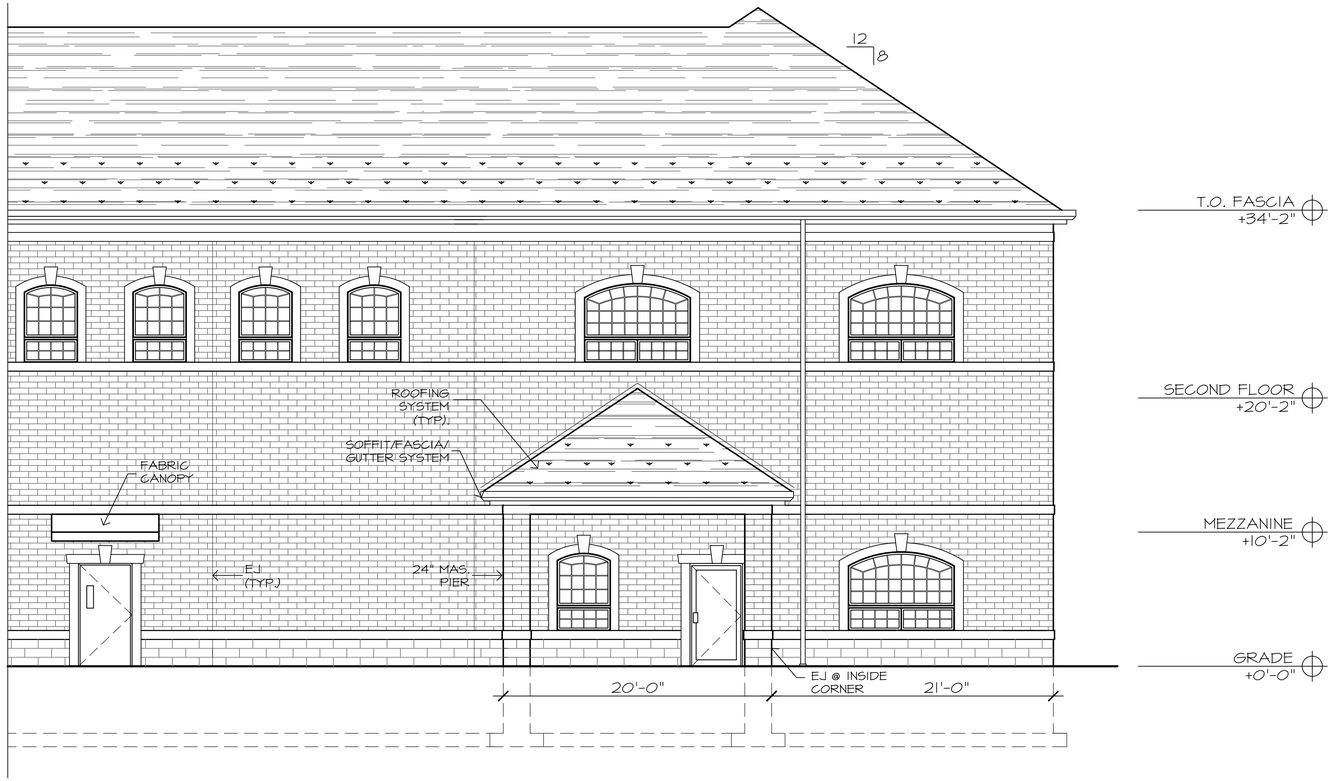


## NORTH ELEVATION BASE BID

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

DATE: ISSUE

12-10-2020 ISSUED FOR BIDDING & PERMIT

02-02-2021 ISSUED AS PART OF ADDENDUM 2

SEAL:


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(845) 275-8859


PROPOSED NEW FACILITY
VALLEY COTTAGE FIRE DISTRICT

20 LAKE ROAD
VALLEY COTTAGE NY 10989

BASE BID PLANS & ELEVATION AT REAR ENTRY

PROJECT #: 1901.02

DRAWN BY:

CAD FILE: 1901.02/P:/BID

DRAWING#:

ATTACHMENT "3"

**ATTACHMENT #4**

**Valley Cottage Fire District**

**General construction bid alternate G1901-GC11**

This deduct alternate for installation of the Siplast roofing system per specification section 07535, in lieu of the Garland roof system per specification 07550 (which is to be included in the base bid) shall be in the amount of _____

_____ ($ _____).

ATTACH THIS PAGE TO THE BID FORM FOR GENERAL CONSTRUCTION BIDS

SECTION 07462

SIDING

(James Hardie HZ10 Engineered for Climate Siding)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fiber cement lap siding, panels, shingle, trim, fascia, moulding and accessories; James Hardie HZ10 Engineered for Climate Siding.

1.2 REFERENCES

A. AS D3359 - Standard Test Method for Measuring Adhesion by Tape Test, Tool and Tape.

1.3 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

C. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cementitious siding materials which are outside the scope of the standard details and specifications provided by the manufacturer.

D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store siding on edge or lay flat on a smooth level surface. Protect edges and corners from chipping. Store sheets under cover and keep dry prior to installing.

C. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.5 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.6 WARRANTY

A. Product Warranty: Limited, non-pro-rated product warranty.
   1. HardiePlank HZ10 lap siding for 30 years.
   2. HardiPanel HZ10 vertical siding for 30 years.
   3. HardieSoffit HZ10 panels for 30 years.
   4. HardieShingle HZ10 siding for 30 years.
   5. HardieTrim HZ10 boards for 15 years.
   6. Artisan HZ10 lap siding for 30 years.

B. Finish Warranty: Limited product warranty against manufacturing finish defects.
   1. When used for its intended purpose, properly installed and maintained according to Hardie's published installation instructions, James Hardie's ColorPlus finish with ColorPlus Technology, for a period of 15 years from the date of purchase: will not peel; will not crack; and will not chip. Finish warranty includes the coverage for labor and material.

C. Workmanship Warranty: Application limited warranty for 2 years.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturer: James Hardie Building Products, Inc., which is located at: 26300 La Alameda Suite 400 ; Mission Viejo, CA 92691; Toll Free Tel: 866-274-3464; Tel: 949-367-4980; Fax: 949-367-4981; Email: request info (info@jameshardie.com); Web: www.jameshardiepros.com.

B. Substitutions: Not permitted.

C. Requests for approval of equal substitutions will be considered in accordance with provisions of Section 01600.

2.2 SIDING AND TRIM

A. HardiePlank HZ10 lap siding, HardiPanel HZ10 vertical siding, HardieSoffit HZ10 panels and HardieShingle HZ10 siding requirement for materials:
   1. Fiber-cement siding - complies with ASTM C 1186 Type A Grade II.
   2. Fiber-cement siding - complies with ASTM E 136 as a noncombustible material.
   3. Fiber-cement siding - complies with ASTM E 84 Flame Spread Index = 0, Smoke Developed Index = 5.
   4. CAL-FIRE, Fire Engineering Division Building Materials Listing - Wildland Urban Interface (WUI) Listed Product.
   5. ICC-ES evaluation reports ESR-2290, ESR-1844, and ESR-2273 (IBC, IRC, CBC, CRC)
   6. City of Los Angeles, Research Report No. 24862.
   7. Miami Dade County, -Notice of Acceptance -15-0122.04.
   8. US Department of Housing and Urban Development Materials Release - 1263f.
   9. California DSA PA-019.
   10. City of New York M EA 223-93-M.
   11. Florida State Product Approval -FL13192, FL13223, and FL13265
   12. Texas Department of Insurance Product Evaluation EC-23.

B. Artisan HZ10 lap siding requirement for Materials:
   1. Fiber-cement siding - complies with ASTM C 1186 Type A Grade II.
   2. Fiber-cement siding - complies with ASTM E 136 as a noncombustible material.

3. Fiber-cement Siding - complies with ASTM E 84 Flame Spread Index = 0, Smoke Developed Index = 5.
4. ICC-ES evaluation report ESR-2290
5. Intertek Product Listing.
6. CAL-FIRE, Fire Engineering Division Building Materials Listing - Wildland Urban Interface (WUI) Listed Product.
7. Florida State Product Approval FL-13192.
8. Miami Dade County, Florida Notice of Acceptance -15-0122.04.
9. Texas Department of Insurance Product Evaluation EC-55.
10. Manufacturer's Technical Data Sheet.

C. Lap Siding: Artisan HZ10 Lap Siding as manufactured by James Hardie Building Products, Inc.
1. Type: Smooth 5-1/4 inches (133 mm) with 4 inches (102 mm) exposure.

D. Trim:
1. HardieTrim HZ10 boards as manufactured by James Hardie Building Products, Inc.
a. Product: Batten Boards, 2-1/2 inch (63 mm) width.
b. Product: 4/4 Boards, 3-1/2 inch (89 mm) width.
2. HardieTrim HZ10 Fascia boards as manufactured by James Hardie Building Products, Inc.
3. Artisan HZ10 Accent trim as manufactured by James Hardie Building Products, Inc.
4. Fiber-cement trim - complies with ASTM C 1186 Type A Grade II.
5. Fiber-cement trim - complies with ASTM E 136 as a noncombustible material.
6. Fiber-cement trim - complies with ASTM E 84 Flame Spread Index = 0, Smoke Developed Index = 5.
7. Intertek Product Listing.

E. Factory Finish Color for Trim, Soffit and Siding Colors:
1. Autumn Tan JH20-20.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If framing preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Nominal 2 inch by 4 inch (51 m by 102 mm) wood framing selected for minimal shrinkage and complying with local building codes, including the use of water-resistive barriers or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.
1. Install water-resistive barriers and claddings to dry surfaces.
2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
3. Protect siding from other trades.

D. Minimum 20 gauge (33 mm) 3-5/8 inch (92 mm) C-Stud 16 inches maximum on center or 16 gauge (54 mm) 3-5/8 inches (92 mm) C-Stud 24 inches (610 mm) maximum on center metal framing complying with local building codes, including the use of water-resistive barriers and/or vapor barriers where required. Minimum 1-1/2 inches (38 mm) face and straight, true, of uniform dimensions and properly aligned.
1. Install water-resistive barriers and claddings to dry surfaces.

2. Repair any punctures or tears in the water-resistive barrier prior to the installation of the siding.
3. Protect siding from other trades.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Install a water-resistive barrier is required in accordance with local building code requirements.

D. The water-resistive barrier must be appropriately installed with penetration and junction flashing in accordance with local building code requirements.

E. Install Engineered for Climate HardieWrap weather barrier in accordance with local building code requirements.

F. Use HardieWrap Seam Tape and joint and laps.

G. Install and HardieWrap flashing, HardieWrap Flex Flashing.

3.3 INSTALLATION - HARDIEPLANK HZ10 LAP SIDING, ARTISAN HZ10 LAP SIDING, AND ARTISAN HZ10 LAP SIDING WITH LOCK JOINT SYSTEM

A. Install materials in strict accordance with manufacturer's installation instructions.

B. Starting: Install a minimum 1/4 inch (6 mm) thick lath starter strip at the bottom course of the wall. Apply planks horizontally with minimum 1-1/4 inches (32 mm) wide laps at the top. The bottom edge of the first plank overlaps the starter strip.

C. Allow minimum vertical clearance between the edge of siding and any other material in strict accordance with the manufacturer's installation instructions.

D. Align vertical joints of the planks over framing members.

E. Butt joints must not fall within 4 inches (102 mm) of a stud. Do not nail within 2 inches (51 mm) of the end of planks.

F. Maintain clearance between siding and adjacent finished grade.

G. Locate splices at least one stud cavity away from window and door openings.

H. For proper fastener selection and fastening schedules for various wind load requirements and framing options, refer to the Technical Data Sheet at www.aspyredesign.com.

I. Face nail to sheathing.

J. Locate splices at least 12 inches (305 mm) away from window and door openings.

**ATTACHMENT #6**

ENERLITES® fbox™

**General Specifications**

# Commercial Grade
# 2-Gang Pop-up Floor Box Assembly
## Model No.: 962301/962301-X-D

962301-C-D

962301-C

962301-S

962301-S-D

*X refers to color code.

**Description:**

The 2-Gang Pop-up Floor Box Assembly is used for carpet and wood floors. Pop-up covers provide easy access to power and internet access and can be snapped closed when not in use. Kit assembly includes a metal floor box, two decorator duplex T&WR receptacles or one decorator duplex T&WR receptacle and RJ45 ports and a cover.

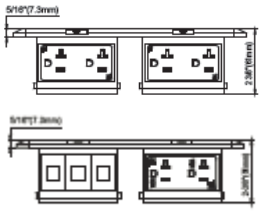
**Features:**

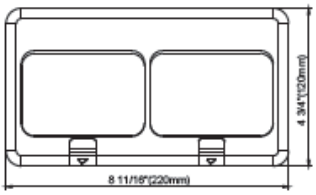
- Two 20A 125V Duplex Tamper & Weather Resistant Receptacles or one 20A 125V Duplex Tamper & Weather Resistant Receptacles and RJ45 ports.
- For use with carpet and wood floors. Also great for counter-top applications.
- Steel floor box must be flush or attached to sub-floor prior to final installation.
- Easy connection wiring accepts #12-10 AWG stranded and solid copper wire.

**Testing & Code Compliance:**

- Compliance with 2011 NEC Article 406.12 for tamper-resistant receptacles.
- Compliance with 2011 NEC Article 314.27 for floor boxes.
- All tamper resistant receptacles are UL listed.

**Dimensions:**





**Specifications:**

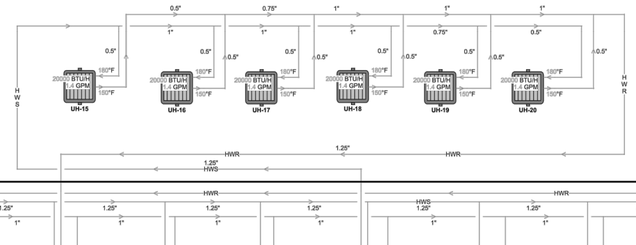
Cover Material .....Brass(C) or Nickel-Plated Brass (S)
Cover Type ..... Rectangular
Cover size.....8-11/16" (220mm) x 4-13/16" (122mm)
Receptacle Rating: ..... 20A 125VAC
Box:
Box Type .....FB-12 4"x7-15/16"x3"
Box Material..... Pre-Galvanized Steel
Knockout Size..... ½" and ¾"
Adjustable Height ..... Up to 1" depth
Warranty..... 2 Years

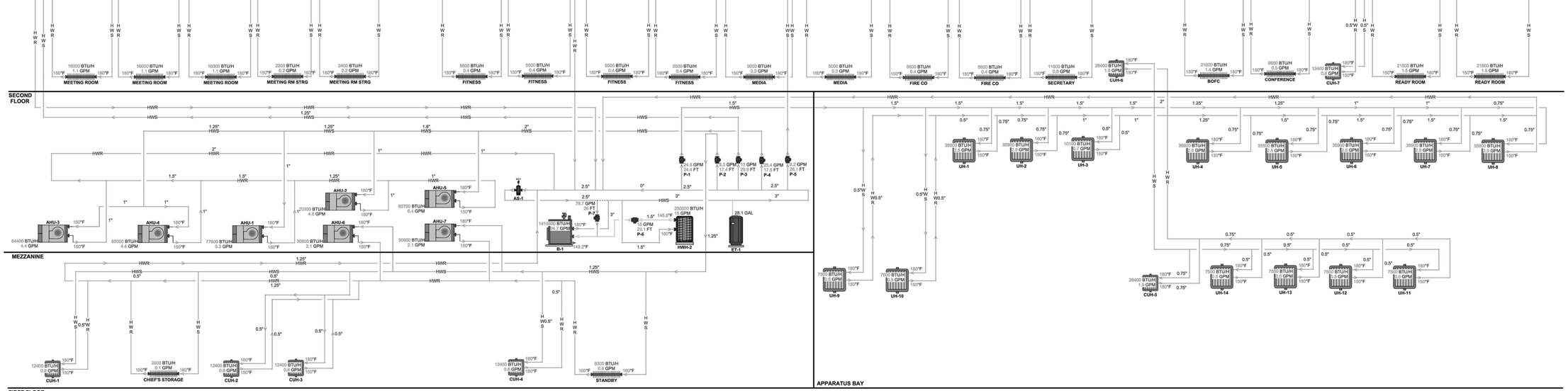
| Cat.No. | Box Type | Receptacle /Datacom | Cover Type | Finish |
|---|---|---|---|---|
| 962301-C | FB-12 4"(101.6mm) x 7-15/16" (201.6mm) x3"(76.2mm) | 63200-TWR-W (Decorator Duplex T&WR Receptacle) | Rectangular | Brass |
| 962301-S | | | | Nickel |
| 962301-C-D | | 63200-TWR-W (Decorator Duplex T&WR Receptacle and RJ45 ports) | | Brass |
| 962301-S-D | | | | Nickel |

Enerlites Inc.
www.enerlites.com
Phone: 949-756-0536 Fax: 949-756-0528 e-mail: sales@enerlites.com

Version 2.0
Date: 09/29/2015

# ATTACHMENT #7




DATE: ISSUE
12-08-2020 FOR BIDDING

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9 SELENA COURT
WALDEN, NY 12586
(845) 522-1243


PROPOSED NEW FACILITY
VALLEY COTTAGE FIRE DISTRICT
20 LAKE ROAD
VALLEY COTTAGE NY 10989

HYDRONIC RISER DIAGRAM

PROJECT #: 1901

DRAWN BY:

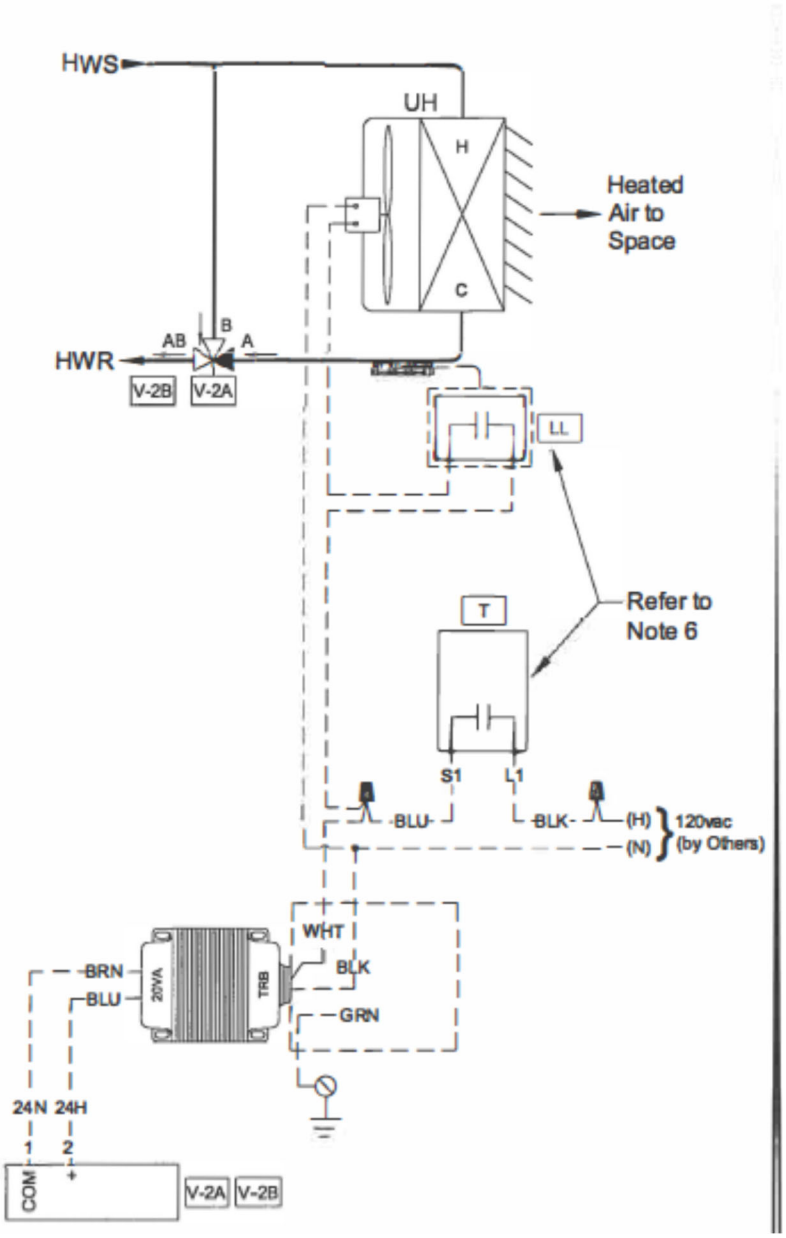
CAD FILE: 1901/P:/DD

DRAWING#: 18 OF 20

M-18

REVISED:

**ATTACHMENT #8**



MODINE

# STEAM/HOT WATER UNIT HEATERS

MODEL HSB/HC


MODEL V/VN


MODEL PT/PTN

MODEL HCH


MODEL GLW

1-150.16 • OCTOBER, 2019

## Table of Contents



***Refer to page 9 for information regarding the Breeze™ AccuSpec Sizing and Selection Program***

C US

BREEZE™ AccuSpec

***Canadian Registered heat exchangers CRN OH 9234.5C***
****Does not apply to V/ PT 952***

***As Modine Manufacturing Company has a continuous product improvement program, it reserves the right to change design and specifications without notice.***

## Application, Design, Construction Overview - All Units

***Wide Product Selection***

- Ratings as low as 11,300 Btu/hr for hot water to as high as 952,000 Btu/hr for steam, based on standard conditions.
- Horizontal, Vertical, and Power-Throw™ (high velocity horizontal air delivery) models offer maximum application flexibility.
- Ratings are shown as Btu/hr (based on 2 PSI steam, 60°F entering air conditions), eliminating the need to convert from EDR. This simplifies the matching of unit ratings to building heat loss.

***Application Flexibility***

- Horizontal and Power-Throw™ units are furnished with louvers for directional control of heated air. Vertical units are available with various louver, truncone, and cone-jet deflector options to accommodate many different air distribution patterns. See page 22 for more information.
- Units are available as low outlet temperature (LOT) models. LOT models have coils with fewer fins per inch to reduce the output rating. This is a benefit for applications where the steam pressure exceeds 30 PSI and mounting height is critical; the lower output results in outlet air temperatures that approximate that of standard coils at standard steam pressure. LOT models are also well suited for dirty environments where the increased fin spacing decreases the build-up of foreign particles. Finally, LOT models offer lower airside resistance resulting in greater allowable mounting heights and greater heat throw.
- Vertical and Power-Throw™ units are available with 90/10 cupro-nickel coils for high pressure/temperature applications, up to 250 PSI or 400°F.
- Side piping connections on the HC/HCH horizontal air delivery model allow for low clearance installations.
- Explosion-proof motors are available for use in hazardous areas. See page 8 for additional details.
- Design assures the correct relationship between air temperature, velocity, and air volume for greater heat throw; air is delivered to the floor at maximum mounting height, increasing comfort and reducing fuel costs.

***Ease of Installation/Maintenance = Reliability***

- Units are compact and lightweight, requiring fewer contractor hours to install.
- All units include an electrical junction box, either integral to the motor or mounted on the unit casing, to allow for easy electrical connections.
- All motors are totally enclosed. All single phase and explosion-proof motors include internal overload protection to protect the motor from insulation damaging heat, resulting in longer motor life.
- Different suspension options are available for most units including threaded rod or pipe hanger adapters.
- All units are component tested for proper motor function and the coils are leak tested under pressure to ensure proper function when the unit arrives at the jobsite.
- Fins on all units are vertical to limit build-up of foreign particles, prolonging periods between cleanings. Fins on vertical and Power-Throw™ units are exposed for easy cleaning.

***Blends with the Environment***

- Quiet operation is assured through the use of carefully selected motors, fans, and scientifically designed venturi fan shrouds.
- HSB/HC/HCHC models have squared off corners for a clean, defined appearance. Vertical and Power-Throw™ units have a pleasing circular symmetry.
- Casings are treated for corrosion resistance and finished with a neutral gray-green baked-on, electrostatically applied polyester powder coat paint finish.
- HCH Casings are treated for corrosion resistance and finished with a Hammertone Beige baked-on, electrostatically applied polyester powder coat paint finish.

## Unit Features - Horizontal Delivery Unit Heaters

Horizontal delivery unit heaters are the most popular of all types. These units are ideal for heating buildings with large open areas and low ceilings. They are used to counter heat loss along outside building walls, especially where windows are present.

***In addition to the features noted on page 2, features that enhance the popularity of the horizontal delivery unit heater are:***

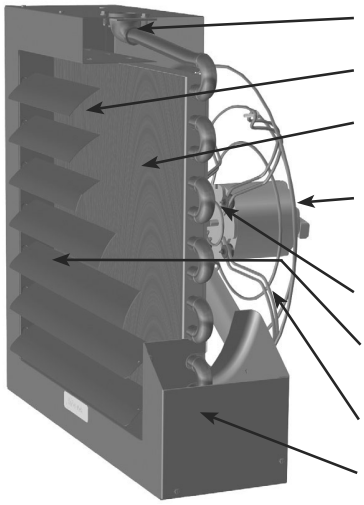
- HSB units have top and bottom supply and return connections. This permits the unit to be rotated 360° without piping changes.
- HC units have side supply and return connections. This permits the unit to be installed in low clearance areas.
- HCH high efficiency units have side supply and return connections. This permits the unit to be installed in low clearance areas.
- Units have a 2-piece casing for easy coil access.
- All models have tapped holes for suspension by threaded rod or optional pipe hanger adapter kit, except HSB 18 and HSB 24 which mount directly to and are supported by the supply and return piping.
- Serpentine copper tube coil design has high resistance to thermal shock, even under high steam pressures.
- Absence of coil headers eliminates potential leaks and increases coil face area without increasing overall size of unit.
- Coil designed for greater water carrying capacity with lower friction loss.

HSB MODEL
TOP/BOTTOM CONNECTIONS

HC MODEL
SIDE CONNECTIONS

HCH MODEL
SIDE CONNECTIONS

***Figure 4.1 - Unit Features***



***Connections*** – Female type permits direct connection of unit heater to the piping and eliminates the need for additional fittings.

***Vertical Fins*** – Less opportunity for dust and dirt to collect. Reduces cleaning. Fins die-formed for added strength and heat transfer.

***Coil*** – All air passes through coil. Heating is uniform. Design assures maximum control over air delivery and temperature of air leaving the heater. Aluminum fins die-formed for added strength – increased heat transfer. Fins mechanically bonded to serpentine copper tube.

***Motor*** – All motors are totally enclosed. Single phase and explosion-proof types include built in thermal overload protection. Selected and tested for operation on specific unit heater models. All motor wiring is terminated in an electrical junction box either supplied on the unit heater casing, or as an integral part of the motor.

***Fan*** – Lightweight. Blades accurately balanced and pitched to move air quietly and positively – with minimum power requirement.

***Deflector Blades*** – Adjustable horizontal air-deflector blades are standard. Vertical blades are also standard on models HC/HSB-258, HC/HSB-290 and HC/HSB-340 and are optional on other models. Both horizontal and vertical blades are illustrated.

***Safety Fan Guard*** – Standard equipment. Bolted to rear casing, steel rod fan guard completely surrounds the fan offering constant protection.

***Casings*** – Baked-on gray-green polyester or Hammertone Beige powdercoat paint is applied over rust-and corrosion-resistance-treated steel
for long life.

## Unit Features - Vertical Delivery Unit Heaters


Vertical delivery unit heaters are ideal for heating buildings with high ceilings or areas that require the heater to be mounted above obstructions such as craneways. Selection from a variety of heat throw patterns is made easy by choosing from four types of air deflectors. Heat throw patterns range from a high-velocity narrow jet to a gentle-velocity broad based cone of heated air.

***In addition to the features noted on page 2, features that enhance the popularity of the vertical delivery unit heater are:***

- Extended motor life with the use of the standard motor cooling cone. The cooling cone protects the motor from intense radiant and convection heat from the coil when the fan is not running. The cone also meters a controlled volume of ambient air over the motor to reduce motor temperature, when the motor is running.
- All models through V/VN 279 have tapped holes for threaded rod or optional pipe hanger adapter kit.
- All models V/VN 333 and larger have angle-iron mounting bracket with 5/8" diameter hanger holes.
- All vertical units are supplied with an outlet fan guard covering the opening in the bottom of the unit.

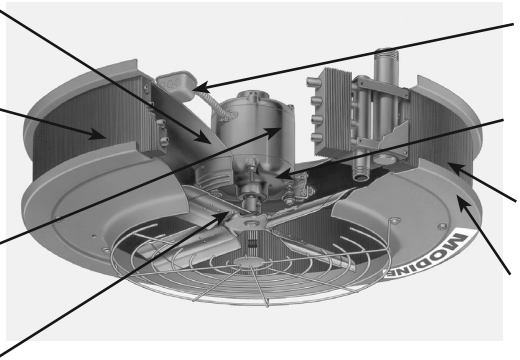
***Figure 5.1 - Unit Features***

***Motor-Cooling Cone*** – Shields motor from coil heat - prolongs life of insulation, windings, and lubricant. Prolongs motor life (V/VN models only).

***Coil*** – Aluminum fins firmly bonded to tubes for maximum heat transfer. Steam and water-carrying passages between extra-heavy steel pipe connections are copper for model V/PT and cupro-nickel for model VN/PTN.

***Motor*** – All motors are totally enclosed. Single phase and explosion-proof types include built in thermal overload protection. Selected and tested for operation on specific unit heater models.

***Fan*** – Accurately balanced to operate quietly and at lowest possible power cost.




***Junction Box*** – All motor wiring is terminated in an electrical junction box either supplied on the unit heater casing or as an integral part of the motor.

***Motor Easily Removable*** – Modine design permits motor to be removed through opening below the unit especially important where heaters are installed close to ceiling (V/VN models only).

***Vertical Fins*** – Less opportunity for dust and dirt to collect. Exposed for easy cleaning with air hose and brush.

***Casings*** – Baked-on, gray-green polyester powder coat paint applied over rust- and corrosion-resistance treated steel lasts longer.

## Unit Features - Power-Throw™ Horizontal Delivery Unit Heaters


Power-Throw™ horizontal delivery unit heaters are ideal for heating large buildings where a number of smaller units can be replaced by a few larger Power-Throw™ units. This results in a more economical installation. Their high velocity air delivery results in the greatest heat throw available.

Power-Throw™ units are also ideally suited for blanketing doors that frequently open.

Because of high velocity air delivery, care must be taken to avoid directing the air stream at building occupants.

***In addition to the features noted on page 2, features that enhance the popularity of the Power-Throw™ horizontal delivery unit heater are:***

- All models through PT/PTN 279 have hanger brackets with 5/8" diameter hanger holes for 3-point suspension.
- All models larger than PT/PTN 279 have hanger brackets with 5/8" diameter hanger holes for 2-point suspension and angle supports for 4-point suspension.
- Air distribution is controlled by a standard adjustable position horizontal louver assembly.
- The air stream can be concentrated into a high velocity jet or broadened to cover a greater area.
- Fan blades are properly balanced and pitched to move large volumes of high velocity air at relatively low sound levels.
- Refer to Figure 5.1 for features similar to the V/VN vertical models.

## *Unit Features - Low Water Temperature Greenhouse Heating Units*

The Modine model GLW units are specifically designed to heat greenhouses with low-temperature water. They can be successfully used in applications where waste or reject heat from steam-electric power plants, refineries, pumping stations, distilleries, and other industrial or processing plants can be utilized for heating. With the ever-increasing cost of fossil fuel, utilizing reject heat as a heat source for greenhouses is a sensible solution with the model GLW.

***Standard features include:***

- Hot water coil with 1/2" O.D. copper tubes, aluminum fins, and 1-1/2" MPT copper connections.
- Maximum operating pressure is 300 PSI, maximum operating water temperature is 180°F
- Frame, enclosure panels, and 24" polytube transitions are galvanized steel for corrosion resistance in humid environments.
- 1/2 HP, totally enclosed motors (1 for GLW330S, 2 for GLW660S), available for single phase or three phase voltages.
- High airflow, 3850CFM for GLW330S and 7700CFM for GLW660S, based on 150 feet of polytube duct.

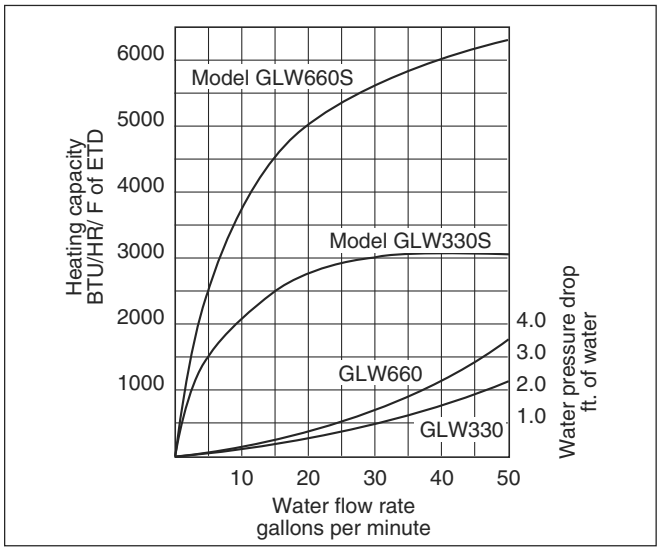
### *Unit Sizing*

Unit performance is based on the flow rate and the temperature of the water relative to the ambient air temperature. Refer to Figure 6.1 and the following example for determining performance.

***Example:***
Determine heating capacity in BTU/hr for model GLW660S at 20GPM, 100°F entering water, and 70°F entering air.

1. Figure 6.1 shows output in terms of BTU/hr per °F of ETD (Entering Temperature Difference). ETD is the difference between the entering water temperature and the entering air temperature. For this example, ETD = 100°F – 70°F = 30°F.
2. From Figure 6.1, at 20GPM, the BTU/hr per °F of ETD for the GLW660S is 5000.
3. The heating capacity = 5000 x 30 = 150,000 BTU/hr.
4. The water temperature drop = (heating capacity)/(500 x GPM) = 150,000/(500 x 20) = 15°F.
5. The water pressure drop from the curve is 0.7 Ft. of water.

***Figure 6.1 - Model GLW Performance Curves***




***Dimensions and Specifications - Model GLW660S, GLW330S*** (All dimensions in inches)

***Figure 6.2 - Top View***

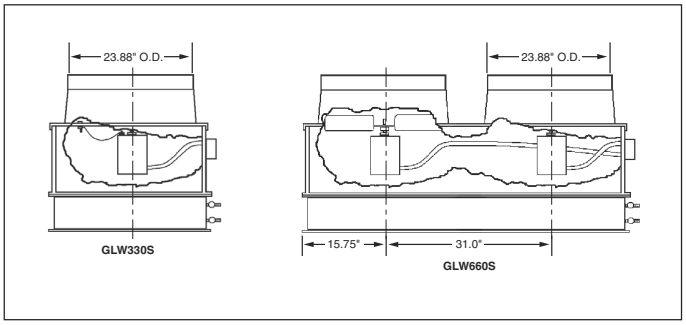
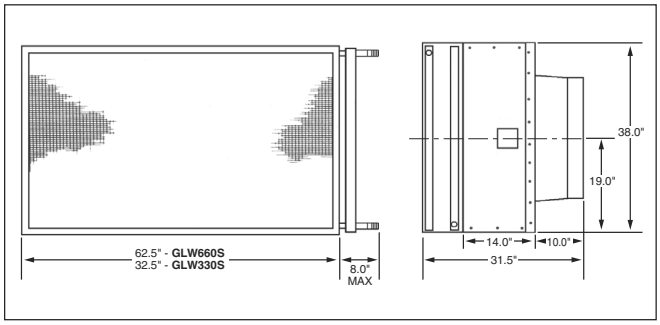



***Figure 6.3 - Discharge and Side Views***




Weight: GLW330S=200 lbs., GLW660S=380 lbs.

Note: Information on this page applies only to Model GLW units. Information contained in Catalog that is not on this page does not apply to Model GLW units.

## Options and Accessories

### Table 7.1
### Factory Mounted Options

| Factory Mounted Option | Description |
|---|---|
| Fingerproof Fan Guard | Standard fan guard may be factory replaced with fingerproof fan guard. For HSB/HC/HCH units only. Not available for units with explosion-proof motors. |

### Table 7.2
### Field Installed Accessories for Horizontal Models

| Field Installed Accessories | Description |
|---|---|
| Vertical Deflector Blades | Blades used to deflect airflow in directions left or right of unit heater. Used in addition to standard horizontal deflector blades. Vertical deflector blades are standard on HSB/HC models 258 through 340. |
| Solid State Speed Control | Not available for Power-Throw™ models.<br>Allows for remote control of airflow volume by controlling fan speed. Available only on HSB/HC models 18 through 108 with Power Code 01. |
| Discharge Hoods | Available for HCH units.<br>30°, 60°, and 90° downward deflector hoods |

### Table 7.3
### Field Installed Accessories for Vertical Models

| Field Installed Accessories | Description |
|---|---|
| Cone-Jet | The cone-jet allows the discharge air stream to be adjusted from a concentrated high velocity jet to a broadened air stream to cover a larger area. See page 22 for additional information. |
| Truncone | The truncone causes a broad discharge air stream covering a larger area than possible with the cone-jet. See page 22 for additional information. |
| One Way Louver | The one-way louver allows the discharge air stream to be adjusted in one direction. See page 22 for additional information. |
| Two Way Louver | The two-way louver allows the discharge air stream to be adjusted in two directions. See page 22 for additional information. |

### Table 7.4
### Field Installed General Accessories

| Field Installed Accessories | Description |
|---|---|
| Thermostat | Honeywell T4051A1003, 50-80°F range, 16A @ 115V, 8A @ 230V |
| Thermostat | Honeywell T451A3005, 44-86°F range, 9.8A @ 115V, 4.9A @ 230V |
| Thermostat | Johnson Controls T22BBC-1, 40-90°F range, Auto/Off/Fan switch, 10A @ 115V, 4.9A @ 230V |
| Explosion-proof Thermostat | Honeywell T6051B1006, 46-84° range, 10.2A @ 115V, 6.5A @ 230V |
| Aquastat | Aquastat, 10 amps @ 115V; 6 amps @ 230V; 100°-240°F range, SPDT, 10°F Diff. Fixed, Johnson A19DAC-1 |
| Thermostat Guard | Clear plastic locking guard with tumbler lock and two keys. Available only on thermostat Item Codes 23124, 23125 and 90348. |
| Pipe Hanger Adapter Kit | Allows unit heater to be suspended by threaded pipe instead of threaded rod. Two kits are required for V and VN models. Kits are not available for HSB-18 and HSB-24 models or Power-Throw™ models. |
| Manual Starter | Toggle switch starter with thermal overload protection for remote on/off control of unit fan operation. Available for power codes 01 and 02 only. |
| Step-Down Transformer | For supply voltages of 208V/60Hz/1ph and all non-explosion-proof 3 phase voltages of 208, 230, 460 and 575, certain Model Numbers require that a 115V/60Hz/1 phase Power Code 01 unit heater be used with a shipped loose accessory transformer. See page 23 for additional information. |

## Power Code Descriptions & Control Sequence

***Table 8.1***
***Power Code Descriptions***

| Power Code | Supply Voltage | Motor Enclosure | Motor Type | Thermal Overload Protection | Motor Starter |
|---|---|---|---|---|---|
| 01 | 115/60/1 | Totally Enclosed | ① | Yes | N/A |
| 02 | 230/60/1 | Totally Enclosed | ① | Yes | N/A |
| 04 | 200-208/60/3 | Totally Enclosed | Polyphase Induction | No | Field Supplied/Installed |
| 05 | 230/460/60/3 | Totally Enclosed | Polyphase Induction | No | Field Supplied/Installed |
| 06 | 115/60/1 | Explosion-proof ② | Split Phase | Yes | N/A |
| 09 | 230/460/60/3 | Explosion-proof ② | Polyphase Induction | Yes | Field Supplied/Installed |
| 10 | 575/60/3 | Totally Enclosed | Polyphase Induction | No | Field Supplied/Installed |

① Motors are shaded pole for models HSB/HC 18-33 and V/VN 42-95. Models HSB/HC 47-340 and V/VN 139-333 are permanent split capacitor.
② Explosion-proof motors are suitable for Class I, Group D, Class II, Groups F and G, and Class III, Division 1 and 2 environments. Canadian Standard Association (CSA) requirements state that the explosion-proof units may not be used with a fluid temperature in excess of 329°F or pressures greater than 87 psig and still maintain their T3B temperature rating.
Class I, Group D motors are for operations in areas containing gasoline, petroleum, naphtha, benzene, butane, propane, alcohol, acetone, lacquer solvent or natural gas.
Class II, Group F motors are for operations in areas containing carbon black, coal or coke dust.
Class II, Group G motors are for operations in areas containing flour, starch or grain dust.
Class III motors are for operations in areas containing easily ignitable fibers and flyings.

### *Control Sequence*

The following control sequence descriptions are typical for steam/hot water unit heaters:

***Intermittent Fan Operation - Hot Coil***
When a room thermostat calls for heat, the motor is energized. Hot water or steam is continuously supplied to the unit heater, even when the motor is not running. When the thermostat is satisfied, the motor is de-energized.

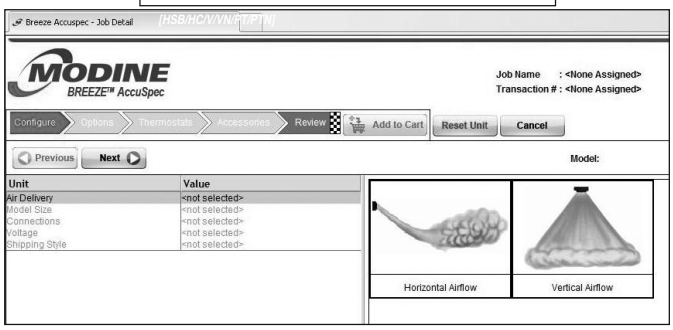
***Continuous Fan Operation - Intermittent Hot/Cold Coil***
When a room thermostat calls for heat, a valve is opened, allowing steam or hot water to enter the unit heater. When the thermostat is satisfied, the valve is closed. The fan runs continuously.

***Intermittent Fan Operation - Intermittent Hot/Cold Coil***
When a room thermostat calls for heat, the motor is energized. At the same time, a valve is opened allowing steam or hot water to enter the unit heater. An aquastat may be attached to the supply or return piping to prevent fan operation until the coil is adequately heated to avoid cold air delivery. When the thermostat is satisfied, the valve closes and the motor is de-energized.

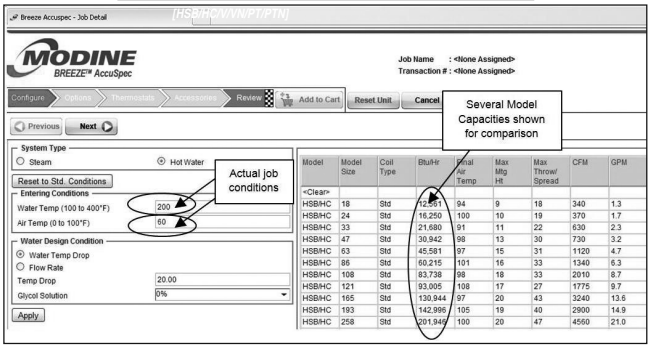
## Modine Breeze™ AccuSpec Sizing and Selection Program

The Modine Breeze AccuSpec is the fastest way to generate performance data based on actual job conditions. The Breeze AccuSpec program is a web-based sizing and selection program. The program provides a series on step-by-step questions that allow for the easy configuration of Modine products. After a model has been configured, the program can generate Submittal Schedules, Submittal Data including performance and dimensional drawings, and Specifications.

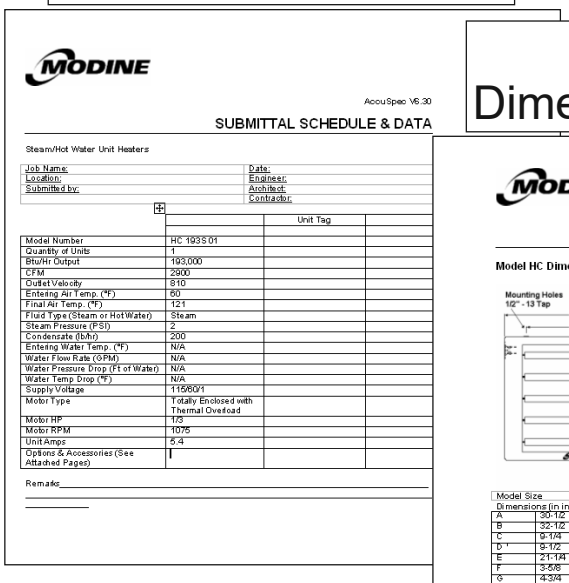
### Pictures for Visual Selection



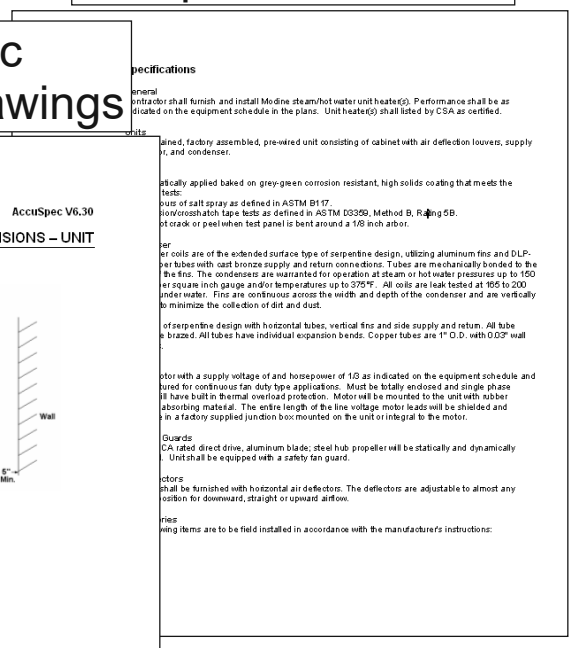

### Capacities at Job Conditions



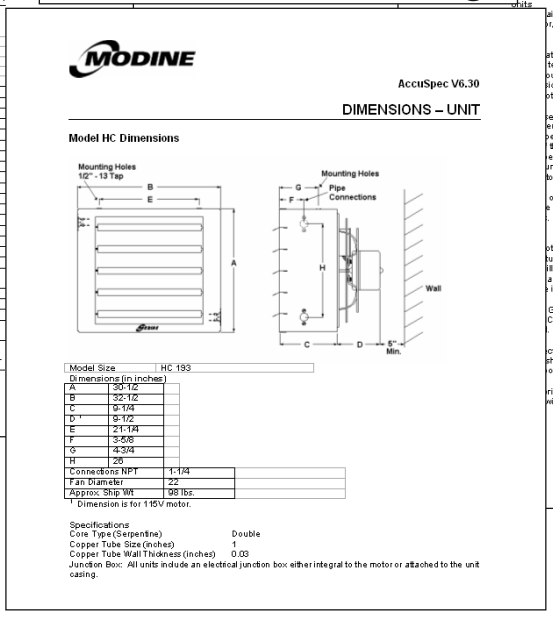

### Submittal Schedules




### Job Specific Specifications




### Unit Specific Dimensional Drawings




For access to the Breeze AccuSpec program, contact your local Modine sales representative.

## Steam Conversion Tables

Table 10.1 and the formulas below are used to determine the heating capacity (Btu/hr) of a unit heater at a steam pressure and/or entering air temperature other than standard conditions of 2 lb. steam, 60°F entering air temperature.

***Table 10.1***
***Steam Heating Capacity Conversion Factors***

| Unit Heater Type | Steam Pressure (PSIG) | Entering Air Temperature (°F) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | -10 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Horizontal Delivery | 0 | 1.54 | 1.45 | 1.37 | 1.27 | 1.19 | 1.11 | 1.03 | 0.96 | 0.88 | 0.81 | 0.74 | 0.67 |
| | 2 | 1.59 | 1.50 | 1.41 | 1.32 | 1.24 | 1.16 | 1.08 | 1.00 | 0.93 | 0.85 | 0.78 | 0.71 |
| | 5 | 1.64 | 1.55 | 1.46 | 1.37 | 1.29 | 1.21 | 1.13 | 1.05 | 0.97 | 0.90 | 0.83 | 0.76 |
| | 10 | 1.73 | 1.64 | 1.55 | 1.46 | 1.38 | 1.29 | 1.21 | 1.13 | 1.06 | 0.98 | 0.91 | 0.84 |
| | 15 | 1.80 | 1.71 | 1.61 | 1.53 | 1.44 | 1.34 | 1.28 | 1.19 | 1.12 | 1.04 | 0.97 | 0.90 |
| | 20 | 1.86 | 1.77 | 1.68 | 1.58 | 1.50 | 1.42 | 1.33 | 1.25 | 1.17 | 1.10 | 1.02 | 0.95 |
| | 30 | 1.97 | 1.87 | 1.78 | 1.68 | 1.60 | 1.51 | 1.43 | 1.35 | 1.27 | 1.19 | 1.12 | 1.04 |
| | 40 | 2.06 | 1.96 | 1.86 | 1.77 | 1.68 | 1.60 | 1.51 | 1.43 | 1.35 | 1.27 | 1.19 | 1.12 |
| | 50 | 2.13 | 2.04 | 1.94 | 1.85 | 1.76 | 1.67 | 1.58 | 1.50 | 1.42 | 1.34 | 1.26 | 1.19 |
| | 60 | 2.20 | 2.09 | 2.00 | 1.90 | 1.81 | 1.73 | 1.64 | 1.56 | 1.47 | 1.39 | 1.31 | 1.24 |
| | 70 | 2.26 | 2.16 | 2.06 | 1.96 | 1.87 | 1.78 | 1.70 | 1.61 | 1.53 | 1.45 | 1.37 | 1.29 |
| | 75 | 2.28 | 2.18 | 2 09 | 1.99 | 1.90 | 1.81 | 1.72 | 1.64 | 1.55 | 1.47 | 1.40 | 1.32 |
| | 80 | 2.31 | 2.21 | 2.11 | 2.02 | 1.93 | 1.84 | 1.75 | 1.66 | 1.58 | 1.50 | 1.42 | 1.34 |
| | 90 | 2.36 | 2.26 | 2.16 | 2.06 | 1.97 | 1.88 | 1.79 | 1.71 | 1.62 | 1.54 | 1.46 | 1.38 |
| | 100 | 2.41 | 2.31 | 2.20 | 2.11 | 2.02 | 1.93 | 1.84 | 1.75 | 1.66 | 1.58 | 1.50 | 1.42 |
| | 125 | 2.51 | 2.41 | 2.31 | 2.21 | 2.11 | 2.02 | 1.93 | 1.84 | 1.76 | 1.68 | 1.59 | 1.51 |
| | 150 | 2.60 | 2.50 | 2.40 | 2.30 | 2.20 | 2.11 | 2.02 | 1.93 | 1.84 | 1.76 | 1.67 | 1.59 |
| Vertical Delivery and Power-Throw | 0 | 1.49 | 1.41 | 1.33 | 1.25 | 1.18 | 1.11 | 1.03 | 0.96 | 0.90 | 0.83 | 0.76 | 0.69 |
| | 2 | 1.52 | 1.45 | 1.37 | 1.29 | 1.22 | 1.15 | 1.07 | 1.00 | 0.93 | 0.86 | 0.80 | 0.73 |
| | 5 | 1.58 | 1.50 | 1.42 | 1.34 | 1.27 | 1.20 | 1.12 | 1.05 | 0.98 | 0.91 | 0.85 | 0.78 |
| | 10 | 1.64 | 1.57 | 1.49 | 1.41 | 1.34 | 1.27 | 1.19 | 1.12 | 1.05 | 0.98 | 0.91 | 0.85 |
| | 15 | 1.70 | 1.62 | 1.55 | 1.47 | 1.40 | 1.32 | 1.25 | 1.18 | 1.11 | 1.04 | 0.97 | 0.90 |
| | 20 | 1.75 | 1.67 | 1.60 | 1.52 | 1.45 | 1.37 | 1.30 | 1.23 | 1.16 | 1.09 | 1.02 | 0.96 |
| | 30 | 1.83 | 1.75 | 1.68 | 1.61 | 1.53 | 1.46 | 1.39 | 1.32 | 1.25 | 1.18 | 1.11 | 1.04 |
| | 40 | 1.90 | 1.82 | 1.75 | 1.68 | 1.61 | 1.53 | 1.46 | 1.39 | 1.32 | 1.25 | 1.18 | 1.11 |
| | 50 | 1.96 | 1.87 | 1.81 | 1.74 | 1.67 | 1.59 | 1.52 | 1.45 | 1.38 | 1.31 | 1.24 | 1.17 |
| | 60 | 2.02 | 1.94 | 1.87 | 1.79 | 1.72 | 1.64 | 1.57 | 1.50 | 1.43 | 1.36 | 1.29 | 1.22 |
| | 70 | 2.07 | 1.99 | 1.92 | 1.84 | 1.76 | 1.69 | 1.62 | 1.55 | 1.47 | 1.40 | 1.33 | 1.27 |
| | 75 | 2.10 | 2.02 | 1.94 | 1.86 | 1.79 | 1.71 | 1.64 | 1.57 | 1.49 | 1.42 | 1.36 | 1.29 |
| | 80 | 2.11 | 2.04 | 1.96 | 1.88 | 1.80 | 1.73 | 1.66 | 1.59 | 1.51 | 1.44 | 1.38 | 1.31 |
| | 90 | 2.15 | 2.08 | 2.00 | 1.92 | 1.84 | 1.77 | 1.69 | 1.62 | 1.55 | 1.48 | 1.41 | 1.34 |
| | 100 | 2.19 | 2.11 | 2.03 | 1.95 | 1.88 | 1.80 | 1.73 | 1.66 | 1.59 | 1.52 | 1.45 | 1.38 |
| | 125 | 2.27 | 2.19 | 2.11 | 1.99 | 1.91 | 1.88 | 1.81 | 1.74 | 1.67 | 1.60 | 1.53 | 1.46 |
| | 150 | 2.34 | 2.26 | 2.18 | 2.10 | 2.03 | 1.95 | 1.88 | 1.81 | 1.74 | 1.67 | 1.60 | 1.53 |
| | 175 | 2.40 | 2.32 | 2.24 | 2.16 | 2.09 | 2.01 | 1.94 | 1.87 | 1.80 | 1.73 | 1.66 | 1.59 |
| | 200 | 2.45 | 2.37 | 2.29 | 2.22 | 2.14 | 2.07 | 1.99 | 1.92 | 1.85 | 1.78 | 1.71 | 1.64 |
| | 225 | 2.50 | 2.42 | 2.34 | 2.26 | 2.19 | 2.12 | 2.04 | 1.97 | 1.90 | 1.83 | 1.76 | 1.69 |
| | 250 | 2.54 | 2.46 | 2.38 | 2.31 | 2.23 | 2.16 | 2.09 | 2.01 | 1.94 | 1.87 | 1.80 | 1.73 |

Applicable formulas (examples on page 15):

To find actual unit heater capacity when operated at non-standard (actual) conditions:

***$Btu_A = Btu_S$ x Heating Capacity Factor***

To select a heater capacity based on standard conditions to meet a heating capacity at non-standard (actual) conditions:

***$Btu_S = Btu_A \div$ Heating Capacity Factor***

Where:
$Btu_S$ = Capacity at standard conditions (2 lb. steam, 60°F entering air temperature) from Tables 13.1 through 14.2
$Btu_A$ = Capacity at non-standard (actual) conditions

## Steam Conversion Tables

Table 11.1 and the formulas below are used to determine the air temperature rise of a unit heater at a steam pressure and/or entering air temperature other than standard conditions of 2 lb. steam, 60°F entering air temperature.

***Table 11.1***
***Air Temperature Rise Conversion Factors***

| Unit Heater Type | Steam Pressure (PSIG) | Entering Air Temperature (°F) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | -10 | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| Horizontal Delivery | 0 | 1.33 | 1.28 | 1.24 | 1.17 | 1.12 | 1.07 | 1.01 | 0.96 | 0.90 | 0.84 | 0.78 | 0.72 |
| | 2 | 1.38 | 1.33 | 1.27 | 1.22 | 1.17 | 1.11 | 1.06 | 1.00 | 0.94 | 0.88 | 0.83 | 0.76 |
| | 5 | 1.43 | 1.38 | 1.33 | 1.27 | 1.21 | 1.16 | 1.11 | 1.05 | 1.00 | 0.93 | 0.88 | 0.82 |
| | 10 | 1.50 | 1.45 | 1.40 | 1.35 | 1.29 | 1.24 | 1.19 | 1.13 | 1.07 | 1.02 | 0.95 | 0.90 |
| | 15 | 1.56 | 1.51 | 1.46 | 1.42 | 1.36 | 1.31 | 1.24 | 1.19 | 1.14 | 1.08 | 1.02 | 0.97 |
| | 20 | 1.61 | 1.56 | 1.52 | 1.46 | 1.41 | 1.36 | 1.30 | 1.25 | 1.19 | 1.14 | 1.08 | 1.02 |
| | 30 | 1.70 | 1.65 | 1.61 | 1.55 | 1.51 | 1.46 | 1.40 | 1.35 | 1.29 | 1.24 | 1.18 | 1.12 |
| | 40 | 1.78 | 1.73 | 1.68 | 1.62 | 1.58 | 1.54 | 1.48 | 1.43 | 1.38 | 1.32 | 1.26 | 1.21 |
| | 50 | 1.84 | 1.79 | 1.74 | 1.69 | 1.65 | 1.60 | 1.55 | 1.50 | 1.45 | 1.39 | 1.33 | 1.28 |
| | 60 | 1.91 | 1.86 | 1.81 | 1.75 | 1.71 | 1.66 | 1.61 | 1.56 | 1.50 | 1.45 | 1.40 | 1.33 |
| | 70 | 1.95 | 1.91 | 1.86 | 1.81 | 1.76 | 1.71 | 1.66 | 1.61 | 1.56 | 1.51 | 1.45 | 1.39 |
| | 75 | 1.97 | 1.93 | 1.89 | 1.84 | 1.79 | 1.74 | 1.69 | 1.64 | 1.58 | 1.53 | 1.47 | 1.42 |
| | 80 | 2.00 | 1.95 | 1.91 | 1.86 | 1.82 | 1.76 | 1.72 | 1.66 | 1.61 | 1.56 | 1.49 | 1.44 |
| | 90 | 2.04 | 2.00 | 1.95 | 1.90 | 1.86 | 1.81 | 1.75 | 1.70 | 1.65 | 1.60 | 1.54 | 1.49 |
| | 100 | 2.08 | 2.04 | 1.99 | 1.95 | 1.89 | 1.85 | 1.79 | 1.75 | 1.69 | 1.64 | 1.59 | 1.53 |
| | 125 | 2.17 | 2.13 | 2.09 | 2.04 | 1.99 | 1.94 | 1.89 | 1.84 | 1.79 | 1.74 | 1.68 | 1.63 |
| | 150 | 2.25 | 2.21 | 2.17 | 2.12 | 2.07 | 2.03 | 1.98 | 1.93 | 1.87 | 1.83 | 1.77 | 1.71 |
| Vertical Delivery and Power-Throw | 0 | 1.36 | 1.31 | 1.25 | 1.19 | 1.13 | 1.08 | 1.02 | 0.96 | 0.90 | 0.84 | 0.78 | 0.72 |
| | 2 | 1.41 | 1.35 | 1.29 | 1.24 | 1.18 | 1.12 | 1.06 | 1.00 | 0.94 | 0.88 | 0.82 | 0.76 |
| | 5 | 1.46 | 1.40 | 1.35 | 1.29 | 1.23 | 1.17 | 1.12 | 1.06 | 1.00 | 0.94 | 0.88 | 0.82 |
| | 10 | 1.54 | 1.48 | 1.43 | 1.37 | 1.31 | 1.25 | 1.20 | 1.14 | 1.08 | 1.02 | 0.96 | 0.89 |
| | 15 | 1.61 | 1.55 | 1.49 | 1.44 | 1.38 | 1.32 | 1.26 | 1.20 | 1.14 | 1.09 | 1.02 | 0.97 |
| | 20 | 1.67 | 1.61 | 1.55 | 1.50 | 1.44 | 1.38 | 1.32 | 1.26 | 1.20 | 1.15 | 1.08 | 1.02 |
| | 30 | 1.77 | 1.71 | 1.65 | 1.60 | 1.54 | 1.48 | 1.42 | 1.36 | 1.30 | 1.25 | 1.18 | 1.12 |
| | 40 | 1.85 | 1.79 | 1.74 | 1.68 | 1.62 | 1.56 | 1.51 | 1.45 | 1.39 | 1.33 | 1.27 | 1.21 |
| | 50 | 1.92 | 1.86 | 1.81 | 1.75 | 1.69 | 1.64 | 1.58 | 1.52 | 1.46 | 1.40 | 1.34 | 1.28 |
| | 60 | 1.99 | 1.93 | 1.88 | 1.82 | 1.76 | 1.70 | 1.65 | 1.58 | 1.53 | 1.47 | 1.41 | 1.35 |
| | 70 | 2.05 | 1.99 | 1.94 | 1.88 | 1.82 | 1.76 | 1.70 | 1.65 | 1.59 | 1.53 | 1.47 | 1.41 |
| | 75 | 2.08 | 2.02 | 1.96 | 1.91 | 1.85 | 1.79 | 1.73 | 1.67 | 1.62 | 1.56 | 1.50 | 1.43 |
| | 80 | 2.10 | 2.04 | 1.99 | 1.93 | 1.87 | 1.81 | 1.75 | 1.70 | 1.64 | 1.58 | 1.52 | 1.46 |
| | 90 | 2.15 | 2.09 | 2.04 | 2.00 | 1.92 | 1.86 | 1.80 | 1.74 | 1.69 | 1.63 | 1.57 | 1.51 |
| | 100 | 2.19 | 2.14 | 2.08 | 2.02 | 1.97 | 1.91 | 1.85 | 1.79 | 1.73 | 1.67 | 1.61 | 1.55 |
| | 125 | 2.29 | 2.24 | 2.18 | 2.12 | 2.07 | 2.01 | 1.95 | 1.89 | 1.83 | 1.77 | 1.71 | 1.65 |
| | 150 | 2.39 | 2.33 | 2.27 | 2.22 | 2.16 | 2.10 | 2.04 | 1.99 | 1.93 | 1.87 | 1.81 | 1.75 |
| | 175 | 2.46 | 2.41 | 2.35 | 2.29 | 2.24 | 2.18 | 2.12 | 2.06 | 2.00 | 1.94 | 1.88 | 1.82 |
| | 200 | 2.54 | 2.48 | 2.42 | 2.37 | 2.31 | 2.25 | 2.19 | 2.13 | 2.07 | 2.02 | 1.96 | 1.89 |
| | 225 | 2.60 | 2.54 | 2.49 | 2.43 | 2.37 | 2.32 | 2.26 | 2.20 | 2.14 | 2.08 | 2.02 | 1.96 |
| | 250 | 2.66 | 2.60 | 2.55 | 2.49 | 2.43 | 2.38 | 2.32 | 2.26 | 2.20 | 2.14 | 2.08 | 2.02 |

Applicable formulas (examples on page 15):

To find actual air temperature rise of unit heater when operated at non-standard (actual) conditions:

$$ATR_A = (FAT_S - EAT_S) \times \text{Air Temperature Rise Factor}$$

To find actual final air temperature of unit heater when operated at non-standard (actual) conditions:

$$FAT_A = EAT_A + ATR_A$$

Where:

$EAT_S$ = Standard conditions entering air temperature (60°F)
$EAT_A$ = Non-standard (actual) entering air temperature
$FAT_S$ = Final air temperature at standard conditions from Tables 13.1 through 14.2
$FAT_A$ = Final air temperature at non-standard (actual) conditions
$ATR_A$ = Air temperature rise at non-standard (actual) conditions

## Steam Conversion Tables

Table 12.1 is used to determine how steam pressures other than 2 lb. affect mounting height.

***Table 12.1***
***Steam Unit Heater Mounting Height Correction Factors*** ①②

| | Steam Pressure, PSIG | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | 5 | 10 | 15 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 125 | 150 | 175 | 200 | 225 | 250 |
| Correction Factor | 1.00 | 0.97 | 0.94 | 0.92 | 0.89 | 0.86 | 0.84 | 0.82 | 0.80 | 0.79 | 0.77 | 0.76 | 0.76 | 0.74 | 0.72 | 0.71 | 0.70 | 0.69 | 0.68 |

① Factors are for use with entering air temperatures that range from 50° to 70°F.
② While all units are capable of operation on steam pressures greater than 30 lb., low outlet temperature models are ideally suited for steam pressures above 30 lb. when mounting height is critical.

Applicable formula (examples on page 15):

***Max. Mounting Height$_A$ = Max. Mounting Height$_S$ x Correction Factor***

Where:
Max. Mounting Height$_A$ = Maximum mounting height at actual conditions
Max. Mounting Height$_S$ = Maximum mounting height at standard conditions

Table 12.2 is used to determine the rate of condensate production at steam pressures other than 2 lb.

***Table 12.2***
***Properties of Steam***

| Gauge Pressure (PSIG) | Temp (°F) | Latent Heat (Btu/lb.) | Gauge Pressure (PSIG) | Temp (°F) | Latent Heat (Btu/lb.) | Gauge Pressure (PSIG) | Temp (°F) | Latent Heat (Btu/lb.) | Gauge Pressure (PSIG) | Temp (°F) | Latent Heat (Btu/lb.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 212.0 | 970.3 | 34 | 279.4 | 924.7 | 70 | 316.0 | 897.3 | 109 | 343.6 | 875.4 |
| 2 | 218.5 | 966.2 | 36 | 281.9 | 922.9 | 72 | 317.7 | 896.0 | 112 | 345.4 | 873.9 |
| 4 | 224.4 | 962.4 | 38 | 284.3 | 921.1 | 74 | 319.3 | 894.8 | 115 | 347.2 | 872.5 |
| 5 | 227.2 | 960.6 | 40 | 286.7 | 919.3 | 76 | 320.9 | 893.5 | 118 | 348.9 | 871.0 |
| 6 | 229.8 | 958.8 | 42 | 289.0 | 917.6 | 78 | 322.4 | 892.3 | 121 | 350.7 | 869.6 |
| 8 | 234.8 | 955.6 | 44 | 291.3 | 915.9 | 80 | 323.9 | 891.1 | 124 | 352.4 | 868.2 |
| 10 | 239.4 | 952.5 | 46 | 293.5 | 914.3 | 82 | 325.4 | 889.9 | 125 | 352.9 | 867.8 |
| 12 | 243.7 | 949.6 | 48 | 295.6 | 912.7 | 84 | 326.9 | 888.8 | 127 | 354.0 | 866.9 |
| 14 | 247.8 | 946.8 | 50 | 297.7 | 911.2 | 86 | 328.4 | 887.6 | 130 | 355.7 | 865.5 |
| 16 | 251.6 | 944.2 | 52 | 299.7 | 909.7 | 88 | 329.8 | 886.5 | 133 | 357.3 | 864.1 |
| 18 | 255.3 | 941.7 | 54 | 301.7 | 908.2 | 90 | 331.2 | 885.4 | 136 | 358.9 | 862.9 |
| 20 | 258.8 | 939.3 | 56 | 303.6 | 906.7 | 92 | 332.5 | 884.3 | 139 | 360.4 | 861.5 |
| 22 | 262.1 | 936.9 | 58 | 305.5 | 905.3 | 94 | 333.9 | 883.2 | 142 | 362.0 | 860.3 |
| 24 | 265.3 | 934.7 | 60 | 307.3 | 903.9 | 96 | 335.2 | 882.1 | 145 | 363.5 | 859.0 |
| 26 | 268.3 | 932.5 | 62 | 309.1 | 902.5 | 98 | 336.6 | 881.1 | 150 | 365.9 | 856.9 |
| 28 | 271.3 | 930.5 | 64 | 310.9 | 901.2 | 100 | 337.9 | 880.0 | 175 | 377.4 | 846.8 |
| 30 | 274.1 | 928.5 | 66 | 312.6 | 899.9 | 103 | 339.8 | 878.5 | 200 | 387.9 | 837.2 |
| 32 | 276.8 | 926.6 | 68 | 314.4 | 898.6 | 106 | 341.7 | 876.9 | 225 | 397.3 | 828.5 |
| - | - | - | - | - | - | - | - | - | 250 | 406.1 | 820.0 |

Applicable formula (examples on page 15):

***Condensate rate = Btu$_A$ ÷ Latent Heat of Steam***

Where:
Btu$_A$ = Capacity at actual operating conditions

## Steam Performance Data - Standard Models

### Table 13.1 - Performance Data for Standard Units at Standard Conditions of 2 lb. Steam and 60°F Entering Air High Motor Speed

| Type | Model No. | Btu/hr | Sq. Ft. EDR | Air Data | | | | | | Motor Data | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Maximum Mounting Height (ft.) ① | Heat Throw or Spread @ Max. Height ① | CFM ② | Outlet Velocity (Fpm) | Final Air Temp. (°F) | Condensate lb/hr | Hp | Approx. RPM |
| Horizontal Delivery | HSB/HC 18 | 18,000 | 75 | 8 | 17 | 340 | 625 | 107 | 19 | 1/60 | 1,550 |
| | HSB/HC 24 | 24,000 | 100 | 9 | 18 | 370 | 695 | 119 | 25 | 1/25 | 1,550 |
| | HSB/HC 33 | 33,000 | 138 | 10 | 21 | 630 | 690 | 108 | 34 | 1/25 | 1,550 |
| | HSB/HC 47 | 47,000 | 196 | 12 | 28 | 730 | 810 | 119 | 49 | 1/12 | 1,550 |
| | HSB/HC 63 | 63,000 | 263 | 14 | 29 | 1,120 | 690 | 111 | 65 | 1/12 | 1,550 |
| | HSB/HC 86 | 86,000 | 358 | 15 | 31 | 1,340 | 835 | 118 | 89 | 1/8 | 1,625 |
| | HSB/HC 108 | 108,000 | 450 | 17 | 31 | 2,010 | 790 | 109 | 112 | 1/8 | 1,625 |
| | HSB/HC 121 | 121,000 | 504 | 16 | 25 | 1,775 | 715 | 122 | 125 | 1/5 | 1,075 |
| | HSB/HC 165 | 165,000 | 688 | 19 | 40 | 3,240 | 880 | 106 | 171 | 1/3 | 1,075 |
| | HSB/HC 193 | 193,000 | 804 | 18 | 38 | 2,900 | 810 | 121 | 200 | 1/3 | 1,075 |
| | HSB/HC 258 | 258,000 | 1,075 | 19 | 44 | 4,560 | 750 | 111 | 267 | 1/2 | 1,075 |
| | HSB/HC 290 | 290,000 | 1,208 | 20 | 46 | 4,590 | 765 | 117 | 300 | 1/2 | 1,075 |
| | HSB/HC 340 | 340,000 | 1,417 | 20 | 46 | 5,130 | 735 | 120 | 352 | 1/2 | 1,075 |
| Power Throw™ ③ | PT/PTN 279 | 279,000 | 1,163 | 16 | 100 | 5,460 | 2,165 | 111 | 289 | 1/2 | 1,075 |
| | PT/PTN 333 | 333,000 | 1,388 | 17 | 110 | 5,980 | 2,165 | 116 | 345 | 3/4 | 1,140 |
| | PT/PTN 385 | 385,000 | 1,604 | 17 | 115 | 7,680 | 1,860 | 110 | 398 | 1 | 1,140 |
| | PT/PTN 500 | 500,000 | 2,083 | 18 | 130 | 10,390 | 2,520 | 108 | 517 | 1 1/2 | 1,140 |
| | PT/PTN 610 | 610,000 | 2,542 | 20 | 140 | 11,750 | 2,315 | 112 | 631 | 1 1/2 | 1,140 |
| | PT 952 | 952,000 | 3,967 | 21 | 145 | 12,170 | 2,321 | 139 | 985 | 2 | 1,140 |
| Vertical Delivery ③ | V/VN 42 | 42,000 | 175 | 11 **15** | 17 **11** | 950 | 825 | 103 | 43 | 1/30 | 1,050 |
| | V/VN 59 | 59,000 | 246 | 14 **19** | 21 **14** | 1,155 | 1,005 | 111 | 61 | 1/30 | 1,050 |
| | V/VN 78 | 78,000 | 325 | 15 **20** | 23 **15** | 1,590 | 1,065 | 109 | 81 | 1/15 | 1,050 |
| | V/VN 95 | 95,000 | 396 | 15 **20** | 23 **15** | 1,665 | 1,120 | 118 | 98 | 1/15 | 1,050 |
| | V/VN 139 | 139,000 | 579 | 18 **24** | 27 **18** | 2,660 | 1,285 | 112 | 144 | 1/6 | 1,075 |
| | V/VN 161 | 161,000 | 671 | 20 **27** | 30 **20** | 2,945 | 1,420 | 115 | 167 | 1/3 | 1,075 |
| | V/VN 193 | 193,000 | 804 | 22 **30** | 33 **22** | 3,500 | 1,690 | 116 | 200 | 1/3 | 1,075 |
| | V/VN 212 | 212,000 | 883 | 22 **30** | 33 **22** | 3,610 | 1,740 | 120 | 219 | 1/3 | 1,075 |
| | V/VN 247 | 247,000 | 1,029 | 26 **34** | 39 **26** | 4,820 | 1,910 | 111 | 256 | 1/2 | 1,075 |
| | V/VN 279 | 279,000 | 1,163 | 30 **37** | 45 **30** | 5,460 | 2,165 | 111 | 289 | 1/2 | 1,075 |
| | V/VN 333 | 333,000 | 1,388 | 30 **37** | 45 **30** | 5,980 | 2,165 | 116 | 345 | 3/4 | 1,140 |
| | V/VN 385 | 385,000 | 1,604 | 30 **36** | 45 **30** | 7,680 | 1,860 | 110 | 398 | 1 | 1,140 |
| | V/VN 500 | 500,000 | 2,083 | 37 **44** | 56 **37** | 10,390 | 2,520 | 108 | 517 | 1 1/2 | 1,140 |
| | V/VN 610 | 610,000 | 2,542 | 36 **43** | 54 **36** | 11,750 | 2,315 | 112 | 631 | 1 1/2 | 1,140 |
| | V 952 | 952,000 | 3,967 | 37 | 56 | 12,170 | 2,321 | 139 | 985 | 2 | 1,140 |

### Table 13.2 - Performance Data for Standard Units at Standard Conditions of 2 lb. Steam and 60°F Entering Air Reduced Motor Speed ④

| Type | Model No. | Btu/hr | Sq. Ft. EDR | Air Data | | | | | | Motor Data | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Maximum Mounting Height (ft.) ① | Heat Throw or Spread @ Max. Height ① | CFM ② | Outlet Velocity (Fpm) | Final Air Temp. (°F) | Condensate lb/hr | Hp | Approx. RPM |
| Horizontal Delivery | HSB/HC 18 | 14,000 | 58 | 8 | 10 | 220 | 415 | 118 | 14 | 1/60 | 1,000 |
| | HSB/HC 24 | 18,000 | 75 | 9 | 11 | 230 | 440 | 131 | 19 | 1/25 | 1,000 |
| | HSB/HC 33 | 25,000 | 104 | 10 | 13 | 395 | 440 | 118 | 26 | 1/25 | 1,000 |
| | HSB/HC 47 | 38,000 | 158 | 12 | 17 | 450 | 515 | 137 | 39 | 1/12 | 1,000 |
| | HSB/HC 63 | 47,000 | 195 | 14 | 17 | 685 | 430 | 122 | 49 | 1/12 | 1,000 |
| | HSB/HC 86 | 64,000 | 265 | 15 | 19 | 825 | 525 | 131 | 66 | 1/8 | 1,000 |
| | HSB/HC 108 | 81,000 | 340 | 17 | 19 | 1,255 | 500 | 119 | 84 | 1/8 | 1,000 |

① Horizontal units with horizontal louvers open 30° from vertical plane. Vertical types equipped with cone jet deflector, blades fully opened are shown in bold. Please see page 22 for additional outlet accessory performance data.
② Cfm for horizontal types is entering Cfm. Cfm for vertical and Power-Throw™ types is leaving Cfm.
③ V and PT models have copper tubes, VN and PTN models have 90/10 cupro-nickel tubes.
④ Requires Solid State Motor Speed Controller.

## Steam Performance Data - Low Outlet Temperature Models

### Table 14.1 - Performance Data for Low Outlet Temperature Units at Standard Conditions of 2 lb. Steam and 60°F Entering Air High Motor Speed

| Type | Model No. | Btu/hr | Sq. Ft. EDR | Air Data | | | | | | | | Motor Data | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Maximum Mounting Height (ft.) ① | | Heat Throw or Spread @ Max. Height ① | | CFM ② | Outlet Velocity (Fpm) | Final Air Temp. (°F) | Condensate lb/hr | Hp | Approx. RPM |
| Horizontal Delivery | HSB/HC 18L | 15,900 | 66 | 9 | | 20 | | 364 | 655 | 100 | 16 | 1/60 | 1,550 |
| | HSB/HC 24L | 19,300 | 80 | 11 | | 21 | | 435 | 795 | 100 | 20 | 1/25 | 1,550 |
| | HSB/HC 33L | 29,500 | 123 | 12 | | 24 | | 695 | 745 | 99 | 31 | 1/25 | 1,550 |
| | HSB/HC 47L | 32,000 | 133 | 14 | | 32 | | 855 | 910 | 94 | 33 | 1/12 | 1,550 |
| | HSB/HC 63L | 52,500 | 219 | 16 | | 33 | | 1,170 | 710 | 101 | 54 | 1/12 | 1,550 |
| | HSB/HC 86L | 61,500 | 256 | 17 | | 36 | | 1,510 | 910 | 97 | 64 | 1/8 | 1,625 |
| | HSB/HC 108L | 86,500 | 360 | 19 | | 36 | | 2,150 | 825 | 97 | 90 | 1/8 | 1,625 |
| | HSB/HC 121L | 88,000 | 367 | 18 | | 29 | | 2,070 | 800 | 98 | 91 | 1/5 | 1,075 |
| | HSB/HC 165L | 143,000 | 596 | 21 | | 45 | | 3,480 | 930 | 97 | 148 | 1/3 | 1,075 |
| | HSB/HC 258L | 190,000 | 792 | 22 | | 51 | | 4,655 | 750 | 98 | 197 | 1/2 | 1,075 |
| | HSB/HC 290L | 207,000 | 863 | 23 | | 53 | | 5,040 | 805 | 94 | 214 | 1/2 | 1,075 |
| | HSB/HC 340L | 255,000 | 1,063 | 23 | | 53 | | 5,575 | 775 | 102 | 264 | 1/2 | 1,075 |
| Power Throw™ ③ | PT/PTN 610L | 470,000 | 1,958 | 22 | | 154 | | 2,400 | 2,445 | 97 | 486 | 1-1/2 | 1,140 |
| Vertical Delivery ③ | V 42L | 33,000 | 138 | 13 | **17** | 20 | **13** | 960 | 835 | 94 | 34 | 1/30 | 1,050 |
| | V 59L | 44,000 | 183 | 16 | **22** | 24 | **16** | 1,190 | 1,035 | 96 | 45 | 1/30 | 1,050 |
| | V 78L | 62,000 | 258 | 19 | **26** | 29 | **19** | 1,740 | 1,070 | 95 | 65 | 1/15 | 1,050 |
| | V 95L | 71,000 | 296 | 19 | **26** | 29 | **19** | 1,760 | 1,180 | 99 | 73 | 1/15 | 1,050 |
| | V/VN 139L | 103,000 | 429 | 23 | **31** | 35 | **23** | 2,860 | 1,380 | 95 | 106 | 1/6 | 1,075 |
| | V/VN 161L | 127,000 | 529 | 26 | **35** | 39 | **26** | 3,400 | 1,640 | 96 | 132 | 1/3 | 1,075 |
| | V/VN 193L | 149,000 | 621 | 27 | **36** | 41 | **27** | 3,710 | 1,790 | 99 | 154 | 1/3 | 1,075 |
| | V/VN 212L | 163,000 | 679 | 27 | **36** | 41 | **27** | 3,830 | 1,845 | 102 | 169 | 1/3 | 1,075 |
| | V/VN 247L | 190,000 | 792 | 32 | **42** | 48 | **32** | 5,110 | 2,030 | 96 | 197 | 1/2 | 1,075 |
| | V/VN 279L | 215,000 | 896 | 36 | **45** | 54 | **36** | 5,790 | 2,300 | 96 | 222 | 1/2 | 1,075 |
| | V/VN 333L | 256,000 | 1,067 | 36 | **45** | 54 | **36** | 6,340 | 2,300 | 100 | 265 | 3/4 | 1,140 |
| | V/VN 385L | 296,000 | 1,233 | 36 | **43** | 54 | **36** | 8,140 | 1,970 | 95 | 307 | 1 | 1,140 |
| | V/VN 500L | 385,000 | 1,604 | 45 | **54** | 68 | **45** | 11,000 | 2,670 | 94 | 400 | 1-1/2 | 1,140 |
| | V/VN 610L | 470,000 | 1,958 | 44 | **52** | 66 | **44** | 12,400 | 2,445 | 97 | 485 | 1-1/2 | 1,140 |
| | V 952L | 733,000 | 3,055 | 45 | **-** | 68 | **-** | 12,940 | 2,450 | 115 | 759 | 2 | 1,140 |

### Table 14.2 - Performance Data for Low Outlet Temperature Units at Standard Conditions of 2 lb. Steam and 60°F Entering Air Reduced Motor Speed ④

| Type | Model No. | Btu/hr | Sq. Ft. EDR | Air Data | | | | | | Motor Data | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Maximum Mounting Height (ft.) ① | Heat Throw or Spread @ Max. Height ① | CFM ② | Outlet Velocity (Fpm) | Final Air Temp. (°F) | Condensate lb/hr | Hp | Approx. RPM |
| Horizontal Delivery | HSB/HC 18L | 12,000 | 51 | 9 | 12 | 230 | 425 | 108 | 12 | 1/60 | 1,000 |
| | HSB/HC 24L | 14,400 | 60 | 11 | 13 | 265 | 490 | 109 | 15 | 1/25 | 1,000 |
| | HSB/HC 33L | 22,000 | 92 | 12 | 14 | 430 | 470 | 107 | 23 | 1/25 | 1,000 |
| | HSB/HC 47L | 24,300 | 101 | 14 | 19 | 540 | 580 | 101 | 25 | 1/12 | 1,000 |
| | HSB/HC 63L | 39,500 | 164 | 16 | 20 | 725 | 445 | 109 | 41 | 1/12 | 1,000 |
| | HSB/HC 86L | 46,000 | 192 | 17 | 22 | 925 | 565 | 105 | 48 | 1/8 | 1,000 |
| | HSB/HC 108L | 65,000 | 270 | 19 | 22 | 1,330 | 520 | 104 | 67 | 1/8 | 1,000 |

① Horizontal units with horizontal louvers open 30° from vertical plane. Vertical types equipped with cone jet deflector, blades fully opened are shown in bold. Please see page 22 for additional outlet accessory performance data.
② Cfm for horizontal types is entering Cfm. Cfm for vertical and Power-Throw™ types is leaving Cfm.
③ V and PT models have copper tubes, VN and PTN models have 90/10 cupro-nickel tubes.
④ Requires Solid State Motor Speed Controller.

## Steam Conversion Tables - Example Calculations

***Conversion factor example #1:***

For an HSB340S operating at 30 lb. steam and 50°F entering air temperature, determine the following:

- Capacity (Btu/hr)
- Final air temperature (°F)
- Condensate (lb./hr)
- Maximum mounting height

***Solution:***

The factors/data necessary to solve this problem are as follows:

- Steam heating capacity conversion factor for 30 lb. steam and 50°F entering air is 1.43, from Table 10.1.
- Air temperature rise conversion factor is 1.40, from Table 11.1.
- The latent heat of steam at 30 lb. is 928.5 Btu/lb., from Table 12.2.
- The mounting height correction factor is 0.86, from Table 12.1.
- The standard rated capacity of an HSB 340 is 340,000 Btu/hr, from Table 13.1.
- The final air temperature of an HSB 340 at standard conditions is 120°F, from Table 13.1.
- The maximum mounting height at standard conditions is 20 feet, from Table 13.1.

$Btu_A = Btu_S$ x Heating Capacity Factor = 340,000 x 1.43 = 486,200 Btu/hr

$ATR_A = (FAT_S - EAT_S)$ x Air Temp Rise Factor = (120°F - 60°F) x 1.40 = 84°F
$FAT_A = EAT_A + ATR_A$ = 50°F + 84°F = 134°F

Condensate rate = $Btu_A$ ÷ Latent Heat of Steam = 486,200 ÷ 928.5 = 523.6 lb./hr

Max. Mounting $Height_A$ = Max. Mounting $Height_S$ x Correction Factor = 20 feet x 0.86 = 17.2 feet

***Conversion factor example #2:***

Which vertical unit heater model is required to deliver 155,500 Btu/hr at 20 lb. steam and 60°F entering air temperature. What will be the actual capacity and rate of condensate production for the selected unit?

***Solution:***

The factors/data necessary to solve this problem are as follows:

- Steam heating capacity conversion factor for 20 lb. steam and 60°F entering air is 1.23, from Table 10.1.
- The latent heat of steam at 20 lb. is 939.3 Btu/lb. from Table 12.2.

$Btu_S = Btu_A$ ÷ Heating Capacity Factor = 155,500 ÷ 1.23 = 126,423 Btu/hr (at standard conditions)
From Table 13.1, a V 139 model meets the requirement with a rated capacity of 139,000 Btu/hr at standard conditions.

The capacity of the V 139 at actual conditions will be $Btu_A = Btu_S$ x Heating Capacity Factor =
139,000 x 1.23 = 170,970 Btu/hr.

Condensate rate = $Btu_A$ ÷ Latent Heat of Steam = 170,970 ÷ 939.3 = 182.0 lb./hr.

***Alternate Solution:***

Low Outlet Temperature models are normally recommended for steam pressures above 30 lb. However, the use of these models with steam pressure less than 30 lb. is acceptable.

Based on the example above, a V 161L model, from Table 14.1, meets the requirement with a rated capacity of 127,000 Btu/hr at standard conditions.

The capacity of the V 161L at actual conditions will be $Btu_A = Btu_S$ x Heating Capacity Factor =
127,000 x 1.23 = 156,210 Btu/hr.

Condensate rate = $Btu_A$ ÷ Latent Heat of Steam = 156,210 ÷ 939.3 = 166.3 lb./hr.

## Hot Water Conversion Tables

Table 16.1 and the formulas below are used to determine the heating capacity (Btu/hr) of a unit heater at a water temperature and/or entering air temperature other than standard conditions of 200° entering water temperature, 60° entering air temperature.

***Table 16.1***
***Hot Water Heating Capacity Conversion Factors***

| Entering Water | Entering Air Temperature (°F) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp. (°F) | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 100 |
| 60 | 0.462 | 0.380 | 0.300 | 0.222 | 0.146 | 0.072 | 0 | 0 | 0 | 0 | 0 |
| 70 | 0.539 | 0.456 | 0.375 | 0.296 | 0.219 | 0.145 | 0.071 | 0 | 0 | 0 | 0 |
| 80 | 0.615 | 0.531 | 0.450 | 0.370 | 0.293 | 0.217 | 0.143 | 0.071 | 0 | 0 | 0 |
| 90 | 0.692 | 0.607 | 0.524 | 0.444 | 0.366 | 0.289 | 0.214 | 0.141 | 0.070 | 0 | 0 |
| 100 | 0.769 | 0.683 | 0.599 | 0.518 | 0.439 | 0.361 | 0.286 | 0.212 | 0.140 | 0.069 | 0 |
| 110 | 0.846 | 0.759 | 0.674 | 0.592 | 0.512 | 0.434 | 0.357 | 0.283 | 0.210 | 0.138 | 0.068 |
| 120 | 0.923 | 0.835 | 0.749 | 0.666 | 0.585 | 0.506 | 0.429 | 0.353 | 0.279 | 0.207 | 0.137 |
| 130 | 1.000 | 0.911 | 0.824 | 0.740 | 0.658 | 0.578 | 0.500 | 0.424 | 0.349 | 0.276 | 0.205 |
| 140 | 1.077 | 0.987 | 0.899 | 0.814 | 0.731 | 0.651 | 0.571 | 0.494 | 0.419 | 0.345 | 0.273 |
| 150 | 1.154 | 1.063 | 0.974 | 0.888 | 0.805 | 0.723 | 0.643 | 0.565 | 0.489 | 0.414 | 0.342 |
| 160 | 1.231 | 1.139 | 1.049 | 0.962 | 0.878 | 0.795 | 0.714 | 0.636 | 0.559 | 0.483 | 0.410 |
| 170 | 1.308 | 1.215 | 1.124 | 1.036 | 0.950 | 0.867 | 0.786 | 0.706 | 0.629 | 0.552 | 0.478 |
| 180 | 1.385 | 1.291 | 1.199 | 1.110 | 1.024 | 0.940 | 0.857 | 0.777 | 0.699 | 0.621 | 0.547 |
| 190 | 1.462 | 1.367 | 1.274 | 1.184 | 1.097 | 1.012 | 0.929 | 0.848 | 0.768 | 0.690 | 0.615 |
| 200 | 1.539 | 1.443 | 1.349 | 1.258 | 1.170 | 1.084 | 1.000 | 0.918 | 0.838 | 0.759 | 0.684 |
| 210 | 1.615 | 1.519 | 1.424 | 1.332 | 1.243 | 1.157 | 1.071 | 0.989 | 0.908 | 0.828 | 0.752 |
| 220 | 1.692 | 1.594 | 1.499 | 1.406 | 1.312 | 1.229 | 1.143 | 1.060 | 0.978 | 0.897 | 0.820 |
| 230 | 1.769 | 1.670 | 1.573 | 1.480 | 1.390 | 1.301 | 1.214 | 1.130 | 1.048 | 0.966 | 0.889 |
| 240 | 1.846 | 1.746 | 1.649 | 1.554 | 1.463 | 1.373 | 1.286 | 1.201 | 1.118 | 1.035 | 0.957 |
| 250 | 1.923 | 1.822 | 1.723 | 1.628 | 1.536 | 1.446 | 1.357 | 1.272 | 1.188 | 1.104 | 1.025 |
| 260 | 2.000 | 1.898 | 1.798 | 1.702 | 1.609 | 1.518 | 1.429 | 1.342 | 1.257 | 1.173 | 1.094 |
| 270 | 2.077 | 1.974 | 1.873 | 1.776 | 1.682 | 1.590 | 1.500 | 1.413 | 1.327 | 1.242 | 1.162 |
| 280 | 2.154 | 2.050 | 1.948 | 1.850 | 1.755 | 1.663 | 1.571 | 1.483 | 1.397 | 1.311 | 1.230 |
| 290 | 2.231 | 2.126 | 2.023 | 1.924 | 1.829 | 1.734 | 1.643 | 1.554 | 1.467 | 1.380 | 1.300 |
| 300 | 2.308 | 2.202 | 2.098 | 1.998 | 1.902 | 1.807 | 1.714 | 1.625 | 1.537 | 1.449 | 1.367 |
| 310 | 2.385 | 2.278 | 2.173 | 2.072 | 1.974 | 1.879 | 1.786 | 1.695 | 1.607 | 1.518 | 1.436 |
| 320 | 2.462 | 2.354 | 2.248 | 2.146 | 2.048 | 1.952 | 1.857 | 1.766 | 1.677 | 1.587 | 1.504 |
| 330 | 2.539 | 2.430 | 2.323 | 2.220 | 2.121 | 2.024 | 1.929 | 1.837 | 1.746 | 1.656 | 1.572 |
| 340 | 2.615 | 2.506 | 2.398 | 2.294 | 2194 | 2.096 | 2.000 | 1.907 | 1.816 | 1.725 | 1.641 |
| 350 | 2.962 | 2.581 | 2.473 | 2.368 | 2.267 | 2.168 | 2.071 | 1.978 | 1.886 | 1.794 | 1.709 |
| 360 | 2.769 | 2.657 | 2.548 | 2.442 | 2.340 | 2.241 | 2.143 | 2.049 | 1.956 | 1.863 | 1.778 |
| 370 | 2.846 | 2.733 | 2.622 | 2.516 | 2.413 | 2.313 | 2.214 | 2.119 | 2.026 | 1.932 | 1.846 |
| 380 | 2.923 | 2.809 | 2.697 | 2.590 | 2.486 | 2.385 | 2.286 | 2.190 | 2.096 | 2.001 | 1.914 |
| 390 | 3.000 | 2.885 | 2.772 | 2.664 | 2.560 | 2.458 | 2.357 | 2.261 | 2.165 | 2.070 | 1.983 |
| 400 | 3.077 | 2.961 | 2.847 | 2.738 | 2.633 | 2.530 | 2.429 | 2.331 | 2.235 | 2.139 | 2.051 |

Applicable formulas (examples on page 21):

To find actual unit heater capacity when operated at non-standard (actual) conditions:

***$Btu_A = Btu_S$ x Heating Capacity Factor***

To select a heater capacity based on standard conditions to meet a heating capacity at non-standard (actual) conditions:

***$Btu_S = Btu_A \div$ Heating Capacity Factor***

Where:

$Btu_S$ = Capacity at standard conditions (200°F entering water temperature, 60°F entering air temperature) from Tables 19.1 through 20.2

$Btu_A$ = Capacity at non-standard (actual) conditions

## Hot Water Conversion Tables

### Table 17.1 - Minimum Water Flow and Water Volume (gallons) ①

| TYPE | Model | Min. GPM | Max. GPM | Coil Volume (gals) | Type | Model | Min. GPM | Max. GPM | Coil Volume (gals) | Type | Model | Min. GPM | Max. GPM | Coil Volume (gals) | Type | Model | Min. GPM | Max. GPM | Coil Volume (gals) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 18 | 0.25 | 5 | 0.13 | | 22 | 0.80 | 10 | 0.30 | | 279 | 4.50 | 60 | 0.97 | | 42 | 0.50 | 10 | 0.15 |
| | 24 | 0.25 | 5 | 0.13 | | 39 | 1.40 | 18 | 0.50 | | 333 | 4.50 | 100 | 1.24 | | 59 | 0.75 | 15 | 0.23 |
| | 33 | 0.40 | 10 | 0.41 | | 67 | 2.60 | 31 | 0.77 | | 385 | 4.50 | 100 | 1.24 | | 78 | 1.00 | 20 | 0.31 |
| | 47 | 0.40 | 10 | 0.41 | | 104 | 4.10 | 48 | 1.10 | | 500 | 6.00 | 100 | 1.66 | | 95 | 1.25 | 25 | 0.38 |
| | 63 | 0.50 | 20 | 0.66 | | 170 | 6.80 | 77 | 1.80 | | 610 | 6.00 | 100 | 1.98 | | 139 | 1.00 | 30 | 0.43 |
| | 86 | 0.50 | 20 | 0.66 | | 195 | 8.00 | 88 | 2.14 | | 952 | 14.00 | 200 | 6.50 | | 161 | 1.25 | 40 | 0.54 |
| HORIZONTAL DELIVERY **HSB/HC** | 108 | 0.50 | 30 | 0.98 | HORIZONTAL DELIVERY **HCH** | | | | | POWER-THROW **PT/PTN** | | | | | VERTICAL DELIVERY **V/VN** | 193 | 1.50 | 50 | 0.65 |
| | 121 | 0.50 | 30 | 0.98 | | | | | | | | | | | | 212 | 2.00 | 60 | 0.86 |
| | 165 | 2.00 | 30 | 1.35 | | | | | | | | | | | | 247 | 2.00 | 60 | 0.86 |
| | 193 | 2.00 | 50 | 1.45 | | | | | | | | | | | | 279 | 2.25 | 75 | 0.97 |
| | 258 | 2.50 | 70 | 2.20 | | | | | | | | | | | | 333 | 2.25 | 75 | 1.24 |
| | 290 | 2.50 | 70 | 2.20 | | | | | | | | | | | | 385 | 2.25 | 75 | 1.24 |
| | 340 | 2.50 | 70 | 2.50 | | | | | | | | | | | | 500 | 3.00 | 100 | 1.66 |
| | | | | | | | | | | | | | | | | 610 | 6.00 | 100 | 1.98 |
| | | | | | | | | | | | | | | | | 952 | 14.00 | 200 | 6.50 |

① Water flow and water volume is the same for standard coils and low-outlet temperature coils

### Table 17.2 - Ethylene Glycol Correction Factors ②

Table 17.2 is used to determine how glycol solutions affect heater capacity. These factors should be applied to the heater capacity at actual entering water and air temperature conditions.

| | Ethylene Glycol Solution % | | | | | | |
|---|---|---|---|---|---|---|---|
| Solution Temperature (°F) | 20% | 30% | 40% | 50% | 60% | 70% | 80% |
| 60 | 0.99 | 0.96 | 0.93 | 0.89 | 0.85 | 0.81 | 0.76 |
| 100 | 0.99 | 0.96 | 0.93 | 0.89 | 0.85 | 0.81 | 0.76 |
| 150 | 0.99 | 0.96 | 0.94 | 0.90 | 0.87 | 0.83 | 0.78 |
| 200 | 0.99 | 0.96 | 0.94 | 0.92 | 0.88 | 0.85 | 0.81 |
| 250 | 0.98 | 0.96 | 0.94 | 0.92 | 0.89 | 0.86 | 0.82 |
| 300 | 0.98 | 0.95 | 0.95 | 0.92 | 0.90 | 0.87 | 0.83 |
| 350 | 0.98 | 0.95 | 0.95 | 0.93 | 0.91 | 0.88 | 0.84 |
| 400 | 0.97 | 0.95 | 0.95 | 0.93 | 0.92 | 0.89 | 0.85 |

② For Propylene Glycol solution correction factor, multiply Ethylene Glycol correction factor by 0.95.

Applicable formulas (examples on page 21):

To find actual unit heater capacity when operated with glycol solution:

$$Btu_{AG} = Btu_S \text{ (or } Btu_A) \times \text{Glycol Correction Factor}$$

To select a heater capacity based on standard conditions to meet a heating capacity with a glycol solution:

$$Btu_S \text{ (or } Btu_A) = Btu_{AG} \div \text{Glycol Correction Factor}$$

Where:

$Btu_S$ = Capacity at standard conditions (200°F entering water temperature, 60°F entering air temperature) from Tables 19.1 through 20.2
$Btu_A$ = Capacity at non-standard (actual) conditions
$Btu_{AG}$ = Capacity with glycol solution

### Table 17.3 - Hot Water Unit Heater Mounting Height Correction Factors ③

Table 17.3 is used to determine how hot water temperatures other than 200°F affect mounting height.

| Entering Water Temperature, °F | Correction Factor | Entering Water Temperature, °F | Correction Factor | Entering Water Temperature, °F | Correction Factor |
|---|---|---|---|---|---|
| 140 | 1.33 | 230 | 0.91 | 320 | 0.74 |
| 150 | 1.25 | 240 | 0.89 | 330 | 0.72 |
| 160 | 1.19 | 250 | 0.86 | 340 | 0.71 |
| 170 | 1.13 | 260 | 0.84 | 350 | 0.70 |
| 180 | 1.08 | 270 | 0.82 | 360 | 0.69 |
| 190 | 1.04 | 280 | 0.80 | 370 | 0.67 |
| 200 | 1.00 | 290 | 0.78 | 380 | 0.66 |
| 210 | 0.97 | 300 | 0.77 | 390 | 0.65 |
| 220 | 0.94 | 310 | 0.75 | 400 | 0.64 |

③ Factors are for use with entering air temperatures that range from 50° to 70°F

Applicable formula (examples on page 21):

$$\text{Max. Mounting Height}_A = \text{Max. Mounting Height}_S \times \text{Correction Factor}$$

Where:

Max. Mounting $Height_A$ = Maximum mounting height at actual conditions
Max. Mounting $Height_S$ = Maximum mounting height at standard conditions

## Hot Water Conversion Tables - Miscellaneous Formulas

Table 18.1 is used to determine how water temperature drop affects heater capacity in Btu, water flow rate in GPM and pressure drop in feet of water. These factors should be applied to the values at actual entering water and air temperature conditions.

***Table 18.1***
***Correction Factors for Varying Water Temperature Drop*** ①

| | Water Temperature Drop, °F | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 |
| Btu Correction Factor | 1.23 | 1.13 | 1.06 | 1.00 | 0.95 | 0.90 | 0.86 | 0.82 | 0.78 | 0.72 | 0.69 | 0.67 |
| GPM Correction Factor | 4.64 | 2.21 | 1.40 | 1.00 | 0.76 | 0.61 | 0.50 | 0.42 | 0.36 | 0.30 | 0.26 | 0.23 |
| WPD Correction Factor | 17.24 | 4.32 | 1.85 | 1.00 | 0.61 | 0.41 | 0.30 | 0.22 | 0.18 | 0.14 | 0.12 | 0.11 |

① Water temperature drop correction factors valid only for standard 200°F entering water and 60°F air temperature conditions.

Applicable formulas (examples on page 21):

To find actual unit heater capacity or flow rate or water pressure drop when operated at non-standard (actual) conditions:

$$Btu_A = Btu_S \times \text{Btu Correction Factor}$$

$$GPM_A = GPM_S \times \text{GPM Correction Factor}$$

$$WPD_A = WPD_S \times \text{WPD Correction Factor}$$

To select a heater capacity based on standard conditions to meet a heating capacity at non-standard (actual) conditions:

$$Btu_S = Btu_A \div \text{Btu Correction Factor}$$

Where:
- $Btu_S$ = Capacity at standard conditions (200°F entering water temperature, 60°F entering air temperature) from Tables 19.1 through 20.2
- $Btu_A$ = Capacity at non-standard (actual) conditions
- $GPM_S$ = Flow rate at standard conditions (200°F entering water temperature, 60°F entering air temperature) from Tables 19.1 through 20.2
- $GPM_A$ = Flow rate at non-standard (actual) conditions
- $WPD_S$ = Water pressure drop at standard conditions (200°F entering water temperature, 60°F entering air temperature) from Tables 19.1 through 20.2
- $WPD_A$ = Water pressure drop at non-standard (actual) conditions

Other miscellaneous useful formulas:

$$FAT_A = EAT_A + [(460 + EAT_A) \times (Btu_A) \div (573 \times Cfm_S)]$$ *for HSB and HC units only*

$$FAT_A = EAT_A + [(460 + EAT_A) \div ((573 \times Cfm_S \div Btu_A) - 1)]$$ *for V/VN and PT/PTN units only*

$$WTD_A = Btu_A \div (480 \times GPM_A)$$

Where:
- $EAT_A$ = Entering air temperature at actual conditions
- $FAT_A$ = Final air temperature at actual conditions
- $Btu_A$ = Capacity at actual conditions
- $Cfm_S$ = Unit airflow as found in Tables 19.1 through 20.2
- $GPM_A$ = Water flow rate at actual conditions in GPM
- $WTD_A$ = Water temperature drop at actual conditions

## Hot Water Performance Data - Standard Models

### Table 19.1 - Performance Data for Standard Units at Standard Conditions of 200°F Entering Water and 60°F Entering Air High Motor Speed

| Type | Model No. | Btu/hr | Water Data | | | Air Data | | | | | | Motor Data | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GPM | Pressure Drop (Ft. of Water) | Min/Max GPM | Maximum Mounting Height (ft.) ① | | Heat Throw or Spread @ Max. Height ① | | CFM ② | Outlet Velocity (Fpm) | Final Air Temp. (°F) | Hp | Approx. RPM |
| Horizontal Delivery | HSB/HC 18 | 12,600 | 1.3 | 0.5 | 0.3 / 5.0 | 9 | | 18 | | 340 | 615 | 93 | 1/60 | 1,550 |
| | HSB/HC 24 | 16,200 | 1.7 | 0.8 | 0.3 / 5.0 | 10 | | 19 | | 370 | 675 | 100 | 1/25 | 1,550 |
| | HSB/HC 33 | 21,700 | 2.3 | 0.2 | 0.4 / 10.0 | 11 | | 23 | | 630 | 675 | 91 | 1/25 | 1,550 |
| | HSB/HC 47 | 30,900 | 3.2 | 0.4 | 0.4 / 10.0 | 13 | | 30 | | 730 | 785 | 98 | 1/12 | 1,550 |
| | HSB/HC 63 | 45,600 | 4.7 | 0.6 | 0.5 / 20.0 | 15 | | 31 | | 1,120 | 680 | 97 | 1/12 | 1,550 |
| | HSB/HC 86 | 60,200 | 6.3 | 1.0 | 0.5 / 20.0 | 16 | | 33 | | 1,340 | 820 | 101 | 1/8 | 1,625 |
| | HSB/HC 108 | 83,700 | 8.7 | 2.8 | 0.5 / 30.0 | 18 | | 33 | | 2,010 | 775 | 98 | 1/8 | 1,625 |
| | HSB/HC 121 | 93,000 | 9.7 | 3.3 | 0.7 / 30.0 | 17 | | 27 | | 1,775 | 700 | 107 | 1/5 | 1,075 |
| | HSB/HC 165 | 130,900 | 13.6 | 8.6 | 2.0 / 30.0 | 20 | | 43 | | 3,240 | 870 | 96 | 1/3 | 1,075 |
| | HSB/HC 193 | 143,000 | 14.9 | 1.4 | 2.0 / 50.0 | 19 | | 41 | | 2,900 | 790 | 105 | 1/3 | 1,075 |
| | HSB/HC 258 | 201,900 | 21.0 | 5.7 | 2.5 / 70.0 | 20 | | 47 | | 4,560 | 740 | 100 | 1/2 | 1,075 |
| | HSB/HC 290 | 228,600 | 23.8 | 7.1 | 2.5 / 70.0 | 22 | | 50 | | 4,590 | 750 | 105 | 1/2 | 1,075 |
| | HSB/HC 340 | 271,100 | 28.2 | 11.3 | 2.8 / 70.0 | 22 | | 50 | | 5,130 | 720 | 108 | 1/2 | 1,075 |
| Power Throw™ ③ | PT/PTN 279 | 192,300 | 20.0 | 0.2 | 4.5 / 60.0 | 17 | | 108 | | 5,460 | 2,165 | 94 | 1/2 | 1,075 |
| | PT/PTN 333 | 238,500 | 24.8 | 0.4 | 4.5 / 100.0 | 18 | | 117 | | 5,980 | 2,165 | 99 | 3/4 | 1,140 |
| | PT/PTN 385 | 276,100 | 28.8 | 0.6 | 4.5 / 100.0 | 18 | | 124 | | 7,680 | 1,860 | 95 | 1 | 1,140 |
| | PT/PTN 500 | 358,000 | 37.3 | 0.5 | 6.0 / 100.0 | 19 | | 138 | | 10,390 | 2,520 | 93 | 1-1/2 | 1,140 |
| | PT/PTN 610 | 450,400 | 46.9 | 1.0 | 6.0 / 100.0 | 22 | | 151 | | 11,750 | 2,315 | 97 | 1-1/2 | 1,140 |
| | PT 952 | 721,600 | 75.2 | 1.1 | 14.0 / 200.0 | 23 | | 150 | | 12,166 | 2,321 | 120 | 2 | 1,140 |
| Vertical Delivery ③ | V/VN 42 | 30,100 | 3.1 | 0.6 | 0.5 / 10.0 | 12 | **16** | 18 | **12** | 950 | 825 | 90 | 1/30 | 1,050 |
| | V/VN 59 | 42,600 | 4.4 | 0.5 | 0.8 / 15.0 | 15 | **20** | 22 | **15** | 1,155 | 1,005 | 96 | 1/30 | 1,050 |
| | V/VN 78 | 57,000 | 5.9 | 0.5 | 1.0 / 20.0 | 16 | **22** | 24 | **16** | 1,590 | 1,065 | 95 | 1/15 | 1,050 |
| | V/VN 95 | 69,300 | 7.2 | 0.5 | 1.3 / 25.0 | 16 | **22** | 24 | **16** | 1,665 | 1,120 | 101 | 1/15 | 1,050 |
| | V/VN 139 | 106,600 | 11.1 | 2.6 | 1.0 / 30.0 | 19 | **26** | 29 | **19** | 2,660 | 1,285 | 99 | 1/6 | 1,075 |
| | V/VN 161 | 123,200 | 12.8 | 2.2 | 1.3 / 40.0 | 21 | **29** | 32 | **22** | 2,945 | 1,420 | 101 | 1/3 | 1,075 |
| | V/VN 193 | 147,200 | 15.3 | 2.2 | 1.5 / 50.0 | 23 | **32** | 35 | **24** | 3,500 | 1,690 | 101 | 1/3 | 1,075 |
| | V/VN 212 | 161,700 | 16.8 | 1.5 | 2.0 / 60.0 | 23 | **32** | 35 | **24** | 3,610 | 1,740 | 104 | 1/3 | 1,075 |
| | V/VN 247 | 188,700 | 19.7 | 2.1 | 2.0 / 60.0 | 28 | **37** | 41 | **28** | 4,820 | 1,910 | 98 | 1/2 | 1,075 |
| | V/VN 279 | 212,600 | 22.2 | 2.1 | 2.3 / 75.0 | 32 | **40** | 48 | **32** | 5,460 | 2,165 | 98 | 1/2 | 1,075 |
| | V/VN 333 | 260,100 | 27.1 | 3.8 | 2.8 / 75.0 | 32 | **40** | 48 | **32** | 5,980 | 2,165 | 102 | 3/4 | 1,140 |
| | V/VN 385 | 302,100 | 31.5 | 5.0 | 3.3 / 75.0 | 32 | **39** | 48 | **32** | 7,680 | 1,860 | 98 | 1 | 1,140 |
| | V/VN 500 | 391,700 | 40.8 | 4.8 | 3.0 / 100.0 | 39 | **47** | 59 | **40** | 10,390 | 2,520 | 96 | 1-1/2 | 1,140 |
| | V/VN 610 | 450,400 | 46.9 | 1.0 | 6.0 / 100.0 | 38 | **46** | 57 | **39** | 11,750 | 2,315 | 97 | 1-1/2 | 1,140 |
| | V 952 | 721,600 | 75.2 | 1.1 | 14.0 / 200.0 | 39 | - | 59 | - | 12,166 | 2,321 | 120 | 2 | 1,140 |

### Table 19.2 - Performance Data for Standard Units at Standard Conditions of 200°F Entering Water and 60°F Entering Air Reduced Motor Speeds ④

| Type | Model No. | Btu/hr | Water Data | | Air Data | | | | | Motor Data | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GPM | Pressure Drop (Ft. of Water) | Maximum Mounting Height (ft.) ① | Heat Throw or Spread @ Max. Height ① | CFM ② | Outlet Velocity (Fpm) | Final Air Temp. (°F) | Hp | Approx. RPM |
| Horizontal Delivery | HSB/HC 18 | 9,900 | 1.3 | 0.5 | 9 | 11 | 220 | 400 | 101 | 1/60 | 1,000 |
| | HSB/HC 24 | 12,400 | 1.7 | 0.8 | 10 | 12 | 230 | 425 | 109 | 1/25 | 1,000 |
| | HSB/HC 33 | 16,700 | 2.3 | 0.2 | 11 | 14 | 395 | 430 | 98 | 1/25 | 1,000 |
| | HSB/HC 47 | 23,600 | 3.2 | 0.4 | 13 | 18 | 450 | 490 | 107 | 1/12 | 1,000 |
| | HSB/HC 63 | 34,600 | 4.7 | 0.6 | 15 | 18 | 685 | 420 | 106 | 1/12 | 1,000 |
| | HSB/HC 86 | 45,900 | 6.3 | 1.0 | 16 | 20 | 825 | 515 | 110 | 1/8 | 1,000 |
| | HSB/HC 108 | 64,300 | 8.7 | 2.8 | 18 | 20 | 1,255 | 490 | 106 | 1/8 | 1,000 |

① Horizontal units with horizontal louvers open 30° from vertical plane. Vertical types equipped with cone jet deflector, blades fully opened are shown in bold. Please see page 22 for additional outlet accessory performance data.
② Cfm for horizontal types is entering Cfm. Cfm for vertical and Power-Throw™ types is leaving Cfm.
③ V and PT models have copper tubes, VN and PTN models have 90/10 cupro-nickel tubes.
④ Requires Solid State Motor Speed Controller.

## Hot Water Performance Data - Low Outlet Temperature Models

***Table 20.1 - Performance Data for Low Outlet Temperature Units at Standard Conditions of 200°F Entering Water and 60°F Entering Air – High Motor Speed***

| Type | Model No. | Btu/hr | Water Data | | | Air Data | | | | | | Motor Data | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GPM | Pressure Drop (Ft. of Water) | Min/Max GPM | Maximum Mounting Height (ft.) ① | | Heat Throw or Spread @ Max. Height ① | | CFM ② | Outlet Velocity (Fpm) | Final Air Temp. (°F) | Hp | Approx. RPM |
| Horizontal Delivery | HSB/HC 18L | 11,300 | 1.2 | 0.4 | 0.3 / 5.0 | 10 | | 21 | | 364 | 650 | 88 | 1/60 | 1,550 |
| | HSB/HC 24L | 13,700 | 1.4 | 0.6 | 0.3 / 5.0 | 12 | | 22 | | 435 | 775 | 88 | 1/25 | 1,550 |
| | HSB/HC 33L | 19,300 | 2.0 | 0.2 | 0.4 / 10.0 | 13 | | 26 | | 695 | 730 | 85 | 1/25 | 1,550 |
| | HSB/HC 47L | 21,100 | 2.2 | 0.2 | 0.4 / 10.0 | 15 | | 34 | | 855 | 890 | 82 | 1/12 | 1,550 |
| | HSB/HC 63L | 37,900 | 4.0 | 0.4 | 0.5 / 20.0 | 17 | | 35 | | 1,170 | 695 | 89 | 1/12 | 1,550 |
| | HSB/HC 86L | 44,600 | 4.6 | 0.6 | 0.5 / 20.0 | 18 | | 38 | | 1,510 | 890 | 87 | 1/8 | 1,625 |
| | HSB/HC 108L | 66,100 | 6.9 | 1.8 | 0.8 / 30.0 | 20 | | 38 | | 2,150 | 815 | 88 | 1/8 | 1,625 |
| | HSB/HC 121L | 66,700 | 6.9 | 1.9 | 0.8 / 30.0 | 19 | | 31 | | 2,070 | 785 | 89 | 1/5 | 1,075 |
| | HSB/HC 165L | 113,200 | 11.8 | 6.6 | 2.0 / 30.0 | 23 | | 48 | | 3,480 | 920 | 89 | 1/3 | 1,075 |
| | HSB/HC 258L | 147,400 | 15.4 | 3.2 | 2.5 / 70.0 | 23 | | 54 | | 4,655 | 735 | 89 | 1/2 | 1,075 |
| | HSB/HC 290L | 161,100 | 16.8 | 3.7 | 2.5 / 70.0 | 25 | | 57 | | 5,040 | 800 | 89 | 1/2 | 1,075 |
| | HSB/HC 340L | 200,900 | 20.9 | 6.6 | 2.5 / 70.0 | 25 | | 57 | | 5,575 | 760 | 93 | 1/2 | 1,075 |
| Power Throw™ ③ | PT/PTN 610L | 344,900 | 35.9 | 0.6 | 6.0 / 100.0 | 24 | | 158 | | 12,400 | 2,445 | 86 | 1 1/2 | 1,140 |
| Vertical Delivery ③ | V 42L | 23,000 | 2.4 | 0.4 | 0.5 / 10.0 | 14 | **18** | 21 | **14** | 960 | 835 | 83 | 1/30 | 1,050 |
| | V 59L | 32,600 | 3.4 | 0.3 | 0.8 / 15.0 | 17 | **23** | 25 | **17** | 1,190 | 1,035 | 86 | 1/30 | 1,050 |
| | V 78L | 43,600 | 4.5 | 0.3 | 1.0 / 20.0 | 20 | **28** | 31 | **21** | 1,740 | 1,170 | 84 | 1/15 | 1,050 |
| | V 95L | 53,100 | 5.5 | 0.3 | 1.3 / 25.0 | 20 | **28** | 31 | **21** | 1,760 | 1,180 | 89 | 1/15 | 1,050 |
| | V/VN 139L | 81,200 | 8.5 | 1.6 | 1.0 / 30.0 | 24 | **33** | 37 | **25** | 2,860 | 1,380 | 87 | 1/6 | 1,075 |
| | V/VN 161L | 93,900 | 9.8 | 1.3 | 1.3 / 40.0 | 28 | **37** | 41 | **28** | 3,400 | 1,640 | 86 | 1/3 | 1,075 |
| | V/VN 193L | 112,500 | 11.7 | 1.3 | 1.5 / 50.0 | 29 | **38** | 43 | **29** | 3,710 | 1,790 | 89 | 1/3 | 1,075 |
| | V/VN 212L | 123,400 | 12.9 | 0.9 | 2.0 / 60.0 | 29 | **38** | 43 | **29** | 3,830 | 1,845 | 91 | 1/3 | 1,075 |
| | V/VN 247L | 143,600 | 15.0 | 1.2 | 2.0 / 60.0 | 34 | **45** | 51 | **35** | 5,110 | 2,030 | 87 | 1/2 | 1,075 |
| | V/VN 279L | 162,200 | 16.9 | 1.2 | 2.3 / 75.0 | 38 | **48** | 57 | **39** | 5,790 | 2,300 | 87 | 1/2 | 1,075 |
| | V/VN 333L | 198,300 | 20.7 | 2.3 | 2.3 / 75.0 | 38 | **48** | 57 | **39** | 6,340 | 2,300 | 90 | 3/4 | 1,140 |
| | V/VN 385L | 229,100 | 23.9 | 3.0 | 2.3 / 75.0 | 38 | **46** | 57 | **49** | 8,140 | 1,970 | 87 | 1 | 1,140 |
| | V/VN 500L | 295,000 | 30.7 | 2.8 | 3.0 / 100.0 | 48 | **57** | 72 | **49** | 11,000 | 2,670 | 85 | 1 1/2 | 1,140 |
| | V/VN 610L | 344,900 | 35.9 | 0.6 | 6.0 / 100.0 | 47 | **55** | 70 | **48** | 12,400 | 2,445 | 86 | 1 1/2 | 1,140 |
| | V 952L | 546,700 | 56.9 | 0.7 | 14.0 / 100.0 | 48 | | 72 | | 12,800 | 2,440 | 102 | 2 | 1,140 |

***Table 20.2 - Performance Data for Low Outlet Temperature Units at Standard Conditions of 200°F Entering Water and 60°F Entering Air – Reduced Motor Speeds ④***

| Type | Model No. | Btu/hr | Water Data | | Air Data | | | | | Motor Data | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GPM | Pressure Drop (Ft. of Water) | Maximum Mounting Height (ft.) ① | Heat Throw or Spread @ Max. Height ① | CFM ② | Outlet Velocity (Fpm) | Final Air Temp. (°F) | Hp | Approx. RPM |
| Horizontal Delivery | HSB/HC 18L | 8,700 | 1.2 | 0.4 | 10 | 13 | 230 | 410 | 94 | 1/60 | 1,000 |
| | HSB/HC 24L | 10,400 | 1.4 | 0.6 | 12 | 14 | 265 | 475 | 95 | 1/25 | 1,000 |
| | HSB/HC 33L | 14,700 | 2.0 | 0.2 | 13 | 16 | 430 | 455 | 91 | 1/25 | 1,000 |
| | HSB/HC 47L | 16,300 | 2.2 | 0.2 | 15 | 21 | 540 | 570 | 87 | 1/12 | 1,000 |
| | HSB/HC 63L | 29,000 | 4.0 | 0.4 | 17 | 21 | 725 | 435 | 96 | 1/12 | 1,000 |
| | HSB/HC 86L | 33,900 | 4.6 | 0.6 | 18 | 23 | 925 | 550 | 93 | 1/8 | 1,000 |
| | HSB/HC 108L | 50,500 | 6.9 | 1.8 | 20 | 23 | 1,330 | 510 | 94 | 1/8 | 1,000 |

① Horizontal units with horizontal louvers open 30° from vertical plane. Vertical types equipped with cone jet deflector, blades fully opened are shown in bold. Please see page 22 for additional outlet accessory performance data.
② Cfm for horizontal types is entering Cfm. Cfm for vertical and Power-Throw™ types is leaving Cfm.
③ V and PT models have copper tubes, VN and PTN models have 90/10 cupro-nickel tubes.
④ Requires Solid State Motor Speed Controller.

## Hot Water Performance Data – High Efficiency Low EWT Models

*Table 21.1 - Performance Data for Low Outlet Temperature Units at Standard Conditions of 140°F Entering Water and 60°F Entering Air – High Motor Speed*

| Type | Model No. | Btu/hr | Water Data | | | Air Data | | | | | Motor Data | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | GPM | Pressure Drop (Ft. of Water) | Min/Max GPM | Maximum Mounting Height (ft.) ① | Heat Throw or Spread @ Max. Height ① | CFM ② | Outlet Velocity (Fpm) | Final Air Temp. (°F) | Hp | Approx. RPM |
| Horizontal Delivery | HCH 22 | 21,688 | 2.2 | 4.9 | 0.8 / 10 | 8 | 27 | 370 | 408 | 113 | 1/25 | 1,550 |
| | HCH 39 | 38,547 | 3.9 | 1.5 | 1.4 / 18 | 8 | 28 | 660 | 409 | 113 | 1/25 | 1,550 |
| | HCH 67 | 66,875 | 6.8 | 2.6 | 2.6 / 31 | 9 | 33 | 1,150 | 456 | 113 | 1/6 | 1,075 |
| | HCH 104 | 104,204 | 10.4 | 4.8 | 4.1 / 48 | 11 | 39 | 1,830 | 503 | 112 | 1/6 | 1,075 |
| | HCH 170 | 169,564 | 17.0 | 7.4 | 6.8 / 77 | 11 | 42 | 2,870 | 475 | 115 | 1/3 | 1,140 |
| | HCH 195 | 194,917 | 19.5 | 10.4 | 8.0 / 88 | 11 | 40 | 3,200 | 455 | 115 | 1/3 | 1,140 |

## Hot Water Conversion Tables - Example Calculations

***Conversion factor example #1:***

What is the capacity (Btu/hr), water flow rate (GPM), water temperature drop (°F) and final air temperature (°F) for an HSB 86 at 240°F entering water temperature (EWT) and 70°F entering air temperature (EAT)? What is the maximum mounting height?

***Solution:***

The factors/data necessary to solve this problem are as follows:

- Hot water heating capacity conversion factor for 240°F EWT and 70°F entering air is 1.201, from Table 16.1.
- The standard rated capacity of an HSB 86 is 60,200 Btu/hr, from Table 19.1.
- The standard rated capacity of an HSB 86 is based on water flow rate of 6.3 GPM, from Table 19.1.
- The standard high motor speed airflow of an HSB 86 is 1340 CFM, from Table 19.1.
- The maximum mounting height, at standard conditions for an HSB 86 is 16 feet, from Table 19.1.
- The mounting height correction factor for 240°F EWT is 0.89 from Table 17.2.

$Btu_A = Btu_S$ x Heating Capacity Factor = 60,200 x 1.201 = 72,300 Btu/hr

For water flow rate, since only the entering water and air temperature conditions have changed, the water flow rate will remain 6.3 GPM.

$WTD_A = Btu_A \div (480 \times G_A)$ = 72,300 Btu/hr ÷ (480 x 6.3 GPM) = 23.9°F

$FAT_A = EAT_A + [(460 + EAT_A) \times (Btu_A) \div (576 \times Cfm_S)]$ = 70°F + [(460 + 70°F) x (72,300) ÷ (576 x 1340)] = 120°F

Max. Mounting $Height_A$ = Max. Mounting $Height_S$ x Correction Factor = 16 ft. x 0.89 = 14.2 feet

***Conversion factor example #2:***

Select a vertical unit heater model that can deliver at least 150,000 Btu/hr with 160°F EWT and 60°F EAT. What will be the required water flow rate, water temperature drop, final air temperature and maximum mounting height?

***Solution:***

The factors/data necessary to solve this problem are as follows:

- Hot water heating capacity conversion factor for 160°F EWT and 60°F entering air is 0.714, from Table 16.1.
- The mounting height correction factor for 160°F EWT is 1.19, from Table 17.2.

$Btu_S = Btu_A \div$ Heating Capacity Factor = 150,000 ÷ 0.714 = 210,084 Btu/hr (at standard conditions)
From Table 19.1, a V 279 model will meet the requirement with a rated capacity of 212,600 Btu/hr at standard conditions.

The capacity of the V 279 at actual conditions will be $Btu_A = Btu_S$ x Heating Capacity Factor = 212,600 x 0.714 = 151,796 Btu/hr.

Since the capacity was calculated based off standard conditions with factors for changes in entering water and air temperature conditions, the water flow rate will remain 22.2 GPM.

$WTD_A = Btu_A \div (480 \times GPM_A)$ = 151,796 Btu/hr ÷ (480 x 22.2 GPM) = 14.2°F

$FAT_A = EAT_A + [(460 + EAT_A) \div ((576 \times Cfm_S \div Btu_A) - 1)]$ = 60°F + [(460 + 60°F) ÷ ((576 x 5,460 ÷ 151,796) - 1)] = 86.4°F

Max. Mounting $Height_A$ = Max. Mounting $Height_S$ x Correction Factor = 40 ft. (with cone-jet deflector) x 1.19 = 47.6 feet

## Maximum Mounting Heights for Vertical Outlet Accessories, Dimensions

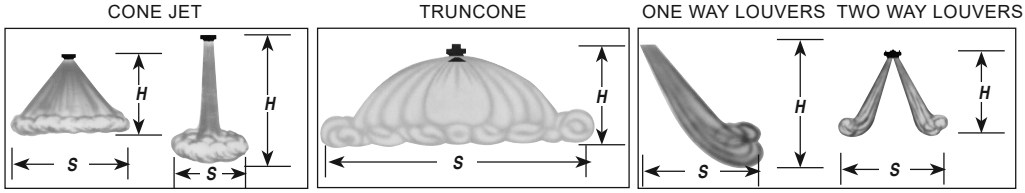



**Table 23.1**
**Mounting Height/Spread for Vertical Unit Air Outlet Accessories①②③④**

| | Cone-Jet | | | | Truncone | | | | One Way Louvers | | | | Two Way Louvers | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Standard | | L.O.T. | | Standard | | L.O.T. | | Standard | | L.O.T. | | Standard | | L.O.T. | |
| Model | H | S | H | S | H | S | H | S | H | S | H | S | H | S | H | S |
| V/VN 42 | 15 | 11 | 17 | 13 | 8 | 19 | 9 | 23 | 13 | 11 | 15 | 13 | 8 | 22 | 9 | 26 |
| V/VN 59 | 19 | 14 | 22 | 16 | 9 | 25 | 11 | 28 | 16 | 14 | 18 | 16 | 10 | 28 | 11 | 32 |
| V/VN 78 | 20 | 15 | 26 | 19 | 11 | 26 | 14 | 33 | 17 | 15 | 22 | 19 | 11 | 30 | 13 | 38 |
| V/VN 95 | 20 | 15 | 26 | 19 | 11 | 26 | 14 | 33 | 17 | 15 | 22 | 19 | 11 | 30 | 13 | 38 |
| V/VN 139 | 24 | 18 | 31 | 23 | 13 | 32 | 17 | 40 | 21 | 18 | 26 | 23 | 13 | 36 | 16 | 46 |
| V/VN 161 | 27 | 20 | 35 | 26 | 14 | 35 | 18 | 46 | 23 | 20 | 30 | 26 | 14 | 40 | 18 | 52 |
| V/VN 193 | 30 | 22 | 36 | 27 | 16 | 39 | 19 | 47 | 25 | 22 | 31 | 27 | 15 | 44 | 19 | 54 |
| V/VN 212 | 30 | 22 | 36 | 27 | 16 | 39 | 19 | 47 | 25 | 22 | 31 | 27 | 15 | 44 | 19 | 54 |
| V/VN 247 | 34 | 26 | 42 | 32 | 17 | 46 | 21 | 56 | 30 | 26 | 37 | 32 | 18 | 52 | 22 | 64 |
| V/VN 279 | 37 | 30 | 45 | 36 | 18 | 53 | 22 | 63 | 35 | 30 | 41 | 36 | 21 | 60 | 25 | 72 |
| V/VN 333 | 37 | 30 | 45 | 36 | 17 | 53 | 20 | 63 | 35 | 30 | 41 | 36 | 21 | 60 | 25 | 72 |
| V/VN 385 | 36 | 30 | 43 | 36 | 17 | 53 | 20 | 63 | 35 | 30 | 41 | 36 | 21 | 60 | 25 | 72 |
| V/VN 500 | 44 | 37 | 54 | 45 | 19 | 65 | 24 | 79 | 42 | 37 | 51 | 45 | 26 | 74 | 31 | 90 |
| V/VN 610 | 43 | 36 | 52 | 44 | 19 | 63 | 24 | 77 | 41 | 41 | 50 | 44 | 25 | 72 | 30 | 88 |
| V 952 | - | - | - | - | - | - | - | - | 45 | 56 | 54 | 65 | 26 | 66 | 31 | 82 |

① Data shown for standard 2 lb. steam, 60°F entering air temperature conditions. For louvers or cone-jet, data shown for deflectors in fully-opened position. For mounting height/spread at steam pressures other than 2 lb., multiply the value by the correction factor in Table 11.1.
② For mounting height and spread for hot water, multiple the values above by 1.06 to approximate the mounting height and spread at 200°F entering water temperature. For entering water temperature other than 200°F, multiply the values above by 1.06 and than multiply the correction factor in Table 16.2
③ All dimensions in feet.
④ V models have copper tubes and VN models have 90/10 cupro-nickel tubes.

**Figure 23.2 - Vertical Air Outlet Accessories**

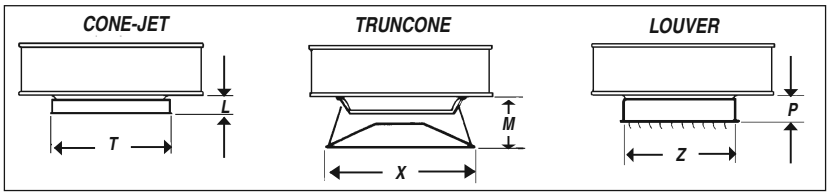



**Table 23.2 - Vertical Air Outlet Accessories Dimensions ⑤**

| Model | Cone-Jet | | Truncone | | Louvers | |
|---|---|---|---|---|---|---|
| Number | L | T | M | X | P | Z |
| V 42, V 59 | 6-1/2 | 18-7/8 | 12 | 22 | 6-1/2 | 16-7/8 |
| V 78, V 95 | 6-1/2 | 18-7/8 | 12 | 22 | 6-1/2 | 16-7/8 |
| V 139, V 212 | 7-1/2 | 24-3/4 | 13 | 27 | 7-1/2 | 19-3/4 |
| V 247, V 279 | 8 | 26-7/8 | 16 | 34 | 8 | 22-3/4 |
| V 333 | 8-1/2 | 28 | 16 | 34 | 8-1/2 | 22-3/4 |
| V 385, V 500 | 10 | 22-3/4 | 21 | 41 | 10 | 27-3/4 |
| V 610 | 10-1/2 | 36-3/4 | 21 | 41 | 10-1/2 | 30-3/4 |
| V-952 | - | - | - | - | 19-1/2 | 32 |

⑤ All dimensions in inches.

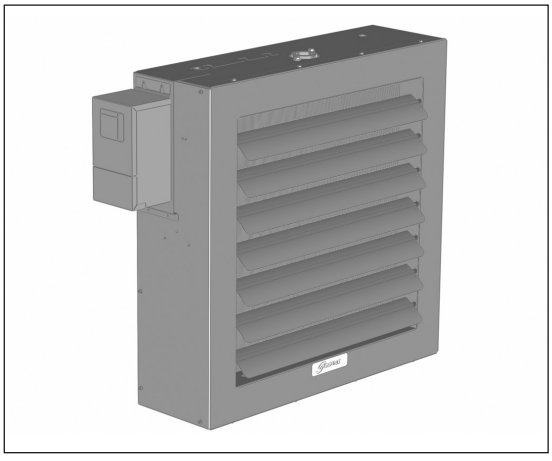
## Motor Data, Step-Down Transformer Accessory Data

### Table 24.1 - Motor Data ①②

| Model Number | Motor HP ③ | Available Motor Type, Voltage and Power Code | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Totally Enclosed | | | | | | Explosion-proof | |
| | | 115/60/1 | 208/60/1 | 230/60/1 | 208/60/3 | 230/460/3 | 575/60/3 | 115/60/1 | 230/460/60/3 |
| | | 01 | N/A | 02 | 04 | 05 | 10 | 06 | 09 |
| HSB/HC 18 | 1/60 | ✓ | ④ | ✓ | ④ | ④ | ④ | ✓ | - |
| HSB/HC/HCH 22, 39, 24, 33 | 1/25 | ✓ | ④ | ✓ | ④ | ④ | ④ | ✓ | - |
| HSB/HC 47, 63 | 1/12 | ✓ | ④ | ✓ | ④ | ✓ ⑤ | ④ | ✓ | - |
| HSB/HC/HCH 67, 104, 86, 108 | 1/6, 1/8 | ✓ | ④ | ✓ | ④ | ✓ ⑤ | ④ | ✓ | - |
| HSB/HC 121 | 1/5 | ✓ | ④ | ✓ | ✓ ⑤ | ✓ ⑤ | ④ | ✓ | ✓ |
| HSB/HC/HCH 165, 170, 193, 195 | 1/3 | ✓ | ④ | ✓ | ✓ ⑤ | ✓ ⑤ | ④ | ✓ | ✓ |
| HSB/HC 258-340 | 1/2 | ✓ | ④ | ✓ | ✓ ⑤ | ✓ ⑤ | ④ | ✓ | ✓ |
| V/VN 42, 59 | 1/30 | ✓ | ④ | ✓ | ✓ ⑤ | ✓ ⑤ | ④ | ✓ | - |
| V/VN 78, 95 | 1/15 | ✓ | ④ | ✓ | ✓ ⑤ | ✓ ⑤ | ④ | ✓ | - |
| V/VN 139 | 1/5 | ✓ | ④ | ✓ | ✓ ⑤ | ✓ ⑤ | ④ | ✓ | ✓ |
| V/VN 161-212 | 1/3 | ✓ | ④ | ✓ | ✓ ⑤ | ✓ ⑤ | ④ | ✓ | ✓ |
| V/VN 247 | 1/2 | ✓ | ④ | ✓ | ✓ ⑤ | ✓ ⑤ | ④ | ✓ | ✓ |
| V/VN, PT/PTN 279 | 1/2 | ✓ | ④ | ✓ | ✓ ⑤ | ✓ ⑤ | ④ | ✓ | ✓ |
| V/VN, PT/PTN 333 | 3/4 | ✓ | ④ | ✓ | ✓ ⑤ | ✓ ⑤ | ④ | - | - |
| V/VN, PT/PTN 385 | 1 | - | - | - | ✓ | ✓ | ✓ | - | ✓ |
| V/VN, PT/PTN 500, 610 | 1-1/2 | - | - | - | ✓ | ✓ | ✓ | - | ✓ |
| V, PT 952 | 2 | - | - | - | - | ✓ | - | - | ✓ |

① Ratings shown are for Standard and Low Outlet Temperature Models.
② All HSB/HC units, V/VN 42 thru V/VN, PT/PTN 333 motor HP listed for power code 01. V/VN PT/PTN 333 thru V/VN, PT/PTN 610 motor HP listed for power code 04 and V/PT 952 motor HP listed for power code 05.
③ For model sizes V/VN/PT/PTN 385 and above, motors for Power Codes 04, 05, and 10 do not have thermal overload protection.
④ For supply voltages of 208V/60Hz/1ph and all non-explosion-proof 3 phase voltages of 208, 230, 460 and 575, Model Numbers indicated with Note ④, require that a 115V/60Hz/1 phase Power Code 01 unit heater be used with a shipped loose accessory transformer. See Table 24.2 for Transformer Sizes.
⑤ For non-explosion-proof 3 phase supply voltages of 208, 230, and 460, Model Numbers indicated with Note ⑤, can be ordered with a Power Code (208V/3ph=04, 230/460V/3ph=05) that provides a motor matched to the supply voltage with amp draw as shown. Alternately, a 115V/60Hz/1 phase Power Code 01 unit heater could be used with a shipped loose accessory transformer. See Table 24.2 for Transformer Sizes.

### Figure 24.1
### Field Installed Transformer Accessory



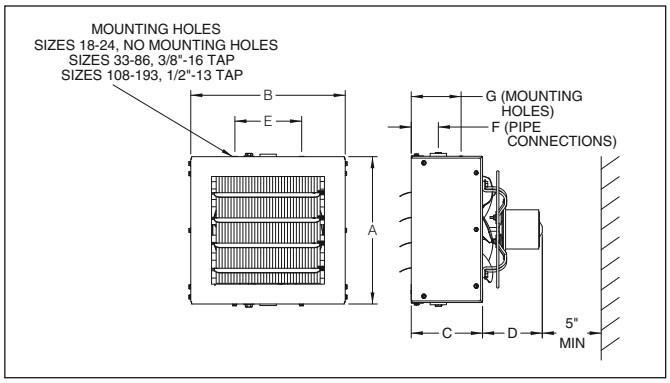
### Table 24.2 - Step-Down Transformer Accessory Selection

| Model Number | 208V/60Hz/1 or 3 phase kVA | 230/460V/ 60Hz/3 phase kVA | 575V/60Hz/ 3 phase kVA |
|---|---|---|---|
| HSB/HC 18-63 | 0.50 | 0.25 | 0.25 |
| HSB/HC 86-121 | | 0.50 | 0.50 |
| HSB/HC 165-193 | 1.00 | 0.75 | 0.75 |
| HSB/HC 258-340 | | 1.00 | 1.00 |
| V/VN 42-59 | 0.50 | 0.25 | 0.25 |
| V/VN 78-139 | | 0.50 | 0.50 |
| V/VN 161-212 | 1.00 | 0.75 | 0.75 |
| V/VN 247-333 | | 1.00 | 1.00 |
| PT/PTN 279-333 | 1.00 | 1.00 | 1.00 |

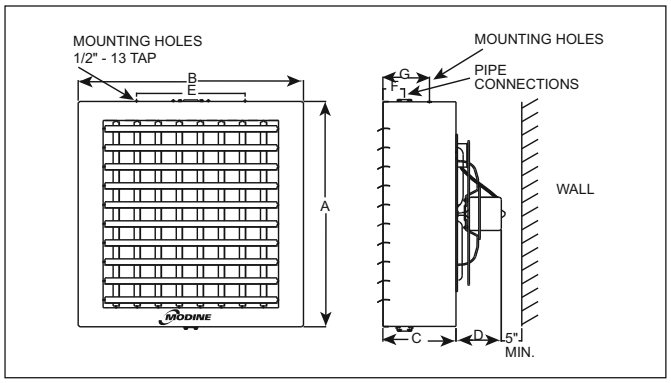
| kVA Size | Ship Wt. (Lb.) |
|---|---|
| 0.25 | 7 |
| 0.50 | 13 |
| 0.75 | 15 |
| 1.00 | 19 |

## Dimensions - Horizontal Air Delivery Models

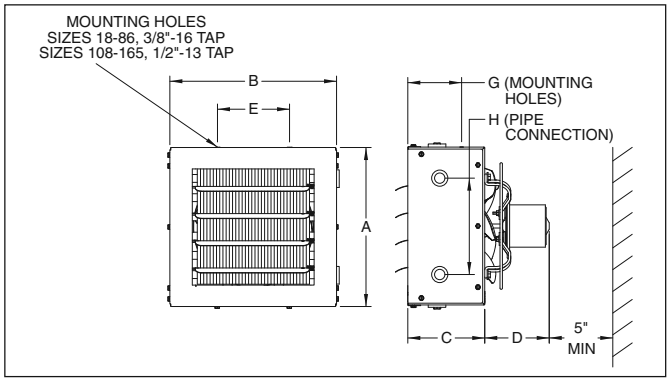
### Figure 25.1 - Model Dimensions HSB 18-193



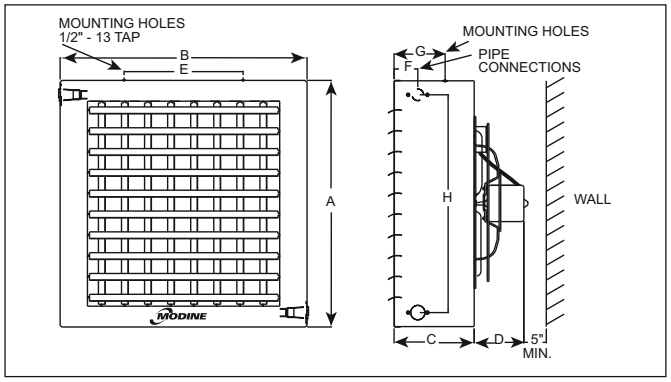

### Figure 25.2 - Model Dimensions HSB 258-340




### Figure 25.3 - Model Dimensions HC 18-165




### Figure 25.4 - Model Dimensions HC 193-340 ①




① Vertical deflector blades shown are standard on models HC 258-340 and optional on model HC 193.

### Table 25.1 - Model HSB and HC Dimensions ②③

| Model Number | A | B | C | D | | E | F | G | H | Female Connections NPT | Fan Diameter | Approx. Shipping Wt. lb. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 115 Std. Motor | 115V Exp. Motor | | | | | | | |
| HSB 18 | 12-3/8 | 13 | 6 | 5 | 12-1/4 | - | 3 | - | - | 3/4 | 9 | 16 |
| HSB 24 | 12-3/8 | 13 | 6 | 5 | 12-1/4 | - | 3 | - | - | 3/4 | 9 | 20 |
| HSB 33 | 16-3/8 | 17-1/2 | 8-3/4 | 6 | 11-3/4 | 11 | 3-5/8 | 6 | - | 1-1/4 | 12 | 34 |
| HSB 47 | 16-3/8 | 17-1/2 | 8-3/4 | 6 | 11-3/4 | 11 | 3-5/8 | 6 | - | 1-1/4 | 12 | 36 |
| HSB 63 | 20-7/16 | 21-1/2 | 8-3/4 | 7-3/4 | 12 | 15 | 3-5/8 | 6 | - | 1-1/4 | 14 | 48 |
| HSB 86 | 20-7/16 | 21-1/2 | 8-3/4 | 7-3/4 | 12 | 15 | 3-5/8 | 6 | - | 1-1/4 | 14 | 52 |
| HSB 108 | 24-7/16 | 25-1/2 | 9-1/2 | 6-3/4 | 13-1/4 | 18 | 3-3/4 | 6-3/8 | - | 1-1/4 | 18 | 74 |
| HSB 121 | 24-7/16 | 25-1/2 | 9-1/2 | 6-3/4 | 13-1/4 | 18 | 3-3/4 | 6-3/8 | - | 1-1/4 | 18 | 76 |
| HSB 165 | 30-1/2 | 30-1/2 | 9-1/4 | 8-1/2 | 14 | 21-1/4 | 3-3/4 | 6-3/8 | - | 1-1/4 | 22 | 92 |
| HSB 193 | 30-1/2 | 30-1/2 | 9-1/4 | 8-1/2 | 14 | 21-1/4 | 3-3/4 | 6-3/8 | - | 1-1/4 | 22 | 98 |
| HSB 258 | 38-1/2 | 38-1/2 | 12-1/2 | 10 | 15 | 18-1/2 | 3-5/8 | 7-7/8 | - | 1-1/4 | 22 | 162 |
| HSB 290 | 38-1/2 | 38-1/2 | 12-1/2 | 10 | 15 | 18-1/2 | 3-5/8 | 7-7/8 | - | 1-1/4 | 24 | 168 |
| HSB 340 | 38-1/2 | 44-1/2 | 12-1/2 | 10 | 15 | 18-1/2 | 3-5/8 | 7-7/8 | - | 1-1/4 | 24 | 176 |
| HC 18 | 11-1/2 | 13 | 6 | 5 | 12-1/4 | 5-5/8 | 2-1/4 | 4-1/8 | 7-1/2 | 1/2 | 9 | 16 |
| HC 24 | 11-1/2 | 13 | 6 | 5 | 12-1/4 | 5-5/8 | 2-1/4 | 4-1/8 | 7-1/2 | 1/2 | 9 | 20 |
| HC 33 | 15 | 17-1/2 | 8-3/4 | 6 | 11-3/4 | 11 | 3-5/8 | 6 | 10 | 3/4 | 12 | 34 |
| HC 47 | 15 | 17-1/2 | 8-3/4 | 6 | 11-3/4 | 11 | 3-5/8 | 6 | 10 | 3/4 | 12 | 35 |
| HC 63 | 18-1/2 | 21-1/2 | 8-3/4 | 7-3/4 | 12 | 15 | 3-5/8 | 6 | 14 | 3/4 | 12 | 48 |
| HC 86 | 18-1/2 | 21-1/2 | 8-3/4 | 7-3/4 | 12 | 15 | 3-5/8 | 6 | 14 | 3/4 | 14 | 52 |
| HC 108 | 22-1/2 | 25-1/2 | 9-1/2 | 6-3/4 | 13-1/4 | 18 | 3-5/8 | 6-3/8 | 18 | 3/4 | 18 | 74 |
| HC 121 | 22-1/2 | 25-1/2 | 9-1/2 | 6-3/4 | 13-1/4 | 18 | 3-5/8 | 6-3/8 | 18 | 3/4 | 18 | 76 |
| HC 165 | 26-1/2 | 29-1/2 | 9-1/4 | 8-1/2 | 14 | 21-1/4 | 3-5/8 | 6-3/8 | 22 | 3/4 | 22 | 92 |
| HC 193 | 30-1/2 | 32-1/2 | 9-1/4 | 8-1/2 | 14 | 21-1/4 | 3-5/8 | 4-3/4 | 26 | 1-1/4 | 22 | 98 |
| HC 258 | 38-1/2 | 38-1/2 | 12-1/2 | 10 | 15 | 18-1/2 | 3-5/8 | 8 | 34 | 1-1/4 | 22 | 163 |
| HC 290 | 38-1/2 | 38-1/2 | 12-1/2 | 10 | 15 | 18-1/2 | 3-5/8 | 8 | 34 | 1-1/4 | 24 | 168 |
| HC 340 | 38-1/2 | 44-1/2 | 12-1/2 | 10 | 15 | 18-1/2 | 3-5/8 | 8 | 34 | 1-1/4 | 24 | 176 |

② All dimensions in inches.

③ Dimensions shown are for Standard and Low Outlet Temperature Models.

## Dimensions - Horizontal Air Delivery Models

*Figure 26.1 - Model Dimensions HCH 22-195*

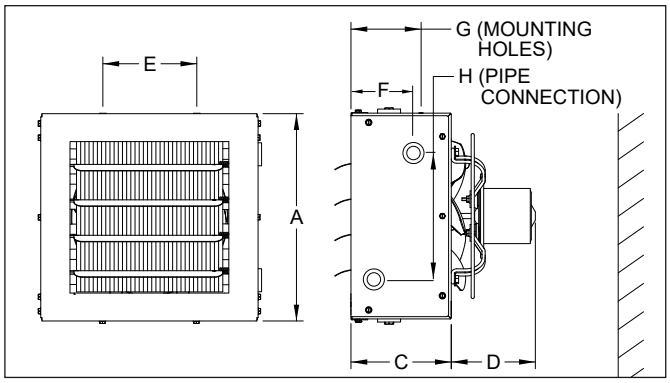


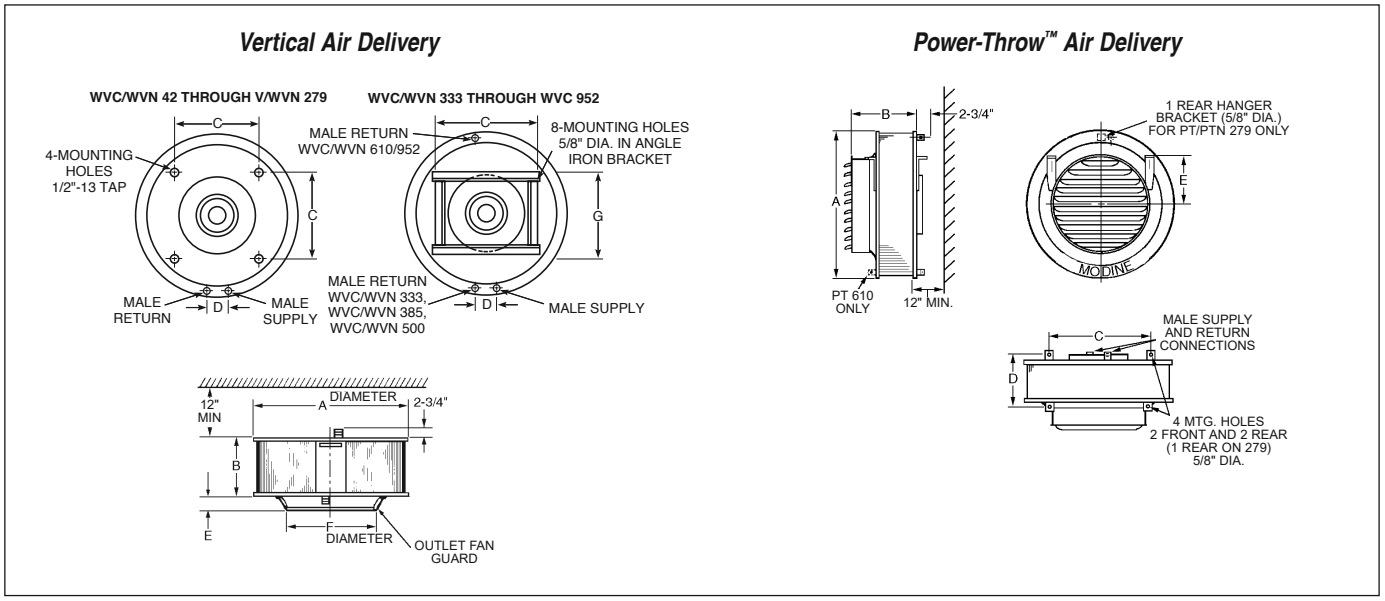

*Table 26.2- Model Dimensions HCH 22-195* ①

| Model Number | A | B | C | D | | E | F | | G | H | Connections Copper Tube OD (in.) | Fan Diameter (in.) | Shipping Wt. lb. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 115V Std. Motor | Exp. Motor | | Inlet | Outlet | | | | | |
| HCH 22 | 14.5 | 20.2 | 8.4 | 7 | 11.5 | 11.0 | 3.1 | 5.7 | 6.5 | 7.2 | 0.5 | 9 | 32 |
| HCH 39 | 18.5 | 24.5 | 8.4 | 7 | 11.5 | 15.0 | 3.1 | 5.7 | 6.6 | 13.2 | 0.875 | 12 | 46 |
| HCH 67 | 22.5 | 29.0 | 9.7 | 10 | 16 | 18.5 | 3.1 | 5.7 | 6.7 | 17.2 | 1.125 | 14 | 80 |
| HCH 104 | 26.5 | 33.0 | 9.7 | 8.5 | 15 | 21.0 | 3.2 | 5.8 | 6.7 | 21.2 | 1.125 | 18 | 93 |
| HCH 170 | 34.5 | 39.5 | 11.2 | 10.5 | 16 | 22.0 | 3.2 | 5.8 | 6.7 | 29.2 | 1.375 | 19 | 145 |
| HCH 195 | 34.5 | 45.5 | 11.2 | 10.5 | 16 | 24.0 | 3.2 | 5.8 | 6.7 | 29.2 | 1.375 | 20 | 160 |

① All dimensions in inches.

## Dimensions - Vertical Air Delivery Models

### Figure 27.1 - Model V/VN and PT/PTN Dimensions




### Table 27.2 - Model V/VN and PT/PTN Dimensions ①②③

| Model Number | A | B | C | D | E | F | G | Fan Diameter | Male Connections NPT Top | Male Connections Shipping Bottom | Approx. Wt. (lb.) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| V/VN 42 | 24-3/4 | 3-5/8 | 11-3/8 | 2-1/8 | 4-3/8 | 14-1/2 | - | 14 | 1-1/4 | 1-1/4 | 36 |
| V/VN 59 | 24-3/4 | 5-1/8 | 11-3/8 | 2-1/8 | 4-3/8 | 14-1/2 | - | 14 | 1-1/4 | 1-1/4 | 42 |
| V/VN 78 | 24-3/4 | 6-5/8 | 11-3/8 | 2-1/8 | 2-5/8 | 16-1/2 | - | 16 | 1-1/4 | 1-1/4 | 46 |
| V/VN 95 | 24-3/4 | 8-1/8 | 11-3/8 | 2-1/8 | 2-5/8 | 16-1/2 | - | 16 | 1-1/4 | 1-1/4 | 48 |
| V/VN 139 | 34-3/4 | 6-7/8 | 18-3/8 | 2-1/8 | 3 | 19-1/2 | - | 19 | 1-1/2 | 1 | 70 |
| V/VN 161 | 34-3/4 | 8-3/8 | 18-3/8 | 2-1/8 | 3 | 19-1/2 | - | 19 | 1-1/2 | 1 | 80 |
| V/VN 193 | 34-3/4 | 9-7/8 | 18-3/8 | 2-1/8 | 3 | 19-1/2 | - | 19 | 1-1/2 | 1 | 86 |
| V/VN 212 | 34-3/4 | 12-7/8 | 18-3/8 | 2-1/2 | 3 | 19-1/2 | - | 19 | 2 | 1-1/4 | 94 |
| V/VN 247 | 34-3/4 | 12-7/8 | 18-3/8 | 2-1/2 | 3 | 21-1/2 | - | 21 | 2 | 1-1/4 | 108 |
| V/VN 279 | 34-3/4 | 14-3/8 | 18-3/8 | 2-1/2 | 3 | 21-1/2 | - | 21 | 2 | 1-1/4 | 112 |
| V/VN 333 | 43-1/4 | 14-5/8 | 31-1/2 | 2-7/8 | 3-1/8 | 22-1/2 | 18-1/5 | 22 | 2-1/2 | 1-1/2 | 166 |
| V/VN 385 | 43-1/4 | 14-1/2 | 31-1/2 | 2-7/8 | 3-1/2 | 27-1/2 | 18-1/5 | 27 | 2-1/2 | 1-1/2 | 168 |
| V/VN 500 | 43-1/4 | 19 | 31-1/2 | 2-7/8 | 3-1/2 | 27-1/2 | 18-1/5 | 27 | 2-1/2 | 1-1/2 | 360 |
| V/VN 610 | 51-1/2 | 19-1/8 | 31-3/8 | - | 3-3/4 | 30-1/2 | 31-3/8 | 30 | 2-1/2 | 1-1/2 | 450 |
| V 952 | 53-3/4 | 21-1/8 | 30 | - | 3-1/2 | 31 | 30 | 30 | 3 | 3 | 487 |
| PT/PTN 279 | 34-3/4 | 22-5/8 | 25-1/4 | 16-3/4 | 16-3/4 | - | - | 21 | 2 | 1-1/4 | 122 |
| PT/PTN 333 | 43-1/4 | 23-7/8 | 30 | 15-3/4 | 14-3/8 | - | - | 22 | 2-1/2 | 1-1/2 | 176 |
| PT/PTN 385 | 43-1/4 | 25-3/4 | 30 | 15-3/4 | 14-3/8 | - | - | 27 | 2-1/2 | 1-1/2 | 184 |
| PT/PTN 500 | 43-1/4 | 29 | 30 | 20-1/4 | 14-3/8 | - | - | 27 | 2-1/2 | 1-1/2 | 376 |
| PT/PTN 610 | 51-1/2 | 29-5/8 | 30 | 20-3/8 | 21 | - | - | 30 | 2-1/2 | 1-1/2 | 472 |
| PT 952 | 53-3/4 | 26-3/8 | 30 | 23-1/8 | 26-7/8 | - | - | 30 | 3 | 3 | 487 |

① All dimensions in inches.
② Dimensions shown are for Standard and Low Outlet Temperature Models.
③ See page 24 for optional air outlet accessory dimensions.

## Model Identification

*Figure 28.1*
*Model Number Designation*

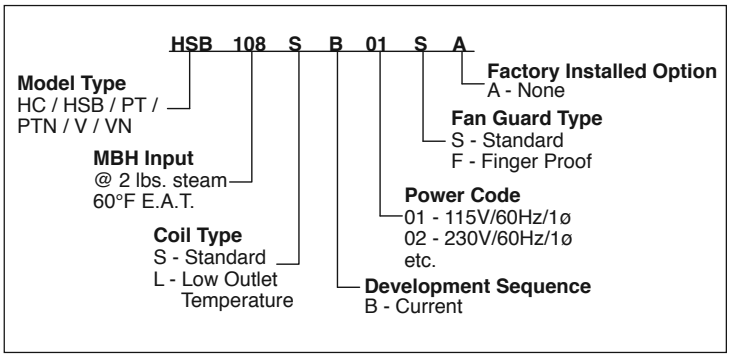



*Figure 28.2*
*Serial Number Designation*

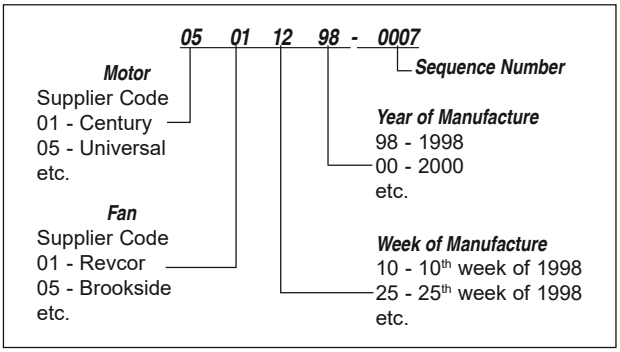
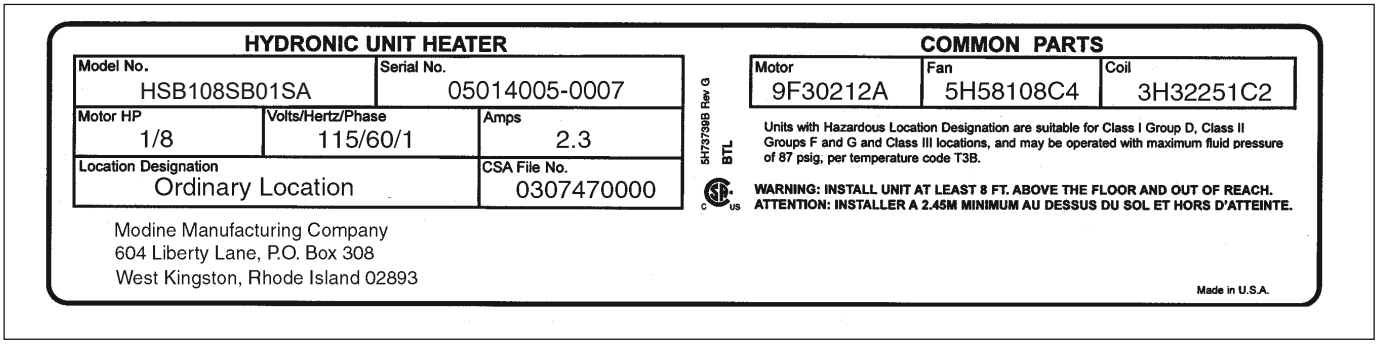



*Figure 27.3*
*Model Identification Plate*



## Specification for Horizontal, Vertical and Power-Throw™ Models

### General

Contractor shall furnish and install steam/hot water unit heater model _____. Performance shall be as indicated on the equipment schedule in the plans. Units shall be listed by CSA as certified to CAN/CSA-C22.2 No. 236-05 “Heating and Cooling Equipment” and UL Std. No. 1995 “Heating and Cooling Equipment.” Additionally for Canada, the units shall have CRN registered heat exchangers.

### Casing

***HSB and HC Models*** - Casings on model sizes 18 through 86 are 20 gauge steel (18 gauge on all other models) and consist of front and back halves. Both halves are joined together at the top and bottom utilizing the condenser mounting screws. Casing top is provided with threaded hanger connections for unit suspension (except for HSB 18 and HSB 24 which are directly mounted to the supply and return piping). Fan venturi is formed in casing back half.

***Vertical and Power-Throw™ Models*** - Casings consist of two circular 18 gauge steel covers. With the coil in between, the covers are securely bolted together to form a single unit. The bottom cover has a die-formed fan venturi. The top cover incorporates a motor cooling cone, which shields the motor from coil heat therefore prolonging motor life. An opening is also provided for circulation of motor cooling air.

***All Models -*** Casing shall be treated to prevent corrosion and painted with a corrosion resistant, baked, polyester powdercoat gray-green finish.

### Condenser

Condenser coils are of the extended surface type, utilizing aluminum fins and DLP-type copper tubes with malleable iron supply and return connections for HSB units, cast bronze connections for HC models and Schedule 40 steel pipe for V/PT models. Tubes are mechanically bonded to the collars of the fins. The condensers are warranted for operation at steam or hot water pressures and temperatures up to 150 psig and 375°F for copper coils and 250 psig and 400°F for 90/10 cupro-nickel coils.

Fins are continuous across the width and depth of the condenser and are vertically oriented to minimize the collection of dirt and dust.

Canadian Standards Association (CSA) requirements state that explosion-proof units (Power Codes 06 and 09) may not be used with fluid temperatures in excess of 329°F or pressures in excess of 87 psig and still maintain their explosion-proof rating for National Electric Code ignition temperature rating T3B for grain dust.

All coils are leak tested at 165 to 200 psig, air under water.

***Horizontal Models -*** Coils are of serpentine design with horizontal tubes, vertical fins and center supply and return connections at top and bottom of unit (except HC models, which have side connections). All tube bends are brazed. All tubes have individual expansion bends. Copper tubes are 1" O.D. with 0.030" wall thickness (except HSB/HC 18 and 24 which are 5/8" O.D. with 0.028" wall thickness).

***Vertical and Power-Throw™ Models*** - Coils are circular, providing for natural expansion. Each tube is continuous between supply and return header. All tube joints are silver soldered. Copper tubes are 5/8" O.D. with 0.028" wall thickness.

***Motors*** - See page 8 for Power Code and motor descriptions and page 23 for motor amp draw information. Motors are designed for continuous duty and can operate in a maximum ambient temperature of 104°F(40°C).

***Fans/Fan Guards*** - Fans are aluminum on all units and are secured to a steel hub. Each fan is balanced and is designed specifically for the unit heater on which it is installed. Horizontal units are equipped with a combination fan guard/motor-mounting bracket. The guard is constructed of steel rod. Vertical units are supplied with an outlet fan guard covering the opening in the bottom of the unit.

***Air Deflectors*** - Horizontal units, including the Power-Throw™ units, are furnished with horizontal air deflectors as standard. The deflectors are adjustable to almost any desired position for downward, straight or upward airflow. Vertical deflectors are available as an accessory for HSB/HC models through size 193, standard on model sizes 258-340. See page 22 for air outlet accessories for vertical models.

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Products from Modine are designed to provide indoor air-comfort and ventilation solutions for residential, commercial, institutional and industrial applications. Whatever your heating, ventilating and air conditioning requirements, Modine has the product to satisfy your needs, including:

### HVAC

- Unit Heaters:
  - Gas
  - Hydronic
  - Electric
  - Oil
- Ceiling Cassettes
- Duct Furnaces
- Hydronic Cabinet Unit Heaters, Fin Tube, Convectors
- Infrared Heaters
- Make-up Air Systems
- Unit Ventilators

### Ventilation

- Packaged Rooftop Ventilation

### School Products

- Vertical Packaged Classroom HVAC:
  - DX Cooling/Heat Pump
  - Water/Ground Source Heat Pump
  - Horizontal/Vertical Unit Ventilators

Specific catalogs are available for each product. Catalogs 75-136 and 75-137 provide details on all Modine HVAC equipment.

Modine Manufacturing Company

1500 DeKoven Avenue
Racine, Wisconsin 53403-2552
Phone: 1.800.828.4328 (HEAT)
www.modinehvac.com

# Current Switches: Adjustable Trip Point

## Hx08 Series & H701

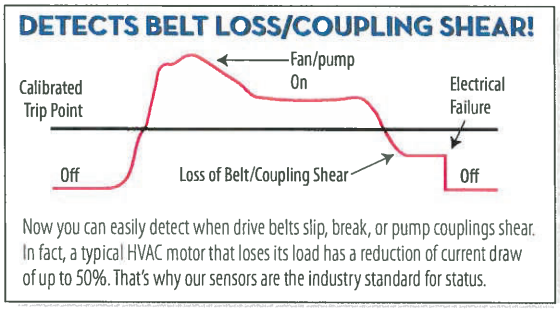
### CS1, CS4, CS10


## SPECIFICATIONS

5 Year Warranty

| | |
|---|---|
| **Sensor Power** | Induced from monitored conductor |
| **Insulation Class** | 600VAC RMS (UL), 300VAC RMS (CE) |
| **Frequency Range** | 50/60 Hz, On/Off status for Variable Frequency Drive (VFD) outputs at 12 to 115 Hz* |
| **Temperature Range** | -15° to 60°C (5° to 140°F) |
| **Humidity Range** | 10-90% RH, non-condensing |
| **Hysteresis** | 10% (typical) |
| **Terminal Block Wire Size**<br>*H608, H701, H708, H808, H908*<br>*H308* | <br>24-14 AWG (0.2 to 2.1 mm²);<br>22-16 AWG (0.3 to 1.3 mm²) |
| **Terminal Block Torque**<br>*H608, H701, H708, H808, H908*<br>*H308* | <br>3.5 to 4.4 in-lbs (0.4 to 0.5 N-m);<br>7 in-lbs (0.8 N-m) |
| **Agency Approvals** | UL 508 open device listing; CE: EN61010-1, CAT III, pollution degree 2, basic insulation |

*Do not use the LED status indicators as evidence of applied voltage.*
*If using this switch in an application that includes an electronically commutated motor (ECM), see Veris Application Note VN61, at www.veris.com.*
** VFD systems generate fields that can disrupt electrical devices. Ensure that these fields are minimized and are not affecting the sensor.*




## Detect Belt Loss, Coupling Shear, And Mechanical Failure

### FEATURES

- *High performance devices in split- and solid-core housings*
- *Adjustable trip point...precise current trip point setting*
- *Minimum trip point as low as 0.5 A (H608)...eliminates the need for multiple wraps of the conductor through the sensor even on loads as small as 1/5 HP*
- *Small size...fits easily inside small enclosures*
- *Self-gripping iris on the split-core housing for easy installation*
- *Status LEDs available for easy setup and local indication*
- *Bracket on H908 can be installed in three different configurations...installation flexibility in tight spaces*
- *1 Amp status output...increased application flexibility*
- *All devices are 100% solid state for high reliability and polarity insensitive for trouble-free installation, with a 5-year warranty*

### DESCRIPTION

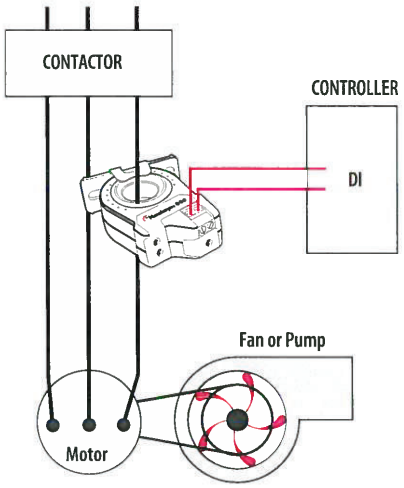
**Hx08 Series** and **H701** adjustable current switches offer high performance, with a wide array of amperage range options. These products can accurately detect belt loss, coupling shear, or other mechanical failure on unit vents, exhaust fans, recirculation pumps, and other fixed loads from 1/5 to 100 HP.

### APPLICATIONS

- *Detecting belt loss, coupling shear, and mechanical failure*
- *Verifying lighting circuit and other electrical service run times*
- *Monitoring status of industrial process equipment*
- *Monitoring status of critical motors (compressor, fuel, etc.)*
- *VFD output On/Off status*

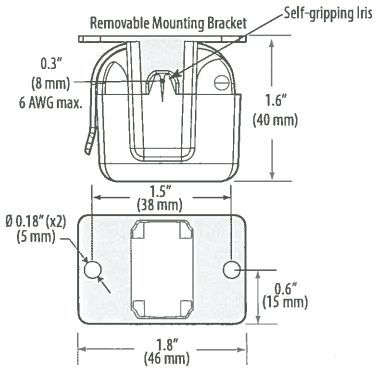
## WIRING DIAGRAMS

*Monitoring Fan /Pump Motors for Positive Proof of Flow*

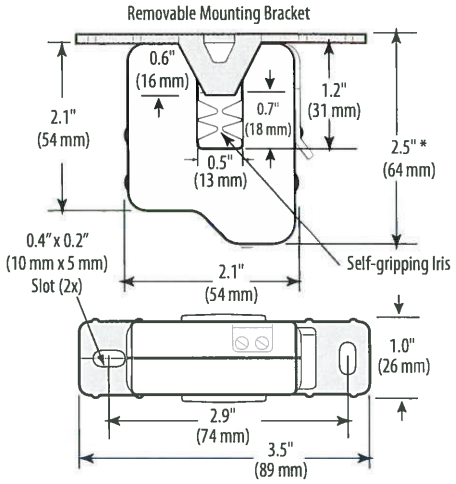



## DIMENSIONAL DRAWINGS

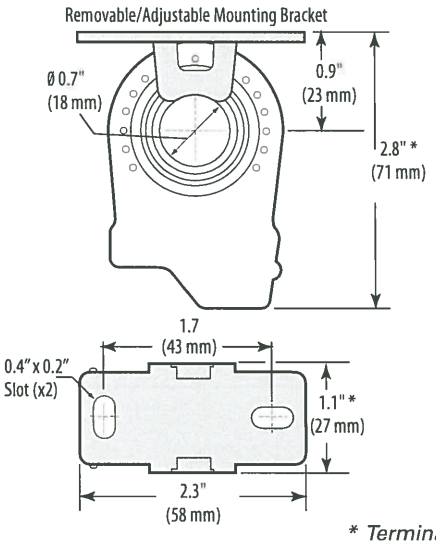
*H308*



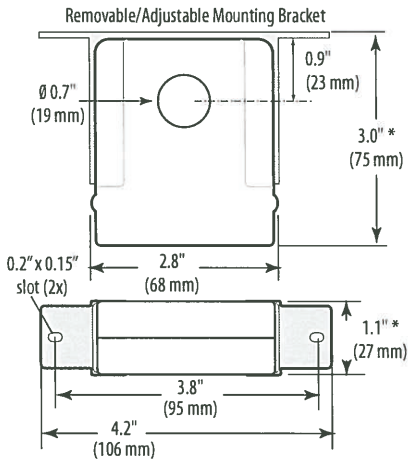

*H608*



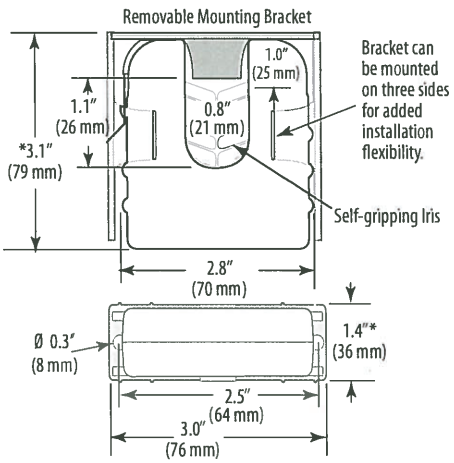

*H808*




*H708/701*




*H908*




* *Terminal block may extend up to 1/8" over the height dimensions shown.*

## ORDERING INFORMATION

| | MODEL | AMPERAGE RANGE @ 50/60 Hz only | STATUS OUTPUT (max.) | MIN. TRIP POINT | HOUSING | STATUS LED | UL | CE | RoHS |
|---|---|---|---|---|---|---|---|---|---|
| | H308 | 0.75 - 50A | N.O. 1.0A@30VAC/DC | 0.75A or less | Split-Core | ● | ● | ●[2] | ● |
| CS1 → | H608 | 0.5 - 175A | | 0.5A or less | Split-Core | ● | ●[1] | ● | ● |
| | H701 | 1 - 135A | | 1.0A or less | Solid-Core | | ● | ● | |
| CS4 → | H708 | 1 - 135A | | 1.0A or less | Solid-Core | ● | ● | ● | |
| CS10 → | H808 | 0.75 - 50A | | 0.75A or less | Solid-Core | ● | ● | ● | ● |
| | H908 | 2.5 - 135A | | 2.5A or less | Split-Core | ● | ● | ● | ● |

*1 Listed for use on 75°C insulated conductors.*
*2 Product provides functional insulation only.*

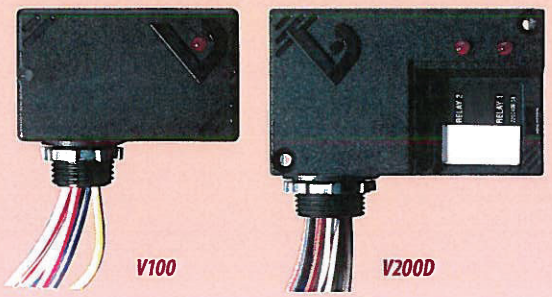
## ACCESSORIES

*DIN Rail Clip Set (AH01 for H6xx, H8xx, H9xx; AH27 for H3xx) DIN Rail (AV01) and DIN Stop Clip (AV02)*

*AH27* *AH01* *AV01* *AV02*

# Enclosed Victory Relays: 10A SPDT

## Great For External Mount Applications




## DESCRIPTION

**Victory 100 and 200 Series** 10A enclosed relays are pilot-duty relays in an easy-to-use nipple mount enclosure. The V100/V200 Series provide quick relay mounting without a dedicated field enclosure, making them ideal for retrofit projects. Field-selectable high and low voltage coil inputs provide on-site versatility.

## APPLICATIONS

- Command contactors
- Control motors
- Isolation
- Device interlocking
- Relay logic
- Sense voltages for alarm conditions

**R1, R3, R4**

## FEATURES

- Sleek field enclosure reduces the need for panel space
- The nipple mount feature allows the Victory Series to be mounted to any electrical enclosure
- Flexible tinned stranded wire...fits easily in tight spaces & provides secure connections to wire nuts
- UL508 Listed...designed and approved for field installation...makes electrical inspection a snap
- Run low voltage instead of line voltage...eliminate conduit in some applications

## TYPICAL COIL PERFORMANCE

| Pull in Voltage | AC | DC |
|---|---|---|
| 10-30V | 8 | 9 |
| 120V | 78 | |
| 208-277V | 154 | |
| **Drop Out Voltage** | **AC** | **DC** |
| 10-30V | 2 | 3 |
| 120V | 18 | |
| 208-277V | 36 | |
| **Voltage** | **Coil Current** | |
| | **AC** | **DC** |
| 10V | 25mA | 14mA |
| 12V | 25mA | 14mA |
| 24V | 31mA | 16mA |
| 30V | 39mA | 18mA |
| 120V | 22mA | - |
| 208V | 19mA | |
| 277V | 25mA | |

## CONTACT RATINGS

| | |
|---|---|
| **Resistive** | 10A@277VAC, 28VDC |
| **Motor** | 120VAC, 1/3HP N.O. & 1/6HP N.C. |
| | 240VAC, 1/3HP N.O. & 1/6HP N.C. |
| | 277VAC, 1/4HP N.O. & 1/8HP N.C. |
| **Pilot Duty** | 277VAC, (1.7A), 480VA N.O. |
| **Ballast** | 277VAC, 1.7A |
| **Tungsten** | 120VAC, TV3 N.O. TV2 N.C. |
| **Gold Flash** | Yes |

## SPECIFICATIONS

5 Year Warranty

*Operating Temperature Range:*

| | |
|---|---|
| **V100, V100DC, V200** | -34° to 60°C (-29° to 140°F) |
| **V100D, V200D** | -40° to 55°C (-40° to 131°F) |
| **Operating Humidity Range** | 10-90% RH non-condensing |
| **Expected Relay Life** | Electrical (@ rated current) 100,000 cycles; Mechanical (unpowered) 10,000,000 cycles |
| **Relay Status** | LED ON=energized |

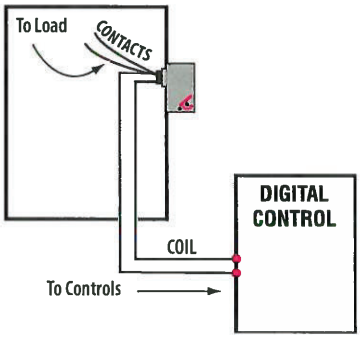
*Wire Specifications:*

| | |
|---|---|
| **Lead Length** | 14" (356 mm) min. |
| **Gauge** | UL1015; Coil: 18 AWG; Contacts: 16 AWG |
| **Insulation Class** | 600VAC RMS |
| **Agency Approvals** | UL 508 |

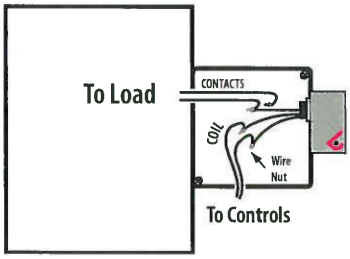
VERIS INDUSTRIES

## APPLICATION/WIRING EXAMPLES

*Nipple mount directly to a panel*

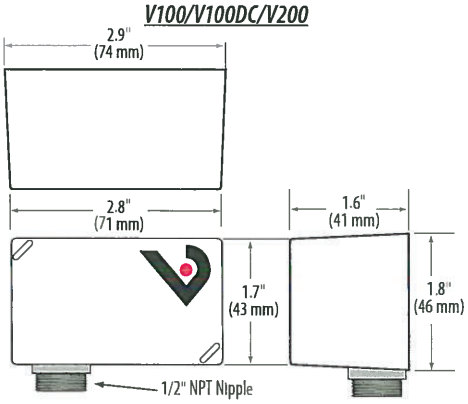



*Nipple mount to any 2x or 4x electrical box*

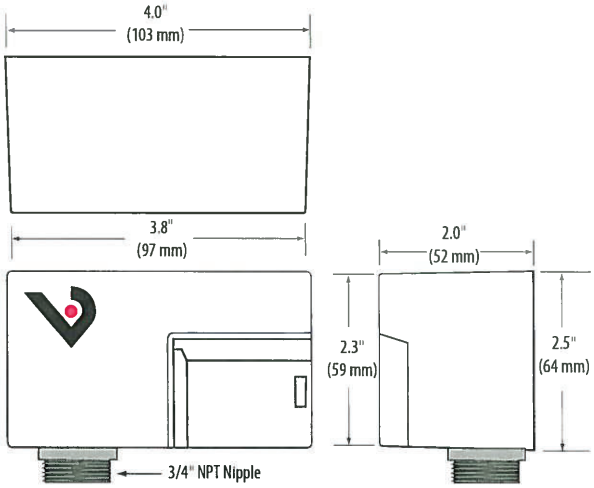



## DIMENSIONAL DRAWINGS

*V100/V100DC/V200*

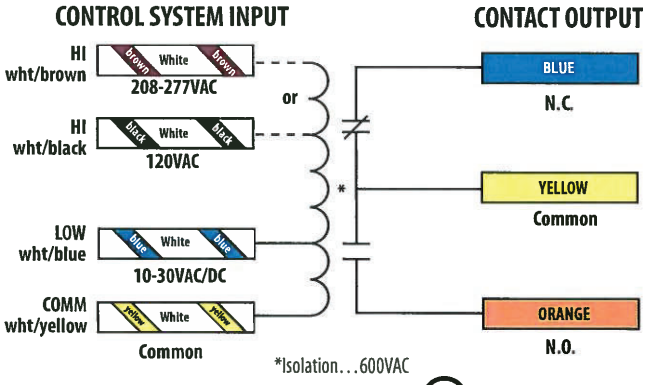



*V100D/V200D*

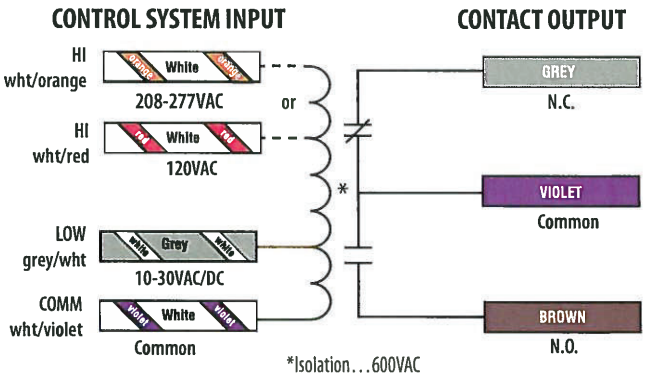



## WIRE COLOR CODES

*Primary*




*Relay 2 on V100D and V200D only*




c UL us LISTED E150462

## ORDERING INFORMATION

| | MODEL | RELAY | COIL | AMPERAGE RATING | RELAY POWER LED | UL |
|---|---|---|---|---|---|---|
| R1 | V100* | SPDT | 10-30VAC/DC, 120VAC | 10A | ● | ● |
| R3 | V100D | 2x SPDT | 10-30VAC/DC, 120VAC | | ● | ● |
| | V100DC | SPDT | 10-30VDC | | ● | ● |
| R4 | V200 | SPDT | 10-30VAC/DC, 208-277VAC | | ● | ● |
| | V200D | 2x SPDT | 10-30VAC/DC, 208-277VAC | | ● | ● |

*Some devices are Plenum rated per UL 1995...see White Paper VWP01 at veris.com for details.*
** Optional domestic version available.*

RELAYS

5 Year Warranty

# Control Transformers

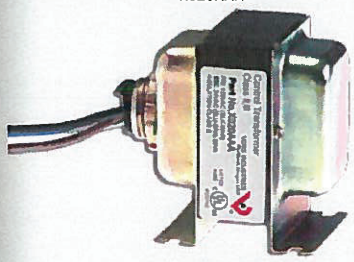
## TR1, TR2, TR3 or TR6

**Veris X Series** Control Transformers are a convenient source of control power for HVAC control and building automation applications. A wide variety of UL-listed transformers are available with single and dual threaded hub mounting options. Multiple current limiting options are available, including a circuit breaker in some models. Save ordering time and purchase order costs when buying other Veris sensors by including transformers in your order.

***Versatile UL Listed transformers...simplify product selection and installation***

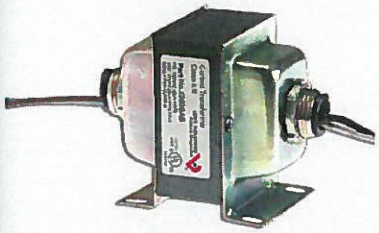
- UL Listings for all models simplify panel building requirements
- Threaded hub options maximize installation flexibility
- One stop shopping...save time by ordering along with other Veris products

X020AAA



1 Hub and Foot Mount

X050BAB

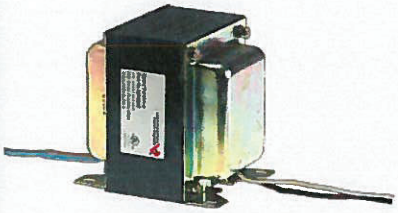


2 Hub and Foot Mount

X100CBE

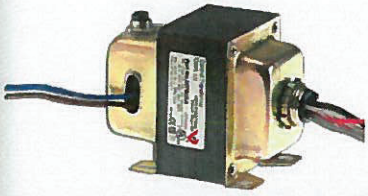
Plate Mount

X375DAC



Foot Mount

X075CBA

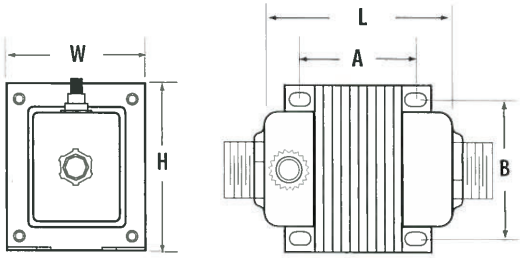


1 Hub and Foot Mount with Separated Secondary Wires

## APPLICATIONS

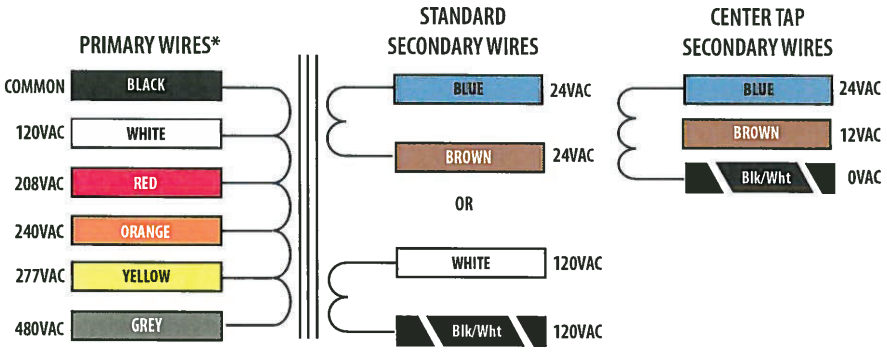
- Controller power
- Switching relays and other digital I/O circuits
- Powering sensors

## DIMENSIONAL DRAWINGS




** See ordering table for dimensions.*

## WIRE COLORS




**Primary of 24V isolation transformers= Red/Red*

## SPECIFICATIONS

| | |
|---|---|
| **Frequency** | 50/60 Hz |
| **Operating Temperature** | -40° to 65°C (-40° to 149°F) |
| **No Load Voltage** | 27 to 28VAC |
| **Hub Style** | Fits 1/2" electrical k.o. |
| **Wire** | UL 1015, 18 AWG* |
| **Wire Length** | 8 inches |

**X085AAA, X375DAC have 14AWG, Secondary wires*

## ORDERING INFORMATION

CE cULus

DIMENSIONS (inches)

| MODEL | VA | PRIMARY VOLTAGE (VAC) | SECONDARY VOLTAGE (VAC) | CURRENT LIMITING METHOD | CLASS | MOUNTING | SEPARATED PRIMARY & SECONDARY WIRES | UL | CE | SPECIAL ORDER ONLY * | L | W | H | A | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **STANDARD** | | | | | | | | | | | | | | | |
| X020AAA | 20 | 120 | 24 | Inherent | II, III | 1HUB+FT | | ● | ● | | 2.3 | 1.9 | 2.6 | 1.59 | 1.69 |
| X020ACA | | 277 | | Inherent | II, III | 1HUB+FT | | ● | ● | | 2.3 | 1.9 | 2.6 | 1.59 | 1.69 |
| X020ADA | | 24 | | Inherent | General | 1HUB+FT | | ● | ● | | 2.3 | 1.9 | 2.6 | 1.59 | 1.69 |
| X020ADB | | 24 | | Inherent | General | 2HUB+FT | ● | ● | ● | | 2.3 | 1.9 | 2.6 | 1.59 | 1.69 |
| X040AAA | 40 | 120 | | Inherent | II, III | 1HUB+FT | | ● | ● | | 2.7 | 2.2 | 2.9 | 1.98 | 1.81 |
| X040AAB | | 120 | | Inherent | II, III | 2HUB+FT | ● | ● | ● | | 2.7 | 2.2 | 2.9 | 1.98 | 1.81 |
| X040ACA | | 277 | | Inherent | II, III | 1HUB+FT | | ● | ● | ● | 2.7 | 2.2 | 2.9 | 1.98 | 1.81 |
| X040ADA | | 24 | | Inherent | II, III | 1HUB+FT | | ● | ● | | 2.7 | 2.2 | 2.9 | 1.98 | 1.81 |
| X040AMB | | 120/208/240/277 | | Fuse | II, III | 2HUB+FT | ● | ● | ● | ● | 2.7 | 2.2 | 2.9 | 1.98 | 1.81 |
| X040BNA | | 120/208/240 | | Fuse | II, III | 1HUB+FT | | ● | ● | ● | 2.7 | 2.2 | 2.9 | 1.98 | 1.81 |
| X050BAA | 50 | 120 | | Fuse | II, III | 1HUB+FT | | ● | ● | | 2.8 | 2.2 | 2.9 | 2.06 | 1.81 |
| X050BAB | | 120 | | Fuse | II, III | 2HUB+FT | ● | ● | ● | | 2.8 | 2.2 | 2.9 | 2.06 | 1.81 |
| X050BCA | | 277 | | Fuse | II, III | 1HUB+FT | | ● | ● | | 2.8 | 2.2 | 2.9 | 2.06 | 1.81 |
| X050BCB | | 277 | | Fuse | II, III | 2HUB+FT | ● | ● | ● | | 2.8 | 2.2 | 2.9 | 2.06 | 1.81 |
| X050BGB | | 208/240 | | Fuse | II, III | 2HUB+FT | ● | ● | ● | ● | 2.8 | 2.2 | 2.9 | 2.06 | 1.81 |
| X050CAA | | 120 | | Circuit Breaker | II, III | 1HUB+FT | | ● | ● | | 3.5 | 2.5 | 3.1 | 1.91 | 2.03 |
| X050CBA | | 120/240/277/480 | | Circuit Breaker | II, III | 1HUB+FT | | ● | ● | | 3.5 | 2.5 | 3.1 | 1.91 | 2.03 |
| X050CBB | | 120/240/277/480 | | Circuit Breaker | II, III | 2HUB+FT | ● | ● | ● | | 3.5 | 2.5 | 3.1 | 1.91 | 2.03 |
| X050CCA | | 277 | | Circuit Breaker | II, III | 1HUB+FT | | ● | ● | ● | 3.5 | 2.5 | 3.1 | 1.91 | 2.03 |
| X050CEB | | 208/240/277/480 | 120 | Circuit Breaker | General | 2HUB+FT | ● | ● | ● | ● | 3.5 | 2.5 | 3.1 | 1.91 | 2.03 |
| X050CEG | | 208/240/277/480 | | Circuit Breaker | General | Plate, 90° Sec | ● | ● | ● | ● | 3.5 | 4.0 | 4.0 | 3.38 | 3.38 |
| X050CGG | | 208/240 | 24 | Circuit Breaker | II, III | Plate, 90° Sec | ● | ● | ● | ● | 4.0 | 4.0 | 4.0 | 3.38 | 3.38 |
| X050CHA | | 120/208/240/480 | | Circuit Breaker | II, III | 1HUB+FT | | ● | ● | ● | 3.5 | 2.5 | 3.1 | 1.91 | 2.03 |
| X050CHB | | 120/208/240/480 | | Circuit Breaker | II, III | 2HUB+FT | ● | ● | ● | ● | 3.5 | 2.5 | 3.1 | 1.91 | 2.03 |
| X050CNA | | 120/208/240 | | Circuit Breaker | II, III | 1HUB+FT | | ● | ● | ● | 3.5 | 2.5 | 3.1 | 1.91 | 2.03 |
| X050CNB | | 120/208/240 | | Circuit Breaker | II, III | 2HUB+FT | ● | ● | ● | ● | 3.5 | 2.5 | 3.1 | 1.91 | 2.03 |
| X050COA | | 120/208/240/277/480 | | Circuit Breaker | II, III | 1HUB+FT | | ● | ● | ● | 3.5 | 2.5 | 3.1 | 1.91 | 2.03 |
| X050DLB | | 220 | | None | II, III | 2HUB+FT | ● | ● | ● | ● | 2.8 | 2.2 | 2.9 | 2.06 | 1.81 |
| X075CAA | 75 | 120 | | Circuit Breaker | II, III | 1HUB+FT | | ● | ● | | 3.9 | 2.5 | 3.1 | 2.31 | 2.03 |
| X075CAB | | 120 | | Circuit Breaker | II, III | 2HUB+FT | ● | ● | ● | | 3.9 | 2.5 | 3.1 | 2.31 | 2.03 |
| X075CBA | | 120/208/240/480 | | Circuit Breaker | II, III | 1HUB+FT | ● | ● | ● | | 3.9 | 2.5 | 3.1 | 2.31 | 2.03 |
| X075CCA | | 277 | | Circuit Breaker | II, III | 1HUB+FT | | ● | ● | | 3.9 | 2.5 | 3.1 | 2.31 | 2.03 |
| X075CHA | | 120/208/240/480 | | Circuit Breaker | II, III | 1HUB+FT | | ● | ● | ● | 3.9 | 2.5 | 3.1 | 2.31 | 2.03 |
| X085AAA | 85 | 120 | | Inherent | General | 1HUB+FT | | ● | ● | | 3.2 | 3.8 | 3.2 | 2.2 | 3.14 |
| X100CAA | 99 | 120 | | Circuit Breaker | II, III | 1HUB+FT | | ● | ● | | 4.1 | 2.5 | 3.1 | 2.51 | 2.03 |
| X100CAB | | 120 | | Circuit Breaker | II, III | 2HUB+FT | ● | ● | ● | | 4.1 | 2.5 | 3.1 | 2.51 | 2.03 |
| X100CBA | | 120/240/277/480 | | Circuit Breaker | II, III | 1HUB+FT | | ● | ● | | 4.3 | 2.5 | 3.1 | 2.70 | 2.03 |
| X100CBB | | 120/240/277/480 | | Circuit Breaker | II, III | 2HUB+FT | ● | ● | ● | | 4.3 | 2.5 | 3.1 | 2.70 | 2.03 |
| X100CBE | | 120/208/277/480 | | Circuit Breaker | II, III | Plate | | ● | ● | ● | 4.3 | 4.0 | 4.0 | 3.38 | 3.38 |
| X100CHB | | 120/208/240/480 | | Circuit Breaker | II, III | 2HUB+FT | ● | ● | ● | ● | 4.3 | 2.5 | 3.1 | 2.70 | 2.03 |
| X100CKB | | 480 | 120 | Circuit Breaker | General | 2HUB+FT | ● | ● | ● | ● | 4.1 | 2.5 | 3.1 | 2.51 | 2.03 |
| X100CLB | | 220 | 24 | Circuit Breaker | II, III | 2HUB+FT | ● | ● | ● | ● | 4.1 | 2.5 | 3.1 | 2.51 | 2.03 |
| X150CAA | 150 | 120 | | Circuit Breaker | General | 1HUB+FT | | ● | ● | | 3.5 | 3.8 | 3.2 | 2.08 | 3.26 |
| X175CAB | 175 | 120 | | None | General | 2HUB+FT | ● | ● | ● | | 4.1 | 3.8 | 3.2 | 3.19 | 3.14 |
| X175CLB | | 220 | | None | General | Foot | ● | ● | ● | ● | 3.8 | 3.8 | 3.2 | 3.05 | 3.14 |
| X175DGC | | 208/240 | | None | General | Foot | ● | ● | ● | | 4.1 | 3.8 | 3.2 | 3.19 | 3.14 |
| X240DAA | 240 | 120 | | None | General | 1HUB+FT | ● | ● | ● | | 3.7 | 3.8 | 4.5 | 3.24 | 3.18 |
| X375DAC | 375 | 120 | | None | General | Foot | ● | ● | ● | | 4.3 | 3.8 | 4.5 | 3.83 | 3.18 |
| **CENTER TAP** | | | | | | | | | | | | | | | |
| X020APC | 20 | 24 | 12/24 | Inherent | II, III | Foot | ● | ● | ● | ● | 2.3 | 1.9 | 2.6 | 1.59 | 1.69 |
| X020AQC | | 120/208/240 | | Inherent | II, III | Foot | ● | ● | ● | ● | 2.3 | 1.9 | 2.6 | 1.59 | 1.69 |
| X040BPC | 40 | 24 | | Fuse | II, III | Foot | ● | ● | ● | ● | 2.7 | 2.2 | 2.9 | 1.98 | 1.81 |
| X040BQC | | 120/208/240 | | Fuse | II, III | Foot | ● | ● | ● | ● | 2.7 | 2.2 | 2.9 | 1.98 | 1.81 |
| X050CIA | 50 | 120 | | Circuit Breaker | II, III | 1HUB+FT | ● | ● | ● | ● | 2.8 | 2.2 | 2.9 | 2.06 | 1.81 |
| X100CRC | 100 | 120/240 | | Circuit Breaker | II, III | 1HUB+FT | ● | ● | ● | ● | 4.3 | 2.5 | 3.1 | 2.70 | 2.03 |

** Special orders are not kept in stock, and may require some additional lead time. Call the factory for more details.*

# B3 Series, 3-Way, Characterized Control Valve
# Chrome Plated Brass Ball and Brass Stem

## Application

This valve is typically used in air handling units on heating or cooling coils, and fan coil unit heating or cooling coils. Some other common applications include Unit Ventilators, VAV box re-heat coils and bypass loops. This valve is suitable for use in a hydronic system with variable or constant flow.

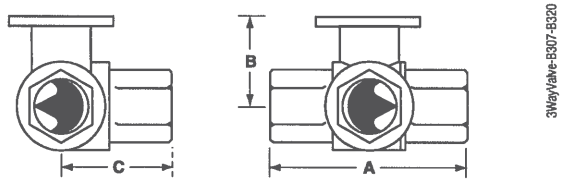
| Technical Data | |
|---|---|
| Service | chilled or hot water, 60% glycol |
| Flow characteristic | A-port equal percentage<br>B-port modified for constant common port flow |
| Controllable Flow Range | 75° |
| Sizes | ½", ¾" |
| Type of end fitting | NPT female ends |
| Materials: | |
| Body | forged brass, nickel plated |
| Ball | chrome plated brass |
| Stem | nickel plated brass |
| Seats | PTFE |
| Characterizing disc | Tefzel® |
| Packing | 2 EPDM O-rings, lubricated |
| Body pressure rating | 600 psi |
| Media temp. range | 0°F to 250°F [-18°C to 120°C] |
| Close off pressure | 200 psi |
| Maximum differential pressure (ΔP) | 50 psi for typical applications |
| Leakage | 0% for A to AB<br><2.0% for B to AB |
| External leakage | according to EN 12266-1:2003 |
| $C_V$ rating | A-port: see product chart for values<br>B-port: 70% of A to AB $C_V$ |

Tefzel® is a registered trademark of DuPont

| | Valve Nominal Size | | Type | Suitable Actuators | | | |
|---|---|---|---|---|---|---|---|
| $C_V$ | Inches | DN [mm] | 3-way NPT | Non-Spring | | Spring | |
| 0.3 | ½ | 15 | B307B | TR Series | LR Series | TF Series | LF Series |
| 0.46 | ½ | 15 | B308B | | | | |
| 0.8 | ½ | 15 | B309B | | | | |
| 1.2 | ½ | 15 | B310B | | | | |
| 1.9 | ½ | 15 | B311B | | | | |
| 3 | ½ | 15 | B312B | | | | |
| 4.7 | ½ | 15 | B313B | | | | |
| 10 | ½ | 15 | B315B | | | | |
| 14 | ½ | 15 | B316B | | | | |
| 4.7 | ¾ | 20 | B317B | | | | |
| 7.4 | ¾ | 20 | B318B | | | | |
| 14 | ¾ | 20 | B320B | | | | |
| 24 | ¾ | 20 | B321B | | | | |

*Models without characterizing disc

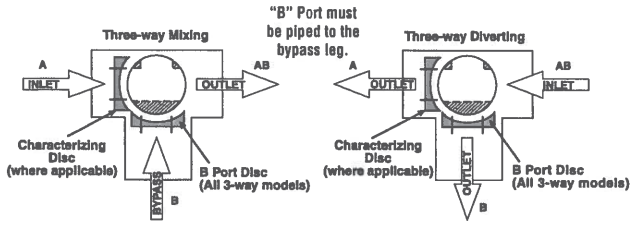
## Dimensions



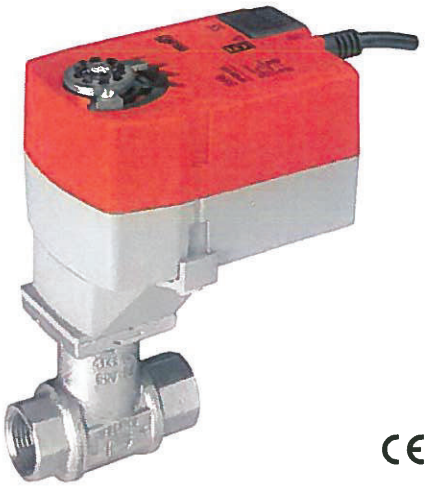

3WayValve-B307-B320

| | Valve Nominal Size | | Dimensions (Inches [mm]) | | |
|---|---|---|---|---|---|
| Valve Body | Inches | DN [mm] | A | B | C |
| B307B-B311B | ½" | 15 | 2.41" [61.1] | 1.39" [35.2] | 1.20" [30.6] |
| B312B-B316B | ½" | 15 | 2.38" [60.4] | 1.78" [45.2] | 1.29" [32.8] |
| B317B-B321B | ¾" | 20 | 2.73" [69.3] | 1.87" [47.4] | 1.47" [37.3] |

## Flow Patterns



BELIMO



5 YEAR WARRANTY

## Models

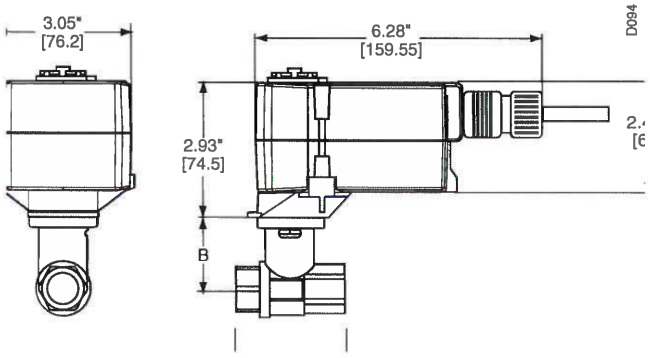
TFRB(X)24 TFRB(X)120
TFRB(X)24-S TFRB(X)120-S w/built-in Aux. Switch

| Technical Data | | |
|---|---|---|
| Control | | on/off |
| Power supply | | |
| TFRB(X)24(-S) | | 24VAC ± 20%, 50/60Hz<br>24VDC ± 10% |
| TFRB(X)120(-S) | | (nominal) 100 to 240 VAC, 50/60 Hz<br>(tolerance) 85 to 265 VAC, 50/60 Hz |
| Power consumption | running | 2.5 W |
| | holding | 1.3 W |
| Transformer sizing | | |
| TFRB(X)24(-S) | | 5 VA (class 2 power source) |
| TFRB(X)120(-S) | | 5 VA (class 2 power source) |
| Electrical connection | | ½" conduit connector |
| (-S models have 2 cables) | | 18 GA appliance cable |
| TFRB(X)24... | | 3 ft [1m] |
| TFRB(X)120 | | 10 ft [3m]<br>16 ft [5m] |
| Overload protection | | electronic throughout 0° to 95° rotation |
| Angle of rotation | | 95° |
| Direction of rotation | | reversible with protected ↷/↶ mounting |
| Position indication | | visual indicator, 0° to 95° |
| Running time | motor | <75 seconds (0 to 18 in-lb) |
| | spring | <75 sec @ -22°F to 122°F [-20°C to 50°C] |
| Humidity | | 5 to 95% RH non-condensing |
| Ambient temperature | | -22°F to 122°F [-30°C to 50°C] |
| Storage temperature | | -40°F to 176°F [-40°C to 80°C] |
| Housing | | NEMA type 2/IP42 |
| Housing material | | UL94 - 5VA |
| Agency listings† | | cULus according to UL 60730-1A/-2-14, CAN/CSA E60730-1:02, CE according to 2004/108/EC and 2006/95/EC for line voltage and/or –S versions |
| Noise level (max) | running | <40 db (A) |
| | spring return | <40 dB (A) |
| Quality standard | | ISO 9001 |

| TFRB(X)...-S | |
|---|---|
| Auxiliary switch | 1 x SPDT, 3A (0.5A) @ 250 VAC, UL Listed<br>adjustable 0° to 95° |

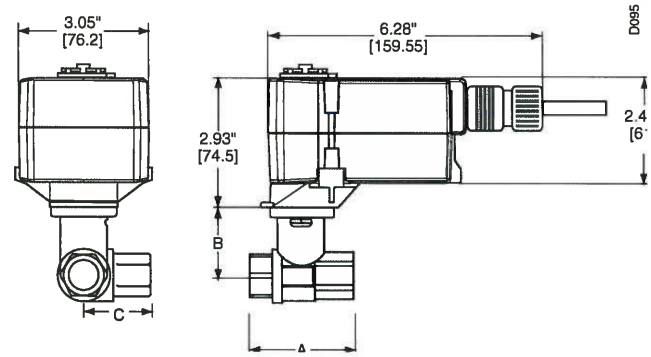
† Rated impulse voltage 800V (4kV for 120V model), Control pollution degree 3, Type of action 1.AA (1.AA.B for -S models)

### Dimensions with 2-Way Valve




| | Valve Nominal Size | | Dimensions (Inches [mm]) | |
|---|---|---|---|---|
| Valve Body | Inches | DN [mm] | A | B |
| B207(B)-B211(B) | ½" | 15 | 2.41" [61.1] | 1.39" [35.2] |
| B212(B)-B215(B) | ½" | 15 | 2.38" [60.4] | 1.78" [45.2] |
| B217(B)-B221(B) | ¾" | 20 | 2.73" [69.3] | 1.87" [47.4] |

### Dimensions with 3-Way Valve




| | Valve Nominal Size | | Dimensions (Inches [mm]) | | |
|---|---|---|---|---|---|
| Valve Body | Inches | DN [mm] | A | B | C |
| B307(B)-B311(B) | ½" | 15 | 2.41" [61.1] | 1.39" [35.2] | 1.20" [30.6] |
| B312(B)-B315(B) | ½" | 15 | 2.38" [60.4] | 1.78" [45.2] | 1.29" [32.8] |
| B317(B)-B321(B) | ¾" | 20 | 2.73" [69.3] | 1.87" [47.4] | 1.47" [37.3] |