

# ROUDENBUSH COMMUNITY CENTER REHABILITATION SCHEMATIC DESIGN SPECIFICATIONS

1 October 2015

Owner: Town of Westford  
Architect: Mills Whitaker Architects LLC  
Structural: Structures North Consulting Engineers  
Sprinklers: Fernandez and Associates  
Mechanical: S. L. Forte Engineering  
Electrical: Johnson Engineering & Design  
Estimator: Daedalus Projects

## PROJECT DESCRIPTION

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Roudenbush Community Center was constructed in 1897 as the Westford Academy's second school building. A gymnasium addition was constructed in 1929 at the rear of the facility. After construction of replacement facilities for Westford Academy in the 1970s, the building became the Roudenbush Community Center in 1975. The historically significant building is a contributing structure in the Westford Center Historic District listed on the National Register of Historic Places.

The rehabilitation project is intended to make the building handicap accessible, replace existing electrical and mechanical systems, improve life safety and enhance facility usability. The work is described for pricing purposes by these SD Specifications and by the accompanying Drawings.

## LIST OF DRAWINGS

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Refer to Drawing A-00 for the List of Drawings: Architectural, Structural, Fire Suppression, Plumbing, HVAC and Electrical.

## DIVISION 00 PROCUREMENT & CONTRACTING REQUIREMENTS

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- 00.1. The project will be publicly bid per MGL Chapter 149. Prevailing Wages, Filed Sub-bids and Payment/Performance Bonds apply to this project.
- 00.2. The estimating process will identify trades that will become Filed Sub-Bids for the project in accordance with the threshold limits of the public bidding regulations. The following trades are assumed to become filed sub-bid trades in the construction documents:
  - a. Division 04: Masonry (brick partitions, granite repointing, lintels, openings)
  - b. Division 07: Roofing and Flashing (slate, copper, EPDM)
  - c. Division 09: Lathing and Plastering (extensive interior repairs and patching)
  - d. Division 09: Acoustical Tile
  - e. Division 09: Painting (interior and exterior throughout)
  - f. Division 14: Elevators (holed hydraulic with front/rear doors)
  - g. Division 21: Fire Suppression (installation of automatic sprinkler system)
  - h. Division 22: Plumbing (gut renovation, except for existing sanitary outflow)
  - i. Division 23: HVAC (gut renovation, except for gym furnaces)
  - j. Division 26: Electrical (gut renovation, including service upgrade, generator)
- 00.3. Funding for the construction phase of the project will be subject to approval at Town Meeting in the spring of 2016. If funding is approved, bidding will proceed thereafter and work will begin in July 2016 and be completed no later than August 2017.

## DIVISION 01 GENERAL REQUIREMENTS

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- 01.1. The project site is located in a National Register Historic District but is not part of a local historic district. A Certificate of Appropriateness from the Town will not be required.
- 01.2. The project will require a Variance from the Massachusetts Architectural Access Board for items related to the requirement of meeting full compliance with current regulations.
- 01.3. The building will be unoccupied during construction.
  - a. The gas-fired steam heating system will be removed in its entirety. The Contractor shall provide a temporary heating system during construction.
  - b. The electrical service and all electrical systems will be completely replaced. The Contractor shall provide a temporary electrical system during construction.

- c. The fire alarm system will be completely replaced. The Contractor shall provide a temporary fire alarm system during construction.
- d. The Owner shall continue to pay for all utilities during the construction period and the Contractor shall make every effort to conserve resources to the extent possible.
- 01.4. Control the migration of dust in the building in the areas of demolition and construction as needed during certain times of the construction period.
- 01.5. Provide two means of egress from every construction area for the safety of workers.
- 01.6. Provide temporary toilets on site for use by the contractor's personnel.
- 01.7. Provide daily cleaning and removal of debris within the building and site.
- 01.8. Retain the existing fire alarm system intact for use during construction or provide a temporary system of heat detectors. Keep system clean and fully operational, trouble-shooting and repairing any damage as needed.
- 01.9. The Owner will pay for independent testing and inspection services for review of all concrete, steel construction and wood framing to the extent necessary. The Contractor will coordinate the schedule of inspections by the testing agency.
- 01.10. Provide cutting and patching to match the existing building materials and finishes where disrupted by construction. Patching will include concrete slabs on grade, masonry (brick, granite, terracotta structural tiles), wood flooring (hard pine, maple, oak), plaster on wood lath (walls and ceilings where to be left exposed), and other selected finishes as needed. Patching of materials in the scope of any Filed Sub-Bidders work shall be performed by those respective subs (e.g., masonry, roofing, plaster).
- 01.11. Provide all closeout training, verification and documentation including as-built drawings, operation/maintenance manuals, commissioning of the MEP systems and Owner training.
- 01.12. Provide pricing for the following Alternates. Include all related general conditions costs within the construction budget for each Alternate so that all associated costs can be adequately considered.

#### ALTERNATE 1 / REPLACE SLATE ROOF:

Refer to description of the work on the Drawings and in Divisions 06, 07 and 09 where noted. This Alternate includes work on the pitched roof areas and on the lower deck area south of the cupola. This Alternate excludes work on the cupola bell deck and above per Alternate 2. The work shall include removal and reinstallation of the lightning arrestor system. (Note: louvers in the cupola per Division 08 are part of the base bid.)

#### ALTERNATE 2 / REPAIR CUPOLA & RESTORE BELL:

Refer to description of the work on the Drawings and in Divisions 06, 07 and 09 where noted. This Alternate excludes all work listed in Alternate 1 and the cupola louvers.

#### ALTERNATE 3 / WATER SUPPLY RELOCATION:

Relocate the existing 6" combined main for domestic water and fire suppression supply from its current location in the front offices to a revised location in the Mechanical Room. Cutback the existing line approximately 40 feet from the foundation wall and re-route below paved driveway to the east façade. Relocate existing water meter and backflow preventers for fire suppression and domestic supply. Pipe material for the new main to be cement-lined ductile iron. Remove sprinkler closet in office area and expand office.

#### ALTERNATE 4 / SEPARATE DOMESTIC SUPPLY:

The current system of water supply uses the combined 6" feed for both domestic water supply and fire suppression. Provide a separate 2" Type K copper domestic water supply pipe underground from the street main to the mechanical room via the exit driveway. Provide an underground water shutoff valve near the curb area per Town requirements.

### **DIVISION 02                      EXISTING CONDITIONS**

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- 02.1. Remove portions of existing floors, walls, ceilings, finishes and structure where noted.
- 02.2. Provide temporary shoring and bracing at all areas of structural demolition to maintain integrity of the existing building. The Contractor shall retain a registered engineer for the design, installation and monitoring of all shoring systems. Determination of shoring requirements and needed locations shall be the full responsibility of the Contractor.
- 02.3. Provide all scaffolding as needed for all trades for work higher than 8' above work surface.

- 02.4. Saw-cut and remove portions of existing slabs in the boiler room and electrical room for placement of under-slab piping and conduits. Remove existing housekeeping pads. Saw-cut existing slabs in the office areas where column supports are indicated.
- 02.5. Remove existing slabs in the Men's and Women's rooms at floor level of the east and west side entrances. Remove associated perimeter support walls and underlying soil to allow for slab replacement. Maintain integrity of adjacent structure at excavated areas.
- 02.6. Refer to Division 06 for salvaged removal and re-installation of existing beadboard at Third Floor for access to insulation and for re-use at partition and ceiling reconfigurations.
- 02.7. Remove existing fire escapes at the south wall, flat roof and exterior sidewalls of the gym.
- 02.8. Remove existing exit doors and HVAC louvers in the south wall of the second floor.
- 02.9. Remove existing plumbing systems in the building unless noted otherwise.
- 02.10. Remove existing steam heating system in its entirety, including but not limited to the boiler, piping, controls and all radiators located throughout the building.
- 02.11. Remove existing FCU, ACCU and ductwork serving the ground floor office areas.
- 02.12. Remove existing window air-conditioning units in the classrooms and offices on the first, second and third floor levels.
- 02.13. Remove abandoned high velocity air conditioning system consisting of fan coil units above the second floor ceiling, fan coil unit on the third floor, and all associated ductwork.
- 02.14. Remove all existing electrical, fire alarm and data systems in the building unless noted.
- 02.15. Remove existing non-compliant wall-mounted handrails in the east and west stairways. Refer to Division 06 for replacement handrails and for work at the original guardrails.
- 02.16. Dispose of demolition debris legally and recycle in accordance with current regulations.
- 02.17. The Owner will remove any concealed asbestos containing materials discovered during construction with a separate licensed contractor.
- 02.18. Refer to Drawings for other selective demolition work as noted or as required for the work.

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**DIVISION 03                      CONCRETE**

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- 03.1. Provide reinforced concrete footings, walls, slabs and interior ramp at reconfigured portions of the Ground Floor as noted on the Structural Drawings.
- 03.2. Provide reinforced concrete elevator pit as noted on the Structural Drawings.
- 03.3. Provide exterior concrete pads and structures for the electrical transformer and emergency generator where noted on the Electrical Drawings.
- 03.4. Provide interior concrete housekeeping pads for the boiler, pumps, domestic hot water heater, fire pump and electrical switchgear.
- 03.5. Repair existing concrete steps at Gym exits at SW and SE corners of the building.
- 03.6. Refer to the Drawings for any other areas that require concrete work.

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**DIVISION 04                      MASONRY**

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- 04.1. Patch existing masonry walls where existing piping, sleeves or other openings are to be removed and infilled. Visible areas shall be patched with matching brick to match existing. Areas concealed from public view shall be grouted solid in lieu of brick units.
- 04.2. Repair and rebuild ends or intersections of existing brick walls where portions of partitions are removed in the Ground Floor level.
- 04.3. Cut and repoint granite base of original 1897 building on north, west and east facades.
- 04.4. Provide coursed granite cladding stones over CMU backup to infill non-original opening at existing exterior door to boiler room from east façade, and to raise sill of other boiler room opening to match original configuration.
- 04.5. Provide sanded sealant over backer rod at joints in granite steps and wing walls. Provide sanded sealant at joints to abutting materials at scored concrete entrance stoop area.
- 04.6. Provide reinforced and grouted CMU walls for elevator hoistway per Structural Drawings.
- 04.7. Reconstruct upper portion of existing brick chimney at Third Floor roof area (scaffolding provided by general contractor); assume upper ten courses to be rebuilt and replacement concrete cap to be poured to replace existing. Cut and repoint remainder of chimney.
- 04.8. Refer to the Drawings for other areas that require masonry work.

**DIVISION 05 METALS**

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- 05.1. Provide color galvanized steel pipe bollards to protect transformer and emergency generator where indicated on the Electrical Drawings. Fill with concrete.
- 05.2. Provide color galvanized steel pipe bollards at outside corners of gym and concrete stairs at SW and SE corners where noted on the Site Plan.
- 05.3. Provide color galvanized replacement steel railings at gym exterior exit stairs.
- 05.4. Provide steel framing and modifications to existing framing per the Structural Drawings.
- 05.5. Provide guardrails on the gym roof at roof hatch and adjacent ACCU for fall protection.
- 05.6. Provide fixed metal ladder in Gym Storage attic to roof hatch for flat roof access.
- 05.7. Provide dual height painted steel handrails (19" and 34" AFF) at both sides of interior accessible ramp at lower lobby. Provide matching handrails at adjacent stairs between levels at lower lobby area by elevator and toilet rooms. Provide with radius wall returns and easings; no mitered joints allowed in railings.
- 05.8. Refer to Division 07 (Alternate 2) for work related to restoration of the bell and yoke.
- 05.9. Refer to the Drawings for other areas that require steel framing and metals work.

**DIVISION 06 WOOD, PLASTICS, & COMPOSITES**

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- 06.1. Provide framed openings in exterior shingled wall surfaces at south façade for louvered openings related to ERV units. Infill existing louvers for abandoned high velocity AC units. Repair and re-attach loose bed moulding at south façade.
- 06.2. Re-establish former window openings at front façade on each side of projecting entrance area at ground floor level for placement of in/out louver openings for ERV units above.
- 06.3. Infill wall framing, sheathing and shingles at exit doors from the Second Floor to fire escape at south wall and tooth-in shingles to match existing.
- 06.4. Repair damaged and drilled areas of existing shingle cladding at east wall of second floor. Replace damaged shingles on west wall following removal of electrical service conduit. Repair damaged shingles at NW corner of entrance façade above entrance steps.
- 06.5. Provide wood sleepers for ACCUs on flat roof of gymnasium per Mechanical Drawings.
- 06.6. Provide wall-mounted oak handrails (34" AFF) at east and west stairways with easings and radius returns. Provide blocking and solid brass handrail brackets at 36" on center.
- 06.7. Provide replacement maple balusters at guardrail of east and west stairways; relocate rail cap upwards as noted in Drawings; provide replacement easings to existing newels.
- 06.8. Provide interior wood trim (door casings, chalk trays, picture rails, baseboards, chair rails) to match existing in reconfigured and modified areas of work.
- 06.9. Provide interior wood beadboard walls in new partitions to match adjacent partitions.
- 06.10. Remove, salvage and re-install ceiling-mounted beadboard at Third Floor to allow for installation of roof insulation at rafter spaces. Provide suspended framing for horizontal beadboard ceiling in front room 306 as noted in the ceiling plans.
- 06.11. Remove salvage and re-install wall-mounted beadboard at Third Floor where partitions are to be reconfigured as noted on the floor plans (Lobby 305 & Recreation 313).
- 06.12. Provide solid surface counters and backsplashes at all toilet rooms. Support counters with concealed brackets (Rakks flush 18 x 18 x 2).
- 06.13. Provide stile-and-rail flat panel painted wood cabinets in Kitchen (base and wall) with solid surface counters and fixed island; use full extension epoxy-coated drawer slides, concealed hinges, brass knobs and pulls.
- 06.14. Provide replacement cubbies at Second Floor classrooms with plastic laminate interiors, pairs of dual coat hooks in each unit, painted wood trim with beaded face trim, moulded baseboards and bullnose caps with quarter round aprons.
- 06.15. Provide wood blocking where needed for attachment of trim, railings, fixtures, toilet accessories, specialties, etc.
- 06.16. Refer to Division 08 for carpentry work related to window work and selective repairs.
- 06.17. Refer to the Drawings for other areas that require framing and carpentry work.
- 06.18. ALTERNATE 1 (Div 06 Portion): Provide 3/4" roof sheathing over existing pitched roof and dormer areas as noted in Structural Drawings, attached securely through existing roof board sheathing to existing wood rafters. Replace deteriorated portions of wood cornice mouldings over existing copper gutter liner (assume 75 linear feet).

- 06.19. ALTERNATE 2 (Div 06 Portion): Replace shingled cladding on curved columns of the cupola to match existing. Replace vertical tongue-and-grooved boards on rectangular portions of columns to match existing. Remove tongue-and-groove cupola ceiling and dispose of assumed bird guano (hazmat) in concealed space above; replicate ceiling materials. Replace horizontal guardrails at cupola openings to match existing. Replace missing portions of eaves with fascia, soffits and dentils to match existing. Provide white oak cribbing system for support of bell; attach and seal to copper deck.

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**DIVISION 07 THERMAL & MOISTURE PROTECTION**

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- 07.1. Refer to Division 06 for work related to wood shingled exterior wall surfaces.
- 07.2. Provide closed-cell spray foam at Third Floor roof, exterior walls and knee wall areas to 6" depth; spray surface with intumescent top coating for fire protection. Also provide spray foam at the Lower Lobby exterior wall furring where noted and in the Staff HCap toilet room exterior wall furring.
- 07.3. Patch existing EPDM membrane roof at gym where HVAC work is done (ACCU sleepers, air intake/exhaust, ERV vents, piping) and where fire escape supports are removed.
- 07.4. Provide two-inch thick rigid extruded polystyrene board insulation and below-grade vapor barrier under concrete slab replacement and patched slab areas per Structural Drawings.
- 07.5. Provide mineral wool sound attenuation fire blankets within any new or infilled partitions.
- 07.6. Provide joint sealants at exterior louver and door openings where provided by the work.
- 07.7. Provide joint sealants at intersection of interior building components.
- 07.8. Provide penetration fireproofing at all slab and wall penetrations to maintain integrity of existing construction and prevent the spread of fire and smoke.
- 07.9. Refer to the Drawings for other areas that require thermal & moisture protection.
- 07.10. ALTERNATE 1 (Div 07 Portion): Remove and salvage (or replace) existing S1 dark gray slates on north, west and east slopes and dormers for reuse or replacement (installed new in 2000). Remove and discard green slates on south slope and dormer (original). Salvage all copper finials, caps, valleys, gutters and accessories for reuse (installed new in 2000). Provide full slate roof over ice/water shield and underlayment, utilizing closed valleys in lieu of open valleys, and re-installing all copper elements. Provide repairs to lower deck at south side of cupola (copper, slate, wood rails and balusters). Provide elastomeric top coating at existing lower deck area. Remove, salvage and re-install existing braided copper wire lighting arrestor system with all clamps and terminations; test integrity of finished system to comply with UL requirements.
- 07.11. ALTERNATE 2 (Div 07 Portion): Provide copper flashings at base of cupola columns and solder to existing copper deck. Remove existing coating from copper deck and provide elastomeric top coating at copper bell deck. Restore components of original cast bronze bell with cast iron yoke, clapper, pull rope and accessories to restore full operability. Provide copper mesh bird netting at open mouths of copper gargoyles. Check and repair all seams in copper cornice, finials and spire roof. Replicate copper bar shapes at compass points and rotating weathervane to replace existing with matching components.

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**DIVISION 08 OPENINGS**

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- 08.1. Provide welded hollow metal doorframes for interior use where noted. (In public areas, frames will be trimmed with wood casings provided under Division 06.)
- 08.2. Provide doors of the type and materials indicated on the Door Schedule and in details. Match existing profiles and details at wood stile-and-rail doors.
- 08.3. Modify existing doors and frames for hardware changes where required. Patch and infill to match adjacent surfaces at changed devices.
- 08.4. Provide coiling door shutter at full width of Receptionist counter area with locking latch.
- 08.5. Provide roof hatch from Gym Storage room area to flat roof for access to ACCUs.
- 08.6. Provide access panels with recessed faces for installation of finishes to match adjacent.
- 08.7. Provide new or replacement hardware at all doors unless "EX" is noted in the "HDWR SET" column of the "Door & Frame Schedule" in the Drawings.
- 08.8. Provide automatic door operators with door actuators on both sides where noted.
- 08.9. Provide magnetic hold-open devices integrated with the fire alarm system for openings where indicated.
- 08.10. Provide exterior storm-proof louvers at each side of the cupola vent level as noted (4 pr).

- 08.11. Provide exterior storm-proof louvers at openings in boiler room as noted (2).
- 08.12. Provide intake and exhaust louvers at energy recovery ventilation units as noted (8).
- 08.13. Provide exhaust louver in sidewall for kitchen exhaust as noted (1).
- 08.14. Repair wood windowsills on east façade of gym addition and integrate with wall and casings for restoration of wall. Restore operation of existing vinyl replacement windows in original wood frames as needed during sill replacement.
- 08.15. Restore wood double-hung window frame at Third Floor dormers on south façade where existing fire escape stair exit door will be removed. Provide 4-over-4 vinyl window in the restored opening to match the adjacent replacement sash.
- 08.16. Restore in-swinging wood window sash at central opening of north façade at Third Floor. Provide low infiltration high-performance operable exterior triple-track storm windows in extruded aluminum frames sealed to existing window casings. Restore original fixed sash at each side in this tri-partite window and provide fixed storms at exterior.
- 08.17. Remove plexiglass at east façade of Finance Office ground floor window and replicate missing vinyl operable sash and frame to restore operation.
- 08.18. Refer to the Drawings for other areas that require openings and associated work.
- 08.19. ALTERNATE 2 (Div 08 Portion): Replace roof hatch to bell deck with hinged and latched version that will operate safely and avoid conflicts with restored bell and guard rail.

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**DIVISION 09 FINISHES**

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- 09.1. Refer to the demolition plans and notes, floor plans and partition legend for information.
- 09.2. Repair damaged sections of wood strip flooring and refinish all wood flooring (maple, oak and hard pine depending upon locations). Use penetrating stain sealer in two coats with restoration cleaner process upon completion prior to occupancy.
- 09.3. Prepare and repaint existing wood treads and landings in east and west stairways.
- 09.4. Provide rubber stair treads at all stairways, cut to reveal 2" of painted wood tread at sides; provide full width of resilient treads at ground floor on all concrete stairs.
- 09.5. Repaint existing concrete entrance slabs at east and west side entrances with epoxy.
- 09.6. Seal concrete slabs in utility areas and ground floor closets.
- 09.7. Provide vinyl composition tile flooring in areas of ground floor where noted; seal and wax.
- 09.8. Provide glue-down carpet in rooms or portions of rooms as scheduled.
  - a. CAR-1: commercial loop-pile solution-dyed broadloom carpet.
  - b. CAR-2: commercial loop-pile solution-dyed carpet tile.
- 09.9. At Third Floor Recreation area (311, 313, 316), provide cushioned synthetic athletic flooring system over plywood underlayment over existing wood strip flooring. Provide tapered custom wood thresholds at door openings into room, and standard wood threshold from room into the adjacent storage areas.
- 09.10. Provide ceramic floor tile at Ground Floor toilet rooms (over concrete slab on grade); provide ceramic floor tile at upper floor toilet rooms over 1/4" tile backer board.
- 09.11. Provide cementitious tile backer boards at toilet room dado and provide ceramic wall tile.
- 09.12. Provide sanded grout (tile floors) and unsanded grout (tile walls) and seal.
- 09.13. Provide gypsum wallboard over metal framing systems at new partitions and ceilings.
- 09.14. Provide plaster repairs at wood lath of existing wall and ceiling surfaces where indicated in Room Finish Schedule. Extent of plaster repairs assumed to be 65% of surface area.
- 09.15. Provide 2" thick fixed sound-attenuating fabric-covered wall panels in Lower Lobby 010.
- 09.16. Provide acoustical tile ceilings where indicated in the Room Finish Schedule.
  - a. ACT-1: High NRC fiberglass 24 x 24 x 0.75 with partially concealed-spline grid.
  - b. ACT-2: Tegular edge mineral fiber 24 x 24 x 0.75 with exposed grid.
  - c. ACT-3: Standard lay-in mineral fiber 24 x 24 x 0.75 with exposed grid.
- 09.17. Paint interior of all surfaces in all finished areas of the building. Refinish and re-stain existing varnished wood beadboard at Third Floor wall and ceiling surfaces.
- 09.18. Paint exterior of all surfaces including wood cladding (shingles) and trim (cornices, window surrounds, columns, archways), doors, frames and all other painted items.
- 09.19. Refer to the Drawings for other areas that require finishes not yet noted above.
- 09.20. ALTERNATE NO. 1 (Div 09 Portion): Paint wood balustrade at lower cupola deck level.
- 09.21. ALTERNATE NO. 2 (Div 09 Portion): Paint all replacement cladding and all trim at the Cupola. Paint replacement ceiling of cupola. Paint restored cast iron metal yoke of bell.

**DIVISION 10 SPECIALTIES**

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- 10.1. Provide ceiling-hung phenolic-core toilet partitions with custom selection for plastic laminate face sheets and heavy-duty commercial hardware.
- 10.2. Owner to furnish freestanding waste receptacles.
- 10.3. Drill lavatory counters in Men 013 and Women 015 and install deck-mounted manual soap dispensers and lavatory faucets with eco-turbine touch-free operation.
- 10.4. Provide commercial quality stainless steel grab bars in the accessible toilet stall rooms.
- 10.5. Provide stainless changing tables with molded polyethylene liners in locations indicated.
- 10.6. Provide hand-drying equipment with power supply and infrared sensors toilet rooms.
- 10.7. Provide toilet paper dispensers in all stalls and unisex toilet rooms.
- 10.8. Provide sixteen (16) fire extinguishers in architectural grade cabinets for access by the public (locations to be determined). Provide wall-mounted fire extinguishers in kitchen, mechanical, electrical and elevator machine rooms.
- 10.9. Provide white boards and bulletin boards in classroom areas and meeting rooms.
- 10.10. Provide interior room signage with Braille; provide directories and directional signage.
- 10.11. Refer to the Drawings for any other areas that may require specialties.

**DIVISION 11 EQUIPMENT**

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- 11.1. Reuse existing kitchen equipment or replace with residential grade provided by Owner.

**DIVISION 12 FURNISHINGS**

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- 12.1. All loose furnishings shall be by Owner.

**DIVISION 14 CONVEYING EQUIPMENT**

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- 14.1. Provide five-stop holed hydraulic elevator with front and rear 42" doors, 3500-pound capacity, 125 FPM, 38'-2" overall rise, five landing doors (one rear, four front) and hoistway dimensions of 8'4" x 7'-10 3/4".
- 14.2. Provide custom cab interior of plastic laminate panels, muntz bronze trim, and luminous suspended ceiling with LED concealed lighting.
- 14.3. Provide muntz bronze landing doors, frames and digital floor indicators at each landing.
- 14.4. Hoistway venting shall be provided through fire-rated duct risers to cupola vent louvers. Venting shall be normally closed via motorized damper that will open automatically in the event of a power failure, fire alarm or temperature of 85-degrees in the machine room.

**DIVISION 21 FIRE SUPPRESSION**

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- 21.1. Refer to the Fire Protection drawings for system requirements, including schematic notes for automatic sprinkler work.
- 21.2. Extent of existing fire suppression system is limited to an incoming 6" main and an existing backflow preventer. No other system components have been installed yet.

**DIVISIONS 22 PLUMBING**

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- 22.1. Refer to the Plumbing drawings and specs for all plumbing system work.
- 22.2. See Alternates for relocation of water supply feeds for sprinkler and domestic water.

**DIVISIONS 23 HEATING, VENTILATING AND AIR CONDITIONING**

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- 23.1. Refer to the Mechanical drawings and specs for replacement of existing HVAC systems in the original building, and modifications to the existing Gym HVAC systems.

**DIVISION 26 ELECTRICAL**

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- 26.1. Refer to the Electrical and Fire Alarm drawings for replacement of existing electrical and fire alarm systems.
- 26.2. Refer to the Architectural reflected ceiling plans for more complete lighting information than currently provided on the Electrical Lighting Drawings.

- 26.3. Lighting cut sheet includes exterior building mounted fixtures that are not yet shown on the electrical drawings (Types G1 and G2). Assume quantity of twelve fixtures with associated wiring and photocell controls.

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**DIVISION 27                      COMMUNICATIONS**

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- 27.1. Refer to the Electrical Drawings for tel/data, TV cabling, security systems and devices.  
27.2. Owner to arrange for telephone service for the elevator and fire alarm systems.

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**DIVISION 31                      EARTHWORK**

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- 31.1. Provide structural fill at excavated area and patch existing bituminous concrete paving where disrupted by the work (fire escape foundations, underground utility services).  
31.2. Other parking lot work related to striping and signage shall be performed by Owner.

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**DIVISION 32                      UTILITIES**

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- 32.1. Existing natural gas, domestic water and fire protection utility supplies are to remain.  
32.2. Refer to the Alternates for possible relocation of water supply (sprinklers & domestic).  
32.3. Existing sanitary sewer piping outflow to a grinder pump shall remain.  
32.4. Existing overhead electrical power will be removed; provide underground service as noted on the Electrical Drawings.  
32.5. Existing overhead telephone, cable TV and data shall be removed and re-routed underground from the same pole as the existing feeds; refer to Electrical Drawings for conduit bank. Existing underground fiber optic cable from site manhole shall remain.

**END OF SCHEMATIC DESIGN SPECIFICATIONS****ATTACHMENTS:**

- Division 22: Plumbing Specification (29 pages)
- Division 23: HVAC Specification (38 pages)
- Division 26: Electrical (43 pages)
- Division 26: Lighting Cut Sheets (37 pages)
- DRAWINGS: 50 sheets

Architectural, Structural, Fire Suppression, Plumbing, HVAC, Electrical

## **SECTION 22 00 00 - PLUMBING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. All of the Contract Documents, including the Conditions of the Contract, Division 1 General Requirements, the Technical Specifications, and all the Drawings apply to the work of this Section.

#### **1.2 SCOPE OF WORK**

- A. The scope of the work under this Specification Section, without limiting the generality thereof, includes the furnishing of all labor, materials, equipment, services and incidentals necessary to complete all of the work in accordance with the Contract Documents, which are intended to describe and provide a completed work product.
- B. The work under this Specification Section is specified herein and is shown on Drawings # P-1 through P-4 inclusive. Reference shall be made to all other drawings and specifications in these documents.
- C. The work includes but is not limited to:
  - 1. Sanitary drainage system inside building for fixtures, drains and equipment, extending the building main sanitary drain to a point at the exterior wall and connecting to the existing building drain.
  - 2. Domestic hot and cold water piping systems inside building for fixtures and other equipment.
  - 3. A gas-fired domestic hot water storage heater for the hot water system with a return system including pump.
  - 4. Gas system inside building for heating system equipment, connecting to gas meter outlet indicated on drawings. Gas meter, regulators and service piping from street main is existing.
  - 5. Water and waste services to equipment which is provided under other Sections.
  - 6. Plumbing fixtures; floor drains; area drains; wall hydrants;

backwater valves; domestic water heater, circulating pump and mixing valve; pipe covering and insulation; backflow preventer; cleanouts; miscellaneous specialties; other work and materials specified herein and/or indicated on the drawings.

7. Demolition; removal of all existing plumbing services, piping, fixtures, etc, within the building and abandonment of existing underslab drains within the building.

D. Furnish the following items for installation under other Sections:

1. Access panels.

### 1.3 RELATED WORK IN OTHER SECTIONS

- A. The work listed below will be furnished and installed under other SECTIONS of the Specifications, or by others noted, at no expense under the Plumbing Section, unless otherwise noted.
- B. Concrete work for pads, sumps and coring for pipe penetrations  
Section 03001, Concrete
- C. Electrical connections and services to plumbing equipment. Mount control cabinets.  
Section 16000, Electrical
- D. Painting.  
Section 09900, Painting
- E. Excavation, backfilling and re-surfacing.  
Section 02200, Earth Work
- F. Flashings for floor drains above grade and for pipes through roof.  
Section 07600, Roofing and Flashing
- G. Toilet room accessories furnished and installed  
Section 10800, Toilet and Bath Accessories.

### 1.4 CODES, PERMITS AND INSPECTIONS

- A. All work shall be done in strict accordance with the rules and regulations governing plumbing and drainage work in the Town of Westford, and shall conform to all other applicable legal regulations, and shall meet all requirements and rules of inspecting authorities. The Plumbing work shall comply with the Massachusetts State Plumbing Code. The completed gas installation shall meet all rules and regulations of the gas company and NFPA No. 54 and the Mass.

Amendments. In any conflict between plans or specifications and such rules and regulations, the latter shall take precedence, and all required work whatsoever shall be done without extra cost to the Owner.

- B. Give all notices, file all plans, obtain all permits and licenses, pay all fees, and obtain all necessary approval from authorities having jurisdiction. Deliver all certificates of inspection to the Architect. No work shall be covered before examination and approval by the Architect and by all Inspectors and Authorities having jurisdiction. Replace any imperfect or condemned work with work conforming to the requirements, and satisfactory to the Architect, without extra cost to the Owner. If work is covered before due inspection and approval, the Plumbing Subcontractor shall pay all costs of uncovering and reinstalling such work.

#### 1.5 VISITS TO THE SITE

- A. Prior to submitting a bid, bidders are expected to visit the site of work and become familiar with existing conditions at the site. Any incorrect assumptions made are at the Subcontractor's expense.

#### 1.6 RECORD DRAWINGS

- A. Refer to General Conditions. As the work progresses the Plumbing Subcontractor shall record on a set of contract plumbing drawings all changes from the installation originally indicated.
- B. The subcontractor performing the work of this Section shall be responsible for the continuous maintenance of the portions of the As-Built set pertaining to this work. The proper maintenance of the Record Documents shall be a condition precedent to payment to the subcontractor, through the Contractor, for any portion of the work of this Section.
- C. At completion of work the Plumbing Sub-contractor shall transfer the changes from the record drawings to approved achievable media and shall be for approved by the Architect.
- D. Indicate control valve locations and valve tag numbering on as-built drawings.

#### 1.7 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS

- A. Provide operating instructions to the Owner's designated representative with respect to operation functions and maintenance

procedures for all equipment and systems installed. The cost of such instruction up to a full day shall be included.

- B. Operating and maintenance manuals shall be compiled, maintained and delivered in accordance with General Conditions, including parts lists and name, address and telephone number of manufacturers' representative and service company.

## 1.8 SUBMITTALS

- A. Comply with the provisions of General Conditions.
- B. Within 30 calendar days after notice to proceed submit:
  - 1. A complete list of all materials proposed to be furnished and installed under this Section.
  - 2. Manufacturer's specifications and catalog cuts as required demonstrating compliance with the specified requirements.
  - 3. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.
  - 4. Shop drawings for all installations.
- C. The shop drawings shall be submitted in accordance with the following and the terms of the General Conditions, with the exception that six (6) prints of each Drawing are required. The shop drawings shall include complete dimensions, details of construction, arrangement, performance characteristics and accessories. Submit shop drawings for Contractor-fabricated items, as required by the Architect.
- D. Submittal for pipe and fittings, hangers and similar standard items shall consist of a list giving the manufacturer's name type and catalog or model number for each item. The Architect reserves the right to request samples of any of the subject items. This subcontractor's intent to use the exact makes specified does not relieve him of the responsibility of submitting such a list.
- E. Drawings, catalog cuts and samples shall be clearly labeled indicating equipment number as per schedules on drawings; specific service or use, job name, Contractor's name, and manufacturers' name and address; incomplete or poorly identified submissions will not be acceptable.
- F. Approval of submissions will be final, and no further changes will

be permitted.

- G. If substitutions for specified items are permitted, the responsibility for the coordination of all related work shall be accepted by the Contractor proposing such substitutions.
- H. The list of materials shall include:
  - 1. Pipe and fittings
  - 2. Pipe hangers
  - 3. Pipe insulation
  - 4. Fixtures and trim
  - 5. Floor drains, backwater valves and cleanouts
  - 6. Valves
  - 7. Domestic water heating equipment and accessories
  - 8. Hot water pumps
  - 9. Tempering valves
  - 10. Backflow preventer.
  - 11. Thermometers and gauges

## 1.9 GUARANTEES

- A. All material and equipment furnished and installed under this section and shown or inferred on the Contract Drawings, shall be guaranteed for a period of one (1) year from the date of final acceptance, by the Owner. This guarantee shall state, in writing, that any defective material, equipment or parts thereof, shall be replaced during this one year period, without cost to the Owner. The guarantee shall be signed by the person or persons performing the work and shall be countersigned by the General Contractor before delivering to the Owner.

## 1.10 PLUMBING DRAWINGS

- A. Work shown on drawings is intended to be approximately correct to scale, but figured dimensions and detailed drawings are to be followed in every case. The drawings shall be taken in a sense as diagrammatic. Sizes of pipes and general method of running them are shown, but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered. To carry out the true intent and purpose of the plans, all necessary parts to make complete working systems ready for use shall be furnished without extra charge to the Owner.
- B. The drawings and specifications are intended to supplement each other so that any details shown on drawings and not mentioned in the Specifications or vice versa shall be executed the same as if both

mentioned in the Specifications and shown on the drawings. Information and components shown on diagrams or details but not on plans (or vice versa) shall be provided as if called for by both.

- C. This subcontractor shall refer to the Architectural, Mechanical, Electrical and Structural Drawings which indicate the type of construction in which the work shall be installed and the work of other trades. Locations shown on the Plumbing Plans shall be checked against the general and detailed drawings of the construction proper. All measurements must be taken at the building.

#### 1.11 DISCREPANCIES IN DOCUMENTS

- A. The Architect's interpretation of documents shall be final. Advise the Architect in writing prior to the award of the contract if the Contract Documents express discrepancies or unclearities. No additional compensation shall be permitted without Architect's approval.
- B. Where Drawings or Specifications do not coincide with the recommendations of the manufacturer of materials or equipment, alert the Architect in writing before installation of the item in question. Otherwise make changes in the installation as required by the Architect without additional cost to the Owner.

#### 1.12 QUALITY AND WORKMANSHIP

- A. All equipment shall be constructed and installed to operate safely and without leakage, undue wear, noise, vibration, corrosion or water hammer. Materials and workmanship shall be of the highest quality, new and free from defects.

#### 1.13 CROSS CONNECTIONS

- A. No piping shall be installed in a manner to permit back siphonage or any flow of water from sanitary or drainage systems into water service or distribution piping under any conditions.
- B. Approved air gaps, open-end or funnel drains, vacuum breaker devices and back-flow preventing devices, as specified in other parts of this SECTION, shall be provided as required by the Massachusetts State Plumbing Code and Department of Environmental Protection, Division of Water quality, and approved by Architect.



## **PART 2 - PRODUCTS**

### 2.1 PIPE AND FITTINGS

- A. General: All pipe and fittings in the work shall be new and unused, conforming to the latest standards of the A.S.A., A.S.T.M., and other similar standards. Each length of pipe and each fitting shall bear the stamp of name of manufacturer.
- B. Soil, Vent, and Waste:
  - 1. Soil, waste, vent and storm drainage pipe and fittings below ground inside building and to points ten feet outside building shall be, except as otherwise specified, service weight cast iron soil, hub and spigot pipe conforming to ASTM A-74, and marked with the trademark of the Cast Iron Soil Pipe Institute and listed by NSF International. Neoprene rubber compression gasket joints shall meet ASTM C-564, or lead and oakum may be used as an alternate. Buried drain line in building shall have a single coat of asphaltum for moisture protection.
  - 2. Above ground soil, waste, vent and storm drain piping and fittings shall be, except as otherwise specified, no-hub cast iron soil pipe conforming to Cast Iron Soil Pipe Institute Standard 301, marked with the trademark of the same, and listed by NSF International. Couplings shall be Code approved, conforming to ASTM C-1540 & C-564, stainless steel, heavy duty, 0.016 inches type 304 stainless steel with Neoprene gasket, equal to Anaheim Foundry Company Huskey SD-4000, Central Foundry or Tyler. Waste lines two inch and smaller may be Type "L" copper tubing, heavy, seamless, with heavy cast brass, solder joint drainage fittings. Urinal wastes shall be only extra heavy hub and spigot cast iron soil pipe with lead and oakum caulked joints.
  - 3. Exposed waste piping at fixtures and equipment shall be solder-joint chromium-plated heavy cast brass drainage type fittings, or chromium-plated I.P.S. heavy gauge brass.
- C. Water Pipe Inside Building:
  - 1. Potable and non-potable domestic hot, hot return and cold water piping, and tempered water piping inside building above ground, except as otherwise specified for exposed pipe and fixtures and equipment, shall be Type L copper tubing hard drawn, with solder-joint cast bronze or cast, or wrought, copper fittings using

code approved lead-free solder. Buried water piping inside building under 4-inch size shall be type K soft copper tubing with sweat cast bronze fittings and silver solder joints. Piping for connections between valves and mechanical equipment, such as water heaters, shall be seamless red brass or copper pipe, iron pipe size, with threaded brass fittings, 125 psi working steam pressure.

2. Exposed uninsulated water piping at fixtures shall be chromium-plated I.P.S. heavy brass with chromium-plated brass or bronze fittings.

D. Gas Pipe:

1. Gas piping inside building shall be black steel Schedule 40 ASTM Designation A120 (seamless type), with black malleable iron threaded or welded fittings conforming to ASA B16.3.
2. 2" and smaller pipe shall be NPT threaded.
3. 2-1/2" and larger pipe shall be welded, except flanged at valves and equipment.

## 2.2 VALVES, FLANGES, UNIONS and DIELECTRICS

- A. All systems under this Section shall be provided with valves to permit complete and sectional control of the system. They shall be located to permit easy operation, replacement and repair. They shall be installed at connections to all equipment, where shown on the drawings and as herein specified. They shall be as manufactured by one of the following companies: Hammond, Watts, Nibco, Apollo, Milwaukee, or approved equivalent, and shall conform to description listed below. Provide unions on water connections to all equipment

1. Water Valves:

Gate valves on water lines in building shall be all bronze with packing glands, stuffing boxes and nuts designed for 300 psi water and shall have solder ends, up to 3-inch size, equivalent to Hammond Fig. IB-645 except as noted. Ball type shut-off valves shall be used up to 2-inch size, except as noted, and shall be Apollo Series 70, Watts, or Nibco, all bronze with solder ends, Teflon seals and seats, 316 stainless steel ball and stem, 600 psi water pressure. Gate valves larger than 3-inch size shall be cast iron, bronze fitted, Hammond Fig. IR-1140. Gate valve shall be

used on back side of water meter.

- B. Drain valves shall be 3/4 inch hose-end ball valves with cap and chain, Apollo No. 70-100-HC. Provide at all low points in water piping system and at the base of all risers so that entire system may be drained.
- C. Check valves shall be swing-type, all bronze, equal to Hammond No. IB-912, solder-end for 3 inches and smaller and flanged for 4 inches and larger.
- D. Balancing valves shall be Apollo Series 70, same as described above for water, ball type shut-off, provided with balancing stop.
- E. Gas Valves: Inside building shall be AGA certified and UL listed, Apollo forged brass body, ball type with tee head and stop, on piping 1-inch size and smaller; model "GB". On 1-1/4 inch pipe and larger, gas valves shall be bronze body with chrome plated ball, with lever handle, suitable for gas service; Apollo model 80-100 series.
- F. Unions: All unions in water piping shall be I.P.S. brass with adapters suitable for not less than 125 pounds steam working pressure, complete with necessary adapters, and shall be of size and materials of adjacent piping.
- G. Unions on ferrous materials shall have a minimum working pressure of 150 # rating and shall be ground joint type.
- H. Flanges: All flanges shall be companion type, faced and drilled for not less than 125 pounds steam working pressure, complete with necessary adapters, and shall be of size and material of adjacent piping.
- I. Dielectric couplings: whenever piping systems of nonferrous and ferrous materials must come in contact - connections shall be made utilizing flanges, or dielectric unions that are electrically isolated. The installation shall maintain the required pressure rating. Manufactured components shall be submitted for approval prior to installation.

### 2.3 TRAPS and STRAINERS

- A. Provide separate traps with cleanouts on fixtures and equipment requiring connection to the sanitary system. Traps shall be provided according to Code requirements. Exceptions to separate traps, only as allowed per Code for multi-compartment fixtures or fixtures with integral traps.
- B. Traps exposed to view shall be chrome plated. Traps shall be sized as indicated

and no trap shall be less than 1-1/2 inch.

- C. Strainers 2-1/2 inch and smaller shall be wye strainers, bronze body, stainless steel screens, 300 psi working pressure, threaded end with blow-off valved and pipe to drain. Manufacturer; Mueller #351, Braukman # FY32 or Strong # SYB.
- D. Strainers 3 inch and larger shall be Wye type, iron body, stainless steel screens, 175 psi working pressure, flanged end with blow-off piped to drain
- E. Manufacturer; Mueller #751, Braukman # FH33 or Strong # F1.

## 2.4 HANGERS AND SUPPORTS

- A. All piping shall be supported from the building structure by means of approved hangers and supports. Piping shall be supported to maintain required grading and pitching of lines, to prevent vibration and secure piping in place, and shall be so arranged as to provide for expansion and contraction.
- B. Maximum spacing of hangers on runs of pipe having no concentration of weight shall be as follows:

Schedule / Hanger spacing in Feet / Pipe Materials:

<u>PIPE SIZE (inches)</u>	<u>COPPER/BRASS-STEEL</u>
1/2	5
3/4	5
1	5
1-1/4	8
1-1/2	8
2	8
2-1/2	10
3	10
4 - 5	10

- C. Maximum spacing of hangers on cast iron soil pipe shall be five feet and hangers shall be provided at all changes in direction. Hanger rods to support piping from structure or direction. Hanger rods to support piping from structure or supplementary steel shall not exceed four feet in total length
- D. Hangers on P or PVC piping, if specified, shall be as required by Plumbing Code.
- E. Where codes having jurisdiction require closer spacing, the hanger spacing shall be as required by code in lieu of the distances

specified herein.

- F. Hangers for uninsulated copper and brass piping shall be copper or shall have factory applied heavy copper plating.
- G. All hangers on insulated lines shall be sized to fit the outside diameter of the pipe insulation. Provide pipe covering protection saddles and at all hangers on the insulated lines.
- H. All piping installed under this Section of the Specifications shall be independently supported from the building structure and not from the piping, ductwork or conduit of other trades.
- I. All hangers shall be secured to approved inserts or expansion shields wherever possible and practicable. Drilling where required shall be done by the Plumbing subcontractor under this Section of the Specifications. Hangers shall be supported from wood members with lag screws.
- J. Provide friction clamps at base of stacks.
- K. Buried piping below structural floor slabs shall be supported with hangers and rods attached to floor slab. Buried hangers and rods shall be given a coat of asphaltum.
- L. Hangers on uninsulated piping 2-inch size and smaller shall be 1A band type with threaded hanger rod, nut and locknut; on all insulated piping they shall be clevis type with threaded rod, nut and adjusting nut. Carpenter-Patterson, or equivalent.

## 2.5 SLEEVES AND ESCUTCHEONS

- A. Furnish and set pipe sleeves in concrete and masonry walls for all work under this Section and be responsible for their proper and permanent location.
- B. Pipes passing through masonry or concrete floors, designated fire walls or partitions shall be provided with sleeves having an internal diameter 1-1/2 inches (3/4 inch annular space) larger than the outside diameter of the pipe or insulation covered lines, except as otherwise specified herein.
- C. Sleeves shall extend 1/2 inch above finished floor, and after the installation of pipe, shall be packed and made watertight and where required, fire rated – see section on fire stopping. Sealant shall be fire retardant. Where under partitions, the sleeves shall be flush with the bottom of the partition.
- D. Sleeve through floors or interior masonry walls shall be of

galvanized iron pipe or wrought iron pipe size except where located in concealed spaces they shall be of 22-gauge galvanized sheet steel.

- E. Escutcheons shall be provided around all exposed insulated or bare pipe passing through walls, partitions, ceilings and floors. Escutcheons shall be of sufficient outside diameter to cover the sleeve opening and shall fit snugly around the insulated or bare pipe and to the wall, partition, floor or ceiling. Escutcheons shall be chrome plated.
- F. Sleeves for pipes through below grade floor slabs and exterior walls below grade shall be made watertight with flange welded to pipe and annular space filled with waterproofing compound.

## 2.6 CLEANOUTS

- A. Bodies of cleanout ferrules in bell and spigot rainwater leader and sanitary piping shall be of standard pipe sizes and conforming in thickness to that required for pipe and fittings, and shall extend not less than 3/4 inch above hub of pipe. Cleanout plug in cast iron piping shall be of cast brass and shall be provided with a raised nut 3/4-inch high. Cleanouts in copper waste piping shall be soldered of same size as line. Cleanouts in threaded 90 degree branch fittings shall be end type with extra heavy brass screw plugs of same size as pipe.
- B. Test tees with brass cleanout plugs shall be installed at foot of all vertical rainwater leader, soil and waste lines. Wherever cleanouts on vertical lines occur concealed behind finished walls, they shall be extended to back of finish walls and wall plate shall be provided flush with finished wall, Josam, Smith or Zurn, or equivalent, equivalently to Zurn No. ZABN-1460-8 stainless steel access cover and plug.
- C. Cleanouts on buried sanitary piping inside building shall be as follows:
  - 1. Tile Floors: Zurn AN-1400-6, round nickel bronze top recessed for tile.
  - 2. Permanently Carpeted floors: ZN1400-14, with carpet retainer
  - 3. Concrete painted floors: ZN-1400-2.

## 2.7 PIPE COVERING AND INSULATION

- A. Furnish and install pipe covering and insulation for the following systems and equipment:
  - 1. All domestic hot water supply and circulating piping, tempered water piping and cold water piping above-ground in the building, including the non-potable water piping.
  
- B. Pipe covering and insulation shall be installed by a qualified insulation Contractor acceptable to the Architect. Installation application shall be in accordance with the manufacturer's recommendations. Jackets and adhesives shall be flame retardant. Cover all piping, fittings and valves on systems noted to be insulated. Carry insulation through sleeves and pipe hangers, with insulation protectors at points of hanger support. Pipe covering shall be as manufactured by Owens-Corning, Manville, Certain-Teed, or equivalent.
  
- C. Piping Insulation Material:
  - 1. On Piping: Fibrous glass, heavy density, pre-moulded sectional type, snap on pipe insulation with all-service factory applied self sealing flame retardant vapor barrier jacket, 25/50 rated, equivalent to Owens-Corning ASJ-SSL-II. Thickness shall be 1 inch for cold water piping; 1 inch for hot water branches and runouts, 1-inch on hot water mains and sub-mains. Inside chases; ½" on cold water, and 1" on hot water and hot water return.
  - 2. Fittings and valves shall have pre-moulded 25/50 rated PVC insulated fitting covers equivalent to Manville zeston.
  
- D. Piping insulation under handicap sinks see plumbing Fixture specifications.

## 2.8 MISCELLANEOUS SPECIALTIES

- A. Thermometers: Terrice, Ashcroft or equal, industrial type, 6-1/2-inch long cast aluminum case, straight or angle form, with lens front red mercury tubing, white background scale with black graduations, brass stem, separable socket type, brass well, 30 to 180 degree Fahrenheit range.
  
- B. Water Pressure Gauges: Terrice, Ashcroft, or equal, 4-1/2-inch dial type with stainless steel case, 0-160 psi range, rigid stem.

- C. Vacuum Relief Valves: Watts regulator Company, Beacon or equal, equal to Watts No. 36A, 3/4-inch size. Provide multiples as required according to Code.
- D. Water Hammer Arrestors in Water Piping: Zurn, Smith, Josam, or equivalent, equivalently to Zurn No. Z-1700, size designation in accord with PDI Standards, where indicated on the drawings.
- E. Dielectric Fittings: To be installed in piping whenever dissimilar metals are joined together, patented type dielectric fittings or couplings, as manufactured by Watts Regulator Company, V-Line, Dart or equivalent.
- F. Vacuum breakers, non-pressure type; Watts No. 288.

## 2.9 WALL HYDRANTS

- A. Wall hydrants shall be Zurn, Josam or Smith, equal to Zurn No. Z-1315, non-freeze, surface mounted, with integral backflow preventer, bronze with nickel bronze face and operating key.

## 2.10 BACKWATER VALVES

- A. Backwater valves on waste piping shall be same size as piping line served, manufactured by Zurn, Smith or Josam, equivalent to Zurn No. Z-1095 cast iron hub and spigot type with flapper and threaded cover. When valve is buried, furnish cast iron pipe extension and install cover at finish floor.

## 2.11 HOSE BIBBS

- A. H.B.-1: Concealed piping, Chicago Faucet Company, T&S Brass, Speakman or equivalent to Chicago No. 952 sill faucet, heavy brass polished chromium-plated with 1/2 inch inlet, 3/4 inch hose outlet, loose tee handle and vacuum breaker.
- B. H.B.-2: Exposed piping, Chicago No. 998 sill faucet of heavy brass, rough chromium-plated, with 1/2 inch inlet, 3/4 inch hose outlet, removable tee handle and vacuum breaker.

## 2.12 FLOOR DRAINS AND AREA DRAINS

- A. Floor drains and area drains shall be Zurn, Smith, Josam, or equivalent to the JR Smith catalog numbers noted below, or sizes indicated in drawings. At those drains without integral trap plumber

shall provide trap.

B. Floor and Area Drains:

1. Floor Drain Type "A": 2010-A cast iron floor drain with 6-inch diameter nickel bronze strainer, cast iron body with bottom outlet, flashing clamp.
2. Floor Drain Type "B.": 2110-B cast iron floor drain with bottom outlet, seepage pan and clamp, 8-inch diameter heavy duty cast iron top grate, sediment bucket.

2.13 BACKFLOW PREVENTERS

- A. Backflow preventer in the domestic water system shall be as manufactured by Watts Regulator Company, Febco, Hersey, or equivalent, and shall be bronze with stainless steel trim, reduced pressure type, complete with strainers and shut-off valves. Material and installation shall be in compliance with the Massachusetts State Plumbing Code and Department of Environmental Protection. This contractor shall submit required drawings and specifications for approval by the Code authorities, and shall arrange for testing and certificate of approval from authorities. Installation shall include approval from authorities. Installation shall include supports and air gap fittings, as indicated on drawings.
- B. RPBP No. 1: In Plant Protection: Watts No. 009-QT-S Reduced Pressure Type Backflow Preventer, with bronze ball shut-offs and strainer, 3/4-inch size, when used on hot water service unit shall be rated for minimum 180°F.
- C. RPBP No. 2: Watts No. 909, reduced pressure type backflow preventer with bronze ball valves and strainer, size as indicated on the drawings. Pipe relief to drain in accordance with local code requirements.
- D. Furnish one test kit, Watts No. TK-9A.

2.14 HOT WATER HEATERS

- A. Hot water storage heaters and tanks shall be tested at 200 psi and rated for working pressure of 150 psi and shall bear stamp certifying testing and rating. Tanks with capacity greater than 120 gallons or input rating greater than 200,000 Btu/hr shall be constructed in accordance with ASME Boiler and Pressure Vessel Code.
- B. Hot water tanks and heaters shall be provided with pressure and temperature relief valve and vacuum relief valve.

1. Pressure and temperature relief valves shall be rated and listed for heater input rating.
  2. Minimum size of pressure and temperature relief valves shall be 3/4 inches.
  3. Temperature and pressure relief valves shall be rated in accordance with applicable ANSI and ASME standards.
  4. Vacuum relief valves shall be listed in compliance with ANSI standards.
  5. Vacuum relief valves shall be installed in cold water supply line at level above top of heater or tank.
- C. Storage tanks and heaters shall have minimum standby heat loss in accordance with requirements of State Energy Code. Tanks and heaters which are not factory insulated and jacketed shall be field insulated.
- D. Field insulation of tanks and heaters shall consist of minimum of 2 in. fiberglass insulation. Refer to paragraph INSULATION for additional requirements.
1. Insulation shall be cut or mitered where necessary to fit shape and contour of equipment. Insulation shall be banded or wired in place on 12 inch centers or impaled over pins on 18 inch centers. Point up open joints with insulating cement.
  2. Apply 1 inch hexagonal mesh over insulation, lacing edges together.
- E. Apply 1/2 inch thick coat of insulating cement and trowel to smooth finish. Adhere glass cloth jacket over cement with approved lagging adhesive. Size jacket with one brush coat of lagging adhesive.
- F. Heaters and tank shall be of size and type as indicated on Drawings.
- G. Furnish and install as detailed on the drawings the following domestic hot water heating equipment as manufactured by State, Rheem, Camline Corp., or equal. The model number is taken from the catalog and is intended to establish the capacity, physical size, style, thermal efficiency and space requirements desired.
- H. One State Model No. GPG 81 140 NE: Commercial gas-fired storage heater with an input of 140,000 BTUH and recovery rate of 136 GPH at a 100 degree F. temperature rise, and a storage capacity of 81 gallons. Water heater shall be pre-wired for factory tested and U.L. listed. Tank shall be glass lined and furnished with an anode rod, designed for 150 psi working pressure and built in accordance with N.S.F. Standard No. 5, with hand-hole cleanouts, heavy blanket

insulation and outer enameled jacket. Tank shall have limited 3-year warranty against tank failure.

1. Unit shall meet ASHRAE 90A requirements for energy efficiency.
2. Heater shall have an A.G.A. temperature steam rated pressure and temperature relief valve. On cold water connection provide Watts Regulator No. 36S vacuum relief valves.

## 2.15 HOT WATER CIRCULATING PUMPS

- A. Hot Water Circulating Pump No. 1 - General Use Hot Water: One domestic hot water circulating pump in the building circulating main, as indicated on the drawings, as manufactured by Taco, Bell and Gossett, equivalent to Taco No. 006, all bronze, 3/4 inch size. in-line centrifugal type, 11 GPM at 10-ft. discharge head, with 1/40 HP motor, 1725 RPM, wired for 120-volt, single phase, 60 Hz. Installation shall include valves bypass and one Honeywell No. L4006A immersion type aquastat for on/off automatic control. Installation shall also include a manual on/off switch.

## 2.16 PLUMBING FIXTURES

- A. General Requirements:
  1. References made herein are generally based on Kohler Company plate numbers to establish type and quality of materials. All exposed piping to fixtures shall be chrome plated and connected to the rough piping system at the wall. Wall escutcheon shall be chrome plated brass with polished, bright surfaces and set screws. Vitreous china and acid-resisting enameled cast iron fixtures shall be Kohler Company, American Standard, Eljer Company, or equal. Kitchen sinks shall be Elkay, Just or equal. Showers shall be Symmons, Leonard or Powers.
  2. The Plumbing Subcontractor shall furnish all supports, brackets, bolts, etc. for proper installation of all fixtures requiring support. They shall be in accordance with the manufacturer's recommendations and, if necessary, shall be built into place as the building progresses. This Contractor shall be held responsible for the stability and proper support of all plumbing fixtures. Refer to Architectural drawings for elevations.

Fixtures shall be white unless otherwise noted.

3. All fixtures furnished under this Section shall be supported and fastened in a manner to prevent damage to building structure. Where wall hung fixtures are secured to masonry or tile walls or partitions, they shall be fastened with 1/4 inch through bolts provided with nuts and washers or plates at back, except where chair carriers are used. Bolt heads and nuts shall be hexagon and exposed bolts, nuts, washers and screws shall be chromium plated brass. Where secured to concrete or brick walls, they shall be fastened with brass bolts or machine screws in lead sleeve type expansion shields and shall extend at least three inches into solid concrete or brick work.
4. Where chair carriers are required they shall be completely concealed in the building construction and shall rigidly support the fixtures from the floor. Chair carriers shall be adjustable both vertically and horizontally, and shall support fixtures in such a manner that no part of the fixture will be supported by the wall or partitions. All wall hung water closets shall be supported on combination wall hung drainage fittings and chair carrier complete with foot or block base lagged to floor in three locations. These fittings shall be cast iron, vertical or horizontal type as indicated on the drawings, fitted with face plate of the proper style to accommodate the water closet specified, furnished complete with the necessary bolts, nuts and washers as well as connecting nipples of the proper length with gaskets for the closet connection. Nipples on closet connections shall be cast iron. Wall hung water closets shall have 300-lb extra rigid carrier.
5. Fixtures shall be white, except as noted.

B. Fixtures Description:

1. See schedule on the drawings for fixture types.

2.17 TRAP PRIMER

- A. Unit shall be designed to deliver a metered amount of water upon sensing of a pressure drop in the line on which it is installed.
- B. Unit shall be adjustable to line pressure and quantity of flow delivered.
- C. Unit shall be corrosion resistant brass construction with "O" ring seals, as manufactured by Precision Plumbing Products, Model P-2 trap primer valve.

## 2.18 MOTORS, STARTERS AND WIRING

- A. Provide motors, contactors and controls, and furnish starters for entire plumbing installation. Provide control and related wiring, including interlocks. Power wiring between panelboard, disconnect switches to starters, and motors including remote and local combination push buttons and pilot light stations shall be provided under other Sections.
- B. Motors, unless otherwise specified, shall be NEMA Design B, constant speed, self-ventilated general purpose squirrel cage induction type. Motors shall have 1.15 service factor unless totally enclosed. Motors shall have Class B insulation.
  - 1. Motors under 1/2 hp, unless otherwise specified, shall be designed for 120 V, 60 Hz, single phase.
  - 2. Motors 1/2 hp and over shall be as required in schedules.
- C. Starters requiring interlocks or remote control shall be magnetic type with HAND-OFF-AUTOMATIC switch in cover. Units requiring magnetic starters shall be so provided.
  - 1. Each 3 phase, 60 Hz motor shall be provided with magnetic starter with ON-OFF push button.
  - 2. Other motors shall be provided with manual starter with ON-OFF switch.
  - 3. Control relay for each starter shall be for operation on 120 V, single phase, and transformer of sufficient capacity within starter case shall be furnished for this purpose.
  - 4. Each starter shall be provided with inverse time limit overload and under voltage protection in each leg and with pilot light.
  - 5. Starters shall be same make: Cutler-Hammer, Clark, Arrow Hart or approved equal
  - 6. Above items shall be provided in all cases, except as required in schedules.

## **PART 3 - EXECUTION**

### 3.1 GENERAL

- A. The plumbing drawings are generally diagrammatic and indicative of the work to be installed. The Plumbing Contractor shall be responsible for the correct installation of his work in manner satisfactory to the best practices of his trade and to complete the scope of this contract in all respects.
- B. The location of piping as indicated on the drawings, unless otherwise noted, is diagrammatic only, and the exact location shall be determined in the field. The run and arrangement of all pipes shall be approximately as shown on the drawings, as directed during installation, as straight as possible, forming right angles on parallel lines with building walls and other pipes, and neatly spaced. All risers shall be erected true and plumb, parallel with walls, and other pipes and neatly spaces. All horizontal runs of piping, except where concealed in partitions shall be kept as high as possible and close to walls. Wherever possible, adjacent pipe lines shall be grouped in same vertical or horizontal planes. Piping shall not interfere with operation of accessibility of doors, windows, access panels or equipment and shall not encroach on aisles or passageways. All piping shall be installed to preserve access to all valves, traps and equipment. Make such offsets and deviations from the drawings as may become necessary to meet actual field condition.
- C. Keep fully informed as to shape, size and positions of openings required for material or equipment to be provided under this and other sections. Give full information so that opening required by work of this section may be coordinated with other work and other openings and may be provided in advance. In case of failure to provide necessary and sufficient information in proper time, trade involved will be required to do cutting and patching or have same done, at own expense and to full satisfaction of the Architect.
- D. The Plumbing Subcontractor shall coordinate all his work with all other trades, and shall so-arrange his work that there will be no delay in the proper installation and completion of any part or parts of each respective work, wherein it may be interrelated with his, so that generally all construction work can proceed in its natural sequence without unnecessary delay. Close coordination is also

required with the contractors in areas serving all trades.

- E. Pipes shall be cut accurately to measurements established at the site, shall be worked into place without springing or forcing. All pipe, regardless of how cut, throughout the job, shall be reamed smooth and all burrs removed before being installed. Pipe shall not be split, bent, flattened, nor otherwise injured either before or during the installation.
- F. The Plumbing Subcontractor shall use every precaution in the installation of all piping to prevent dirt, chips, or other foreign materials from entering the inside of piping. All pipes shall be cleaned and blown out to the satisfaction of the Architect or his representative before closing of any line. Keep the ends of piping capped or blind flanged and openings in apparatus or fixtures plugged during the construction of the system to keep out dirt or other foreign matter. The plugs and caps are to remain until permanent and final installation is made. The use of paper, waste, rags, and so forth to temporarily close openings will not be permitted.
- G. Maintenance of equipment and systems: provide maintenance for Plumbing equipment and systems until final acceptance by the Architect and Owner, and take such measures as necessary to ensure adequate protection of equipment and material during delivery, storage, installation and shutdown conditions. This responsibility shall include provisions required to meet conditions incidental to delays pending final test of systems and equipment under seasonal conditions.
- H. Use of premises: Shall be as restricted by the Architect and as follows. As required, during progress of work, remove and properly dispose of resultant dirt and debris, and keep premises reasonably clean. Upon completion of the work, remove equipment and unused material provided for work, and put building and premises in neat and clean condition, and do cleaning and washing required to provide acceptable appearance and operation of equipment, to the satisfaction of the Architect and as otherwise specified herein.
- I. Rough-in measurements: Base reference points both horizontally and vertically shall be extended from known points provide by the General Contractor. Plumbing subcontractor shall be responsible for correct layout of his work. In the event of discrepancies between actual dimensions and those indicated on the drawings, notify Architect in writing and do not proceed further without written instructions or prior approval.
- J. Fireproofing: installation of work under this Section shall be

performed prior to application of fireproofing. Damage to installed fire proofing caused by the installation of the work of this Section shall be remedied by this subcontractor and at no cost to the Owner.

- K. Temporary heat: Refer to Section 01500 Temporary Facilities.

### 3.2 SANITARY SYSTEMS - INSTALLATION

- A. Work shall include sanitary drainage piping inside building for fixtures and drains, as indicated on the drawings, and extending the building sanitary sewer to a point as indicated on the drawings.
- B. Interior sanitary and storm drain piping shall pitch in accordance with code requirements, unless otherwise noted. Buried sanitary piping shall be a minimum of three inches in diameter, except as indicated. All changes in pipe size and direction of piping shall be made with Y's and cleanouts, reducing fittings or recessed reducers. Y's and 45-degree combination fittings shall be used wherever conditions permit.
- C. Sanitary long sweep bends and Y's shall be used for connections to branch lines for fixtures and TY's on vertical runs of pipe. Long turn fittings shall be used wherever conditions permit, or as required by Code.
- D. Cleanouts shall be installed in the sanitary and storm systems where indicated on the drawings, or approximately every fifty feet along horizontal runs, at all changes of direction and at the base of all soil, waste and leader stacks. Test tees with brass cleanout plugs shall be installed at the base of all vertical piping. No projection above the floor line will be permitted. Cleanouts occurring in or back of walls shall be extended out to a wall panel. Cleanouts located in floor shall be extended to grade and finished with an access panel as specified herein before in this section.
- E. Each fixture, drain and piece of equipment must be separately trapped, unless otherwise indicated, and all traps must be vented. All main stacks of back ventilation shall run parallel and as close as possible to the soil stack, and shall connect to the vent continuation of the soil stack. Horizontal vent lines shall pitch to a waste line.
- F. Vents shall extend sufficiently above roof so that outlet will be a minimum of twenty-four inches above roof.

### 3.3 DOMESTIC HOT AND COLD WATER SYSTEMS

- A. Work shall include domestic hot and cold water systems inside

building, with cold water service extending and terminating ten feet outside building. The domestic cold water system shall have a backflow preventer for in-plant protection, with non-potable cold water for the heating system make-up.

- B. The exterior service water piping shall be laid at minimum depth of five feet over top of pipe. Piping shall be kept clean during laying operations by plugging or other approved method. Pipe shall not be laid in water. Fittings at bends in piping shall be firmly wedged against the vertical face of pipe trench, with concrete thrust blocks by general Contractor. Underground water service piping shall be flushed, tested and sterilized in a manner acceptable to local water department and Architect.
- C. All water piping inside building shall be installed without traps or pockets and shall pitch to draw-offs so that the whole system or individual sections can be properly drained. All draw-off valves shall have hose end which shall be capped.
- D. Changes in pipe size shall be made with reducing fittings. The use of bushings will not be allowed.
- E. All lines of water piping shall be protected from water hammer by shock absorbers or air chambers, unless otherwise noted, at the end of all branches, risers, ends of battery branches and at all fixtures.
- F. Water piping shall be installed, complete in all respects to each piece of plumbing equipment or fixture requiring same. Final connections shall be by the Plumbing Subcontractor.
- G. At completion of work all hot water circulating mains and branches shall be balanced for equal flow, by adjustment of balancing valves.

#### 3.4 GAS PIPING SYSTEMS INSTALLATION

- A. The Plumbing Subcontractor shall arrange for and pay all charges associated with the installation of the new gas service from the street into the building. The Gas Company will install the new service, regulator and meter. Work shall consist of new gas piping to heating boilers and hot water heater.
- B. Shut-off valves shall be provided at connections to all equipment. Drip legs shall be installed at all low points. Provide shut-off valves on branches to equipment, at each riser and where noted on drawings.

#### 3.5 FIRESTOPPING

- A. Firesafing and smoke seal is required where all pipes and conduit leave or enter all vertical shafts, at all floors and through all walls above or below all Class "A" acoustical tile ceilings, and all spaces without any type of finish ceiling.
- B. Firesafing and smoke seal is required for all penetrations through rated walls and partitions and at positions separating smoke zones.
- C. Firesafing and smoke seal of pipe and duct penetrations through non-rated secondary walls within a rated larger area need not require firesafing and smoke seal until they penetrate the rated walls.
- D. Firesafing and smoke seal materials are as follows:
  - 1. "Poke-through" fire containment, USG "THERMAFIBER", fire test CEG 4-11-78; USG 6-2-76; CEG B-7-85.
  - 2. USG "THERMAFIBER" Rigid-type, various thickness.
  - 3. USG "THERMAFIBER SMOKE SEAL COMPOUND" - UL No. RI 1327-L; UL No. RI 1327-R.
  - 4. Dow Corning fire stop sealant and Dow Corning fire stop foam "A" an "B" classified for 1, 2 and 3 hours.
- E. All firesafing material must be noncombustible as defined by NFPA Standard 220 when tested in accordance with ASTM E136; melt point - 2000 F; when in contact with metal, be non-corrosive meeting FS-HH-1-558 B; "k" value of 0.25 or less per ASTM C 518; the material shall be moisture-resistant, mildew, vermin-proof and non-deteriorating. The firesafing insulation shall meet fire containment tests per ASTM E119.

### 3.6 EXPANSION PROVISIONS

- A. Installation of piping must allow for expansion using offsets, loops, swing joints, expansion joints, etc. as shown and as may be necessary to prevent undue strain. Take-offs from mains to runouts shall not have less than three elbow swing.
- B. Mains and risers with loops or offsets shall be securely anchored to structure so as to impart expansion towards loops or offsets. Anchors shall be constructed of heavy forged wrought iron, secured to pipe and structure. Provide vibration isolation as required.
- C. Provide pipe alignment guides as required to guide expanding pipe to move freely from anchor points toward expansion joints, offsets, etc.

### 3.7 ACCESS AND ACCESS PANELS

- A. Perform work required so as to provide proper access to material or equipment which may need inspection, replacement, repair or service. If proper access cannot be provided, confer with Architect as to best method of minimizing effect of reduced access which may result.

- B. Furnish access panels for installation under other Sections where shut-off valves, control valves, check valves and other items requiring access which are installed under this Section and concealed in floor, wall, furred space or above ceiling. Access panels shall be by Knapp, Milcor, Way Loctor or approved equal; coordinate selection with other trades supplying similar access panels.
- C. Ceilings consisting of lay-in or removable splined tiles do not require access panels and each valve above ceiling shall have location marked with thumb tack on finished ceiling panel. Location shall be noted on record drawings.

### 3.8 ESCUTCHEONS

- A. Escutcheons shall be installed around exposed piping passing through finished floor, wall or ceiling. Escutcheons shall be heavy cast brass, chrome plated, adjustable, shall be of sufficient outside diameter to cover the sleeve opening and shall fit snugly around the pipe.

### 3.9 FLASHING and COUNTER FLASHING

- A. Floor drains shall be provided with 20 oz. copper sheet flashing extending eight inches beyond the drain flashing flange and clamped in place watertight.
- B. Provide counter flashing for roof penetrations required under this section including vents and roof drains.
- C. Except as otherwise noted above, flashing shall be installed performed under other Sections.

### 3.10 TESTING OF PIPING SYSTEMS

#### A. General

1. Test all new piping systems with water or air at the pressure head stated for the time interval required without adding air or water. While any system is being tested, required head or pressure shall be maintained until all joints are inspected.
2. All tests shall be witnessed by the inspector having jurisdiction with 48 hour notice given to these authorities.
3. Provide all equipment, material, and labor required for testing any of the various systems or any part thereof.

#### B. Sanitary Systems

1. Test all new drainage piping either in its entirety or in sections as required, after rough piping has been installed. Each section shall be filled with water but no section shall be tested with less

than 10 foot head of water. In testing, successive sections at least the upper 10 feet of the next preceding section shall be tested so that no joint of piping in the building except the uppermost 10 feet of the system shall be submitted to a test of less than 10 foot head of water. The water shall be kept in the system for at least 15 minutes before inspection starts; the system shall be then made tight at all points.

2. Any points of the drainage system to be tested with air instead of water shall be tested by attaching an air compressor testing apparatus to a suitable opening and after closing all other inlets or outlets, forcing air into the system until there is a uniform gauge pressure of psi or sufficient to balance a column of mercury 10 inches high. This pressure shall be held without the introduction of additional air for a period of at least 15 minutes.
- C. Gas System: Test as required by code and local utility company but no less than at an air pressure equivalent to 12 inches of mercury greater than system pressure.
- D. Water Piping:
1. Test new water piping at 150 psi working water pressure for a period of at least 2 hours.
- E. Defective Work:
1. If inspection or tests show defects, such defective work or material shall be replaced and inspection and tests shall be repeated. All repairs to piping shall be made with new material. No caulking of screwed joints or holes will be acceptable.
- F. Additional Tests:
1. Provide all additional tests such as smoke or pressure tests as required by the regulations or as directed by authorities making the inspection.
  2. Provide for any repeated test as directed by the Architect to make all systems tight as required.
  3. Visual inspections of joints, valves, etc., shall be made as directed by the Architect.

### 3.11 DISINFECTION OF WATER SYSTEM

- A. The entire water system shall be thoroughly disinfected in strict accordance with the Massachusetts State Plumbing Code.
- B. The system, or part thereof, shall be filled with a water and chlorine solution containing not less than 50 parts per million of available chlorine; and the same shall then be allowed to stand six (6) hours before the system, or part thereof, shall be filled with a solution which contains one hundred (100) parts per million of available chlorine; and the same shall be allowed to stand two (2) hours before the system, or part thereof, is flushed and returned to service.

### 3.12 VALVE TAGS, NAME PLATES AND CHARTS

- A. All valves shall have neat circular brass valve tags of at least 1-1/2-inches in diameter attached with brass hook to each valve stem Seton, Brady, or equal. Stamp on these tags in letters as large as practical, the number of the valve and service, such as "HW", "CW", "HWC", "G", for hot water, cold water, hot water circulating gas respectively. Provide extra long tag chains so that tags will be accessible, as required. Non-potable water line tags shall be in shape of triangle, 4-inch sides, with the words "WATER UNSAFE", 1/2-inch high.
- B. These numbers shall correspond to numbers indicated for valves on the RECORD DRAWINGS and on two printed detailed lists. These printed lists shall state the number and locations of each valve and the fixture or group of fixtures which it controls, and other necessary information, such as, requiring the opening and closing of another valve or valves, when one valve is to be opened or closed.
- C. These printed lists shall be prepared in a form to meet the approval of the Architect and shall be framed under glass, or in laminated form, suitable for wall mounting.
- D. Nameplates, catalog numbers and rating identifications shall be securely attached to electrical and Mechanical equipment with screws or rivets. Adhesives or cements will not be permitted.

### 3.13 CLEANING

- A. Thoroughly clean installation upon completion. Equipment, fixtures, pipe, devices, valves and fittings shall be completely cleaned of grease, metal cuttings, dirt, etc.
- B. Staining, discoloration or damage to parts of building, its finish or furnishings resulting from failure to properly clean piping system shall be repaired by trade involved at no increase in contract price.

### 3.14 PIPE IDENTIFICATION

- A. The Plumbing Subcontractor shall be responsible for and accomplish all identification of all new piping furnished and installed under this Section. Identification work shall be done after the painting of piping is completed and accepted.
- B. Horizontal piping shall be marked at intervals of 20 feet, at changes in direction and adjacent to valves except valves on plumbing fixtures and equipment. Identification shall be by means of self adhering labels or stenciling, identifying service and flow direction.
- C. Colors shall be in accordance with ANSI A13.1 Standards, except that potable water lines shall be green; non-potable yellow.
- D. Size of stencil letters shall be as follows:

Pipe Diameter (inch)	Size of Letter (inch)
1/2	3/8
3/4	3/8
1	1/2
1-1/4	1/2
1-1/2	3/4
2	3/4
2-1/2	7/8
3 and 4	7/8

END OF SECTION

## **SECTION 23 00 00 - HEATING, VENTILATING, AIR CONDITIONING**

### **PART 1 - GENERAL**

#### **1.1 GENERAL PROVISIONS**

- A. Part A and Division 1 of Part B General Requirements are hereby made a part of this Section.

#### **1.2 SCOPE OF THE WORK**

- A. The scope of the work under This section, without limiting the generality thereof, includes the furnishing of all labor, materials, equipment services and incidentals necessary to complete all of the work in accordance with the Contract Documents, which are intended to describe and provide for a finished piece of work and to be complete; what is called for by either shall be complete in every detail, notwithstanding whether or not every item necessarily involved is particularly mentioned.
- B. The work shall consist of the following:
  - 1. Remove the existing heating equipment and related piping and equipment. This includes boilers, steam piping and radiators. The existing gas furnaces in the Gym are to remain, except as noted on the drawings.
  - 2. Toilets exhaust system including ducts, and fans, grilles, and controls, etc.
  - 3. Registers and grilles.
  - 4. Ductless split system VRF AC system for air-conditioning.
  - 5. Furnish and install new gas fired boiler/burner.
  - 6. Install new unit heaters, fin-tube, and fan coil units..
  - 7. Hot water distribution piping.
  - 8. Refrigerant piping distribution.
  - 9. Furnish and install new expansion tank.
  - 10. Furnish and install new inline circulators.
  - 11. Install new duct and pipe insulation.
  - 12. Boiler/burner controls including outdoor air reset.
  - 13. Control thermostats, electric-electronic wiring, control dampers and pump and fan controls.

14. Wall and roof penetration for boiler vent and supply air.
15. Air-conditioning retro-fit of gym air handler.
16. Fresh air connection to existing gas-fired units serving gym.
17. Energy recovery ventilators (ERV's).
18. Testing and Balancing.
19. Kitchen exhaust
20. Intake and relief hoods.
21. Elevator hoist way and machine room vent ducts.
22. All other work as indicated on the drawings and as specified herein.

C. All related Work in Other Sections

1. Power wiring of electrical services for equipment,
2. Temporary facilities
3. Access doors, louvers etc.
4. Flashing of roof penetrations.
5. Concrete for equipment bases, pads.
6. Roof and wall flashing.
7. Panting
8. Plumbing

### 1.3 CONTRACT DOCUMENTS

- A. Due to the scale employed, the Contract Drawings are generally diagrammatic. Refer to the Specifications for a full understanding of the extent and detail of the work; coordinate work with that of all the other trades so that installation will be in the most direct and workmanlike manner and so that interferences between piping, equipment, architectural and structural features will be avoided. All piping shall be installed as closely as possible to walls, ceilings and columns, so as to occupy a minimum of space; all offsets and fittings required to accomplish this shall be furnished by this Sub-contractor without additional expense to the Owner.

### 1.4 VISITS TO THE SITE

- A. Prior to submitting a bid, bidders are expected to visit the site of work and become familiar with existing conditions at the site. Any assumptions

made are at the Subcontractor's expense.

#### 1.5 PROTECTION

- A. Properly protect the work under this Section of the specifications so as to prevent obstruction or damage.
- B. All pipe openings shall be closed with caps or plugs during the installation.
- C. All equipment shall be tightly covered and protected against dirt, water or mechanical injury and shall be delivered in perfect condition.

#### 1.6 WORKMANSHIP AND MATERIALS

- A. All work shall be installed in a first class, neat and workmanlike manner, by licensed mechanics experienced in the trade, and work must be acceptable to the Engineer.

#### 1.7 COORDINATION

- A. Keep fully informed as to the shape, size and position of all openings required for the equipment, and give full information to the Sub-contractors sufficiently in advance of the work so that all openings may be built in advance.
- B. Furnish and set sleeves, supports and accessories, hereinafter specified, so that the Contractor may build same in place.
- C. Obtain detailed information from the manufacturers of equipment, as to the proper method of installing and connecting same; advise the Contractor and Sub-contractor as necessary to facilitate the work and the completion of the whole project.

#### 1.8 INTERRUPTION OF SERVICES

- A. Interruption of services shall take place only upon prior approval of the Owner.

#### 1.9 DEMOLITION AND REMOVAL

- A. The HVAC Contractor shall be responsible for all demolition and removal shown on heating plans, unless otherwise noted.
- B. All equipment and materials taken out of service shall be removed from the premises.

#### 1.10 CODES, REGULATIONS, AND STANDARDS

- A. All work shall be performed in strict accordance with local and state regulations and the requirements of all such offices and authorities having jurisdiction. All pressure vessels shall conform to ASME codes and regulations. All work shall conform to NFPA 90A, IMC-2012, IECC-2012,

and all materials shall be UL approved. Work shall conform to the requirements of the Massachusetts Department of Public Safety.

- B. Any materials called for or implied in the above mentioned requirements, even though not specified or shown on the Drawings, shall be furnished and installed by the subcontractor as though they had been specifically mentioned or indicated. If the Drawings and Specifications are at variance with any of the above mentioned regulations, the bidder shall notify the Architect prior to the Award of the General Contract.
- C. Secure and pay for any and all permits that may be necessary in connection with the installation of all equipment. Pay all backcharges.
- D. Comply with all applicable codes and standards, including but not limited to:

- American Standards Association - ASA
- American Society of Mechanical Engineers - ASME
- National Board of Fire Underwriters - NBFU
- Dept. of Public Safety, Commonwealth of Massachusetts
- National Fire Protection Association - NFPA
- Standard of Underwriters Laboratories - UL
- American Society of Testing Materials – ASTM
- International Building Code – IBC
- International Mechanical Code – IMC
- International Energy Conservation Code - IECC
- American Society of Heating, Refrigeration and Air Conditioning Engineers - ASHRAE
- Massachusetts State Building Code
- National Electric Code - NEC

#### 1.11 RECORD DOCUMENTS

- A. Refer to General Conditions. As the work progresses the HVAC Subcontractor shall record on a set of contract HVAC drawings all changes from the installation originally indicated.
- B. The subcontractor performing the work of this Section shall be responsible for the continuous maintenance of the portions of the As-Built set pertaining to this work. The proper maintenance of the Record Documents shall be a condition precedent to payment to the subcontractor, through the Contractor, for any portion of the work of this Section.
- C. At completion of work the HVAC Sub-contractor shall transfer the changes from the record drawings to approved achievable media and shall be for approved by the Architect.

#### 1.12 OPERATING INSTRUCTIONS AND MAINTENANCE INSTRUCTIONS

- A. Provide operating instructions to the Owner's designated representative with

respect to operating and maintenance procedures, for all new equipment and systems installed. The cost of such instruction up to a full eight (8) hours shall be included in the contract price

- B. Provide three copies of indexed hard cover manufacturer's manuals and warranties of all equipment installed. Deliver to Engineer for approval.

#### 1.14 SHOP DRAWINGS, PRODUCT DATA SUBMITTALS

- A. Comply with the provisions of General Conditions.
- B. Within 30 calendar days after notice to proceed submit:
- C. A complete list of all materials proposed to be furnished and installed under this Section.
- D. Manufacturer's specifications and catalog cuts as required demonstrating compliance with the specified requirements.
- E. Manufacturer's recommended installation procedures which, when approved by the Architect, will become the basis for inspecting and accepting or rejecting actual installation procedures used on the work.
- F. Shop drawings for all installations.
- G. The shop drawings shall be submitted in accordance with the following and the terms of the General Conditions, with the exception that six (6) prints of each Drawing are required. The shop drawings shall include complete dimensions, details of construction, arrangement, performance characteristics and accessories. Submit shop drawings for Contractor-fabricated items, as required by the Architect.
- H. Submittal for pipe and fittings, hangers and similar standard items shall consist of a list giving the manufacturer's name type and catalog or model number for each item. The Architect reserves the right to request samples of any of the subject items. This subcontractor's intent to use the exact makes specified does not relieve him of the responsibility of submitting such a list.
- I. Drawings, catalog cuts and samples shall be clearly labeled indicating equipment number as per schedules on drawings; specific service or use, job name, Contractor's name, and manufacturers' name and address; incomplete or poorly identified submissions will not be acceptable.
- J. Approval of submissions will be final, and no further changes will be permitted.
- K. If substitutions for specified items are permitted, the responsibility for the coordination of all related work shall be accepted by the Contractor proposing such substitutions.
- L. The list of materials shall include:

2. Pipe and fittings and valves.
3. Pipe & duct insulation
4. Boiler and accessories.
5. Pumps
6. Fans.
7. Fin tube and enclosure
8. Convectors
9. Unit heaters.
10. VFR terminals and condensing units.
11. Duct Construction Standards
12. Automatic temperature controls.
13. Thermometers and gauges
14. Comply with the provisions of Division1, Section 01300, Submittals.

#### 1.15 GUARANTEES AND WARRANTIES

- A. All material and equipment furnished and installed under this section and shown or inferred on the Contract Drawings, shall be guaranteed for a period of one (1) year from the date of final acceptance, by the Owner. This guarantee shall state, in writing, that any defective material, equipment or parts thereof, shall be replaced during this one year period, without cost to the Owner. The guarantee shall be signed by the person or persons performing the work and shall be countersigned by the General Contractor before delivering to the Owner.

## **PART 2 - PRODUCTS**

### 2.1 GENERAL

- A. All materials and equipment necessary to make the installation complete in every detail shall be furnished and installed under this contract whether or not specifically indicated on the Drawings or specified herein. All materials and equipment shall be new.
- B. It is the intent of the Specifications that one manufacturer be selected, not a combination, for any particular classification of material. For example, all valves of one manufacturer, all fittings of one manufacturer, etc., except specific material classifications in which delivery time becomes a problem, the Engineer may give specific exemption from the requirement.
- C. Where materials, equipment, apparatus, or other products are specified by manufacturer, brand name, type or catalog number, such designation is to establish standards of performance, quality, type and style.

### 2.2 PIPE AND FITTINGS

- A. Hot water supply and return - Schedule 40 black steel, ASTM A-53.
- B. Piping 2" and smaller shall be threaded, with malleable iron 150# ASTM rated fittings.
- C. Piping 2-1/2" and larger shall be rolled groove end and joined with Victaulic, or approved equal, gasketed couplings, and EPDM gaskets rated for hot water service. Fittings and accessory components shall meet the manufacturer's specifications and conform to ASTM Standards.
- D. Nipples and fitting shall be of the same material and thickness as the pipe with which they are used, except where screwed fittings are used, in which case, they shall be of close grained cast iron, standard weight, with heavy band and clean cut full taper thread.
- E. Refrigerant piping.
  - 1. Copper tube, type ACR, in coil lengths, factory cleaned and end capped. Fittings to be wrought copper with joints brazed.

### 2.3 PIPE CONNECTIONS

- A. Steel piping sized 2 inches and smaller may be screwed.
- B. Piping connection to equipment and valves sized 2-1/2 inches and larger shall be made with welding neck flanges if 150 psig construction.
- C. Dielectric pipe unions:
  - 1. Unions shall be rated at 250 PSI at 180 F and shall meet requirements of

ANSI B16.39.

2. Unions shall withstand a minimum of 600 volts (dry line) with no flashover.
3. Unions shall be Watts 3000 series suitable for copper/iron connections or approved equal.

#### 2.4 FIRE STOPPING

- A. Provide for all new piping which enters or passes through fire rated walls or floors. Fire seal fittings shall be used around pipes, in core drilled holes passing through fire rated walls and floors. Fire stopping shall be T&B Fire-Seal or equal by OZ/Gedney, or Minnesota Mining and Manufacturing Company.

#### 2.5 HANGERS AND SUPPORTS

- A. Furnish and install all pipe supports, hangers and other supporting appliances necessary to support firmly and substantially the materials and equipment described in the Contract Documents.
- B. Where concentrated loadings such as heavy fittings or valves occur, the supports for horizontal piping shall be not greater than 10'-0" apart; otherwise, the maximum spacing shall be as follows:

1/2 Inch to 1 Inch	-	7 Feet
1-1/4 Inches to 2 Inches	-	10 Feet
2-1/2 Inches to 3 Inches	-	12 Feet
- C. Vertical piping shall be supported by riser clamps securely fastened to the risers and building construction so as to prevent sagging or swinging.
- D. Pipe sized three inches diameter and larger shall be supported by pipe rolls with adjustable rod hangers, sized two 1/2 inch rods minimum.
- E. Piping sized 2-1/2 inches diameter and smaller shall be supported by adjustable clevis hangers (sized for insulation thickness) with one (1) rod hanger, sized 1/2 inch.
- F. At each support provide a steel pipe protection saddle.
- G. Hangers and rods shall be installed outside the covering.
- H. Copper Tubing
  1. Horizontal piping shall be supported on 6 foot centers by means of hangers.
  2. Horizontal insulated copper tubing shall be supported on 6 foot centers by means of clevis type hangers, provide a galvanized steel saddle, No. 18 gauge 8 inches long, 120 degree arc.
- I. Polyvinyl

1. Horizontal piping shall be supported by means of band hangers spaced in accordance with the manufacturer's published instructions.

## 2.6 VALVES

- A. All valves 2 inch and smaller shall be standard port ball valves with cast bronze bodies, replaceable Teflon seats, blowout proof stem, stems shall be extended 1 inch to accommodate insulation, adjustable packing gland and stainless steel ball. Valves to be Milwaukee Valve Company Model BA-1005, NIBCO Model T-580-66, Apollo 70-100 or Watts Model B-6000.
- B. Valves 2-1/2" and larger:
  1. O.S.&Y gate valves, 125 pound working pressure, iron body, bronze mounted, rising stem, bolted bonnet, solid wedge with flanged, threaded or weld ends. Valves to be Hammond #IR1140, Nibco F-617, Stockham G-623.
  2. Butterfly valves, lug or IPS grooved body style, 200 pound working pressure, ductile iron body, bronze or stainless steel trim, lever operated locking handles with 10 position locking plate. Hammond 6201-X, Stockham LG-7X2-BS2-E, Nibco LD2000-5 or GD4765-3.
- C. Combination balancing and shutoff valves shall be globe design, cast bronze bodies, replaceable Teflon seats, test ports, adjustable packing gland and stainless steel disc and stem. Provide also an adjustable stop lever. Valves to be Nibco Fig. T1710 for 2" and smaller or Nibco F737A for 2-1/2" and larger. Or equal as manufactured By Watts Regulator or Tour and Anderson.
- D. Balancing valves with screwdriver stop for one inch and smaller valves; stainless steel ball, cast brass or bronze body, 300 psi & 250 deg F ratings, blow-out proof, integral drain port, Teflon seats, test taps, memory stop, dial readout. Taco "Accu-Flo", or equal as manufactured by Griswold "Speedset", or Bell & Gossett "Circuit Setter".
- E. Check valves shall be of Class 125 type, body and caps shall be of ASTM B-62 bronze composition with threaded ends and swing type disc. Valves to be Milwaukee Valve Company Model 509T or S, Stockham B319 or NIBCO T-413.

## 2.7 SELF-CONTAINED CONTROL VALVES

- A. Furnish where indicated on drawing self-contained control valves. Fully automatic – non electric (no wiring). Furnish protective cap for all valves.
- B. Operators shall be replaceable without shut-off and or draining the system. They shall be lockable. Capillaries shall be stainless steel. Sensor shall be mountable, of high sensitivity, and of brass construction. Temperature setting range: 46 deg. – 82 deg. Dial setting; \* &, 1-9.
- C. Valves shall be line sized according to equipment connection and manufacturer's sizing data. Rated for 20 psi differential, max. temperature rating of 250 deg. F

- D. Where remote sensors are indicated, sensor shall be installed within cabinet return plenum.
- E. They shall be as manufactured by Tunstall/Macon, or approved equal.
- F. Exposed valves in corridors, or stair halls shall have chrome plated cap with adjustable setting.

## 2.8 STRAINERS

- A. Strainers shall be cast iron body with stainless steel 20 mesh screens. They shall be rated for steam service at a minimum of 125 PSI and 350F. Those 2 inches and smaller shall be screwed and those 2 1/2 inches and larger shall be flanged.
- B. They shall be Armstrong F4SC or A1FL-250, Sarco type IT or IF-125, or Hoffman Model 415 or 450B.

## 2.9 PRESSURE GAUGES

- A. They shall be bronze tube precision pressure gauges as manufactured by Trerice Model 500XB, or approved equal. The gauges shall be designed for surface mounting with bottom connections and shall have white faces with black filled engraved letters. The body of the gauges shall be cast aluminum, dull black with the bevel or rim chrome-plated. All gauges shall have 4-1/2 inch dials, they shall be connected with brass pipe fittings, shut-off cocks and snubbers. Ranges shall be twice the expected operating pressure rating.

## 2.10 THERMOMETERS

- A. They shall be separable well type, V-case, thermometers, as manufactured by the H. O. Trerice Company, or approved equal. They shall have a red reading eight inch scale, with 2 deg. F. graduations. They shall have a temperature range of 30 deg. to 240 deg. F. They shall be angular or straight, as best suited, for easy reading from the floor.
- B. Thermometer wells shall be bronze, monel or stainless steel; they shall be installed in such a manner as to provide a minimum restriction to the flow of water in the pipe.

## 2.11 INSULATION

### A. Piping

1. Insulate all hot water supply and return piping. The insulation shall be glass fiber pipe insulation. Provide All Service Jacket with self sealing laps. Fittings, flanges, couplings, and valves shall be covered with glass fiber of thickness equal to adjacent pipe and shall have a molded PVC cover. Mitered pipe insulation may be used where molded fittings are not available. Provide metal caps at ends of all insulation.
2. Insulation shall be as manufactured by Owens Corning, Pittsburgh,

Manville or Certainteed. Piping: Fibrous glass, heavy density, pre-molded sectional type, snap on pipe insulation with all service factory applied self sealing flame retardant vapor barrier jacket, 25/50 rated, equivalent to Owens-Corning ASJ/SSL-II.

3. Fittings and valves on new insulated pipes shall have pre-molded 25/50 rated PVC insulated fitting covers equivalent to Manville Zeston.
4. Thicknesses shall be as follows:
  - a. Hot water supply & return:

Up to 1-1/2" pipe	1-1/2"
1-1/2" & larger	2"
5. Refrigeration suction and liquid lines and drains shall be insulated with elastomeric foam insulation that is non-absorptive and resistant to UV radiation. The insulation shall be a minimum of 1-1/2" thickness. Insulation shall be as manufactured by Armaflex or approved equal. Installation shall comply with the manufacturer's recommended installation procedures.

B. Ductwork:

1. Intake plenums and outside air supply ducts shall be insulated with a rigid fiberglass board, 2-inch thick, of 3.8 pcf density, R-8.7 with Fiberglass reinforced foil scrim (FSK) vapor proof jacket. Duct insulation shall be firmly applied to sheet metal surfaces and all seams and joints shall be sealed, all as according to the manufacturer's recommended best practice. Insulation to be Owens-Corning or approved equal.
2. Supply and return ducts shall be insulated with fiberglass duct wrap with fiberglass reinforced foil scrim (FSK) vapor proof jacket installed according to the manufacturer's recommended installation procedures. Duct insulation shall meet the requirements of MA State Energy Code (IECC-2012). Insulating value of R-5 minimum.
3. Duct insulation shall have a maximum flame spread of 25 and a maximum smoke developed of 50 and shall be in strict accordance with UL requirement B and OSHA regulations.

2.12 SLEEVES AND PLATES

A. General

1. They shall be black steel, Schedule 40, in accordance with ASTM Specification A-120.
2. They shall be provided at all joints where pipes pass through walls, slabs, partitions or other building construction. They shall be sized so as to provide for pipe covering and for lateral expansion.
3. The ends shall be flush with the surfaces, except in floors, where it is

possible for water to accumulate, in which case, they shall terminate one (1) inch above the finished floor.

- B. Where pipes pass through partitions, ceilings and furring (plaster and glazed tile), furnish and install No. 24 gauge galvanized iron sleeves, over which furnish and install cast metal floor plates of the escutcheon type, designed to cover the sleeves and to remain in permanent position.
- C. Provide chromium-plated escutcheon plates, at all exposed locations in finished rooms where pipes pass through walls, floors and ceilings.
- D. Openings for rectangular ducts passing through walls, slabs, partitions and other building construction shall be framed or boxed by the General Contractor. Openings shall provide for not less than 1/2-inch clearance around duct and insulation. Round ductwork shall be provided with sleeves as described herein for piping.
- E. The HVAC Subcontractor shall be responsible for providing all sleeves and for providing to the General Contractor all locations and dimensions of sleeves and openings.
- F. Pipe sleeves passing through floors, exterior walls below grade, smoke partitions and fire walls shall be installed with fire stopping between sleeve and pipe for the full depth of penetration. Fire stopping shall be provided according to previous subparagraph indicating Fire Stopping.
- G. Rectangular duct penetrations into the finished spaces shall be provided with 28 gauge stainless steel strips fastened rigidly to building construction with stainless steel fasteners. Strips shall be sized to fit the outside flat frame dimensions of duct and insulation (if any) and cover the framed opening.

## 2.13 GASKETS

- A. Flanged joints shall be fitted with ring gaskets designed for the service, as manufactured by Johns-Manville, or approved equal.

## 2.14 HOT WATER SPECIALTIES

### A. Automatic Air Vents

- 1. High capacity, brass body, non-ferrous internals. Maximum working pressure 150 psi, maximum operating temperature 250 deg. F.
- 2. They shall be Bell & Gossett No. 98, or approved equal manufactured by Maid-O-Mist or Hoffman.

### B. Manual Air Vents

- 1. Air vents shall be manual, coin operated. As manufactured by Bell and Gossett (Model 4V) or equal.

## 2.15 TEMPERATURE AND PRESSURE TEST PLUGS

- A. They shall be Pete's Plug No. 110, with Nordel core and body, sized 1/4 inch, as manufactured by Peterson Engineering Company, P.O. Box 217, Richardson, TX 75080, or equal.
- B. Provide three (3) Pressure Gauge Adapters with probe, sized 1/8 inch, three (3) pocket thermometers with 5 inch stem, having a temperature range of 25 degrees F. to 125 degrees F., and three (3) pocket thermometers with 5 inch stem, having a temperature range of 50 degrees F. to 500 degrees F.

## 2.16 PUMPS

- A. Furnish and install pumps with capacities as shown on plans. Pumps shall be in-line type for installation in vertical or horizontal piping. Pump must be capable of being serviced without disturbing piping connections.
- B. Pump body shall be of Class 30 cast iron, rated 175 psi working pressure, with gauge ports at nozzles, and with vent and drain ports.
- C. Impeller shall be cast bronze, dynamically balanced, enclosed type, dynamically balanced, keyed to the shaft and secured by a locking capscrew or nut.
- D. The liquid cavity shall be sealed from the pump bearing by an internally-flushed mechanical seal with ceramic seal seat of at least 98% alumina oxide content, and carbon seal ring, suitable for continuous operation at 225 degree F. A non-ferrous shaft sleeve shall completely cover the wetted area under the seal.
- E. Pump bearing bracket shall have oil lubricated bronze journal and thrust bearings. Bracket shaft shall be alloy steel having ground and hardened thrust bearing faces. A flexible coupling to dampen starting torque and torsional vibrations shall be employed.
- F. The motor shall meet NEMA specifications and shall be the size, voltage and enclosure called for on the plans.
- G. Each pump shall be factory tested. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.
- H. Each pump shall be checked by the contractor and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to pump for owner's reference.

## 2.17 SUCTION DIFFUSER

- A. Provide at each pump a Suction Diffuser of size and type noted on drawings. Units shall consist of angle type cast iron body with steel straightening vanes and steel combination Diffuser Strainer-Orifice Cylinder with 3/16" diameter openings for pump protection. A permanent magnet shall be located within the flow stream and shall be removable for cleaning. The orifice cylinder shall be equipped with a disposable fine mesh bronze strainer which shall be removed after system start-up. Orifice cylinder shall be designed to withstand pressure differential equal to pump shutoff head and shall have a free area equal to five times cross section area of pump suction opening. Straightening vanes shall extend the full length of the orifice cylinder and shall be replaceable. Unit shall be provided with adjustable support foot to carry weight of suction piping.
- B. MANUFACTURER: The manufacturer shall be Taco, ITT Bell & Gossett or approved equal.

#### 2.18 PRESSURE REDUCING VALVE

- A. Furnish and install as shown on plans a diaphragm operated Pressure Reducing Valve with brass body, low inlet pressure check valve and inlet strainer. This valve shall be set to limit the system fill pressure per the value as shown in the schedule. The strainer must be easily removed without system shutdown. The valve seat, strainer and stem must be removable and of non-corrosive material.
- B. MANUFACTURER: The manufacturer shall be ITT Bell & Gossett or approved equal.

#### 2.19 RELIEF VALVE

- A. Furnish and install as shown on plans a diaphragm operated Safety Relief Valve, ASME labeled for relieving pressure at the scheduled pressure with a BTU/hr rating as shown on the schedule. The fluid should not discharge into the spring chamber. The valve should have a low blow-down differential. The valve seat and all moving parts exposed to the fluid are to be of non-ferrous material.
- B. MANUFACTURER: The manufacturer shall be ITT Bell & Gossett or approved equal.

#### 2.20 AIR SEPARATOR

- A. Furnish and install as shown on plans, a cast iron boiler fitting with copper dip tube. The boiler connection shall have appropriate size system and compression tank connections. Boiler fitting shall prevent free air from rising into the system by directing released air to the automatic air vent. Maximum working pressure 125 psi at 250 deg f. Boiler fitting shall be provided with one coat of enamel paint.
- B. MANUFACTURER: The manufacturer shall be Bell & Gossett, Taco, ITT Spirovent, or approved equal.

## 2.21 EXPANSION TANKS

- A. Furnish and install expansion tanks of the size and type as shown on the plans. Tanks shall be Amtrol Model LBC-series Extrol, bladder type, or approved equal.
- B. Bladder type tanks shall be designed and constructed per ASME Section VIII, Division I and rated for a maximum working pressure of 125 PSI at 240°F. Units shall be furnished with lifting rings, and have the system connection and charging valve at the tank top and a tank drain connection at the bottom. Bladder type expansion tanks shall have an internal replaceable elastomer bladder with the minimum acceptance volume and factory pre-charge pressure as shown on the plans. The bladder shall be suitable for a maximum system operating temperature of 240°F. Bladder type tanks shall be furnished with a steel base ring for vertical mounting.
- C. All materials of construction shall be compatible with water and ethylene and propylene glycol mixtures.

## 2.22 SHEET METAL

- A. Materials: duct work shall be of galvanized sheet metal. Galvanized sheet metal shall be new copper bearing (or prime grade) galvanized steel sheets of lockforming quality. Zinc coating that will flake or peel under any forming operations or laminated sheet will not be allowed.
- B. Sheet metal work shall be fabricated and installed in accordance with applicable requirements of SMACNA HVAC Duct Construction Standards, Third Edition. All duct work shall be neat, accurate, rigidly constructed and mechanically secured to be free of vibration.
- C. Sheet metal subcontractor shall install the automatic dampers furnished by control subcontractor.
- D. Provide flexible connections of neoprene coated fiberglass securely fastened with zinc coated iron clinch type drawband for all air handling units.

## 2.23 BOILER AIR INTAKE AND VENT DISCHARGE PIPE

- A. Vent discharge piping shall be positive pressure type AL29-4C super ferric stainless steel pipe and fittings with lock tabs. Pipe shall be double wall type, outer wall of aluminized steel. Temperature rated for 550 deg. F.
- B. Discharge vent - provide all fittings, accessories for a complete installation including, but not limited to: thimble, cap, appliance connector, drain and cleanouts where indicated on the plans and/or manufacturer's installation manual. Vertical to horizontal transition shall be made with a 45 degree Y.
- C. Discharge vent - manufactured by MetalFab, Z-Vent or Selkirk or approved equal.

- D. Intake air duct shall be galvanized sheet metal duct. See paragraph on Ductwork in this Section.

2.24

## BOILERS

### A. General Requirements

1. Furnish and install low pressure, direct vent gas-fired, cast iron boiler.
2. Pre-packaged with integrated boiler management system for a single stand alone unit.
3. See schedule on the drawings. – see schedule for design characteristics.
  - a. Boiler-burner-controls, fully integrated.
  - b. Natural gas.
  - c. Water.
  - d. Induced draft.
4. Boiler(s) shall be rated I=B=R Hydronics Institute gross output(s) at 100% firing rate.
5. Boiler(s) shall be manufactured by ISO 9001 registered company and conform to Section IV of the ASME Boiler and Pressure Vessel Code.
  - a. Boiler shall be hydrostatically pressure tested at factory in accordance with ASME requirements.
  - b. The boiler rating label shall read maximum allowable working pressure; **30 PSI** water.
6. Regulatory Requirements
  - a. Boiler(s) and controls to comply with all applicable regulations.
  - b. Provide U.L. labeled burner(s).
  - c. Provide add option for local code(s) i.e.: MASS Code, BAR
7. Submittals
  - a. Submit shop drawings and product data.
  - b. Submittal packet to include boiler (and burner) manufacturer descriptive literature, installation instructions, operating instructions, and maintenance instructions.

### B. Product

1. Acceptable boiler/burner manufacturer(s) include(s):
  - a. Aerco as specified above, or approved equal by, Lochinvar, or Raypac. Unit shall be eligible for Nstar rebate based on energy efficiency.
  - b. Other manufacturer(s) or other Aerco boiler(s) must comply with the following requirements, including:
    - 1.) Full intent of these specifications, and provide complete submittal including literature, wiring diagrams, fuel piping diagrams, and a list of similar installations.
    - 2.) Burner(s) and Control System(s) must be tested and approved for installation with specified boiler by boiler manufacturer.
2. Boiler construction
  - a. Cast Iron sections.
  - b. Assembled with short, individual draw rods.
  - c. Cast with sealing grooves for high temperature sealing rope to assure permanent gas-tight seal.
  - d. Sealed watertight by elastomer sealing rings.
  - e. Must be designed to provide completely water-cooled combustion chamber.
  - f. Provided with sufficient tappings to install required controls.
  - g. Limited 10-year warranty against workmanship and defects to be in writing by manufacturer. 20 year warranty on thermal shock.
3. Boiler(s)
  - a. Designed to provide balanced water flow through entire section assembly using single supply and return connections for water. Capable of 10:1 water flow through the unit
  - b. Designed with a low silhouette to provide maximum headroom.
  - c. Shipped with insulated heavy gauge steel jacket(s) with durable powdered paint enamel finish. Jacket designed to be installed after connecting supply and return piping.
  - d. Jacket design will allow easy access to top and sides of boiler for maintenance and/or inspection without use of tools.
4. Boiler foundation(s):

- a. Installer to construct needed support and level concrete foundation(s) where boiler room floor is uneven or will not support the weight of the boiler(s).

5. Boiler trim:

- a. All electrical components to be of high quality and bear the U.L. label.
- b. Water boiler(s) standard controls furnished:
  - 1) Combination low temperature limit (operating) and high temperature limit control.
  - 2) Low temperature limit set according to system design. High temperature limit set at least 20°F higher than the low limit (160°F is the maximum design water temperature).
  - 3) Combination pressure-temperature gauge with dial clearly marked and easy to read.
  - 4) ASME certified pressure relief valve, set to relieve at 30 PSIG. Side outlet discharge type; contractor to pipe outlet to floor drain or near floor, avoiding any area where freezing could occur.
- c. Low water cut-off for boiler(s):
  - 1) Boiler(s) to be furnished with U.L. labeled low water cut-off with ASME working pressure rating equal to or exceeding the maximum boiler working pressure as shown on the boiler's rating label. Install cut-off according to manufacturer's instructions.

C. Burner, Controls and Start-Up & Service:

- 1. Burner(s)
  - a. Burner fuel supply system and burner installation to conform to burner manufacturer's installation instructions and applicable codes.
  - b. Burner motor characteristics: 120/60/1.
  - c. Control characteristics 120/60/1.
  - d. Burner fuel – Natural gas.
  - e. Code(s) - standard boiler.
  - f. Burner(s) to have U.L. label(s) supplied by the burner manufacturer.
  - g. Burner(s) designed to ensure high efficiency and good performance.
  - h. Burner(s) to be adjusted to provide optimum air fuel ratio.
- 2. Panel options.
  - a. Domestic hot water priority
  - b. Outdoor reset control sensor

- c. Circulator controls
- d. Alarm Bell

### 3. Start-up and Service

- a. The contractor shall obtain the services of a factory-authorized agent to provide burner light off and adjustment. The start-up agent shall provide a burner light-off report as written proof that the burner was adjusted to optimum performance.

#### D. Installation

1. Installation shall conform to all recommended practices and procedures as published by the manufacturer. Provide all recommended accessories and components according to the manufacturer's installation manual.
2. All boiler discharges shall be piped to floor drains and as shown according to the drawings.
3. Provisions shall be made for the expansion and contraction of the heating mains connected to the boiler by providing substantial anchorage at suitable points and assisted by the use of swing joints to allow the piping to expand and contract without imposing excessive forces on the boiler piping.
4. Boiler installation shall be accomplished within acceptable A.S.M.E. piping practices and requirements and in strict accordance with the boiler manufacturer's recommendations and instructions.
5. A hydrostatic pressure test of one-and-one-half times the working pressure of the boiler shall be conducted on this boiler for a period of not less than five hours. Such tests shall be of such duration as necessary and as directed by the engineer to ensure the boiler has been assembled and installed correctly with no leaks or improper operating conditions.

#### 2.24 AUTOMATIC TEMPERATURE CONTROL

- A. Furnish and install, as hereinafter specified, a complete Electric/Electronic system. The system shall be comprised of all electric/electronic control equipment, controllers, thermostats, sensors, valves, dampers, actuators, panels, related hardware and other accessory equipment, along with a complete system of electrical control wiring, to fill the intent of the Specifications and provide for a complete and operable system. All control equipment shall be fully proportioning, except as noted otherwise. All control components shall be the latest, state-of-the-art, in manufacture and performance. System design is based

on components as manufactured by Siemens, Invensys, TAC and Johnson Controls, Inc.

B. The control systems shall be installed by competent control mechanics and electricians regularly engaged in the design and installation of the control equipment. All control equipment shall be the product of a control equipment manufacturer and all ATC components shall be capable of interfacing with the HVAC equipment.

C. Scope

1. Provide damper operators for equipment as indicated and where such operators are not supplied by the equipment manufacturer.
2. Alarm bells, where applicable and all interlocking wiring required shall be provided by ATC Contractor.
3. The ATC Contractor shall review and study all HVAC Drawings and entire Specification to familiarize himself with the equipment and system operation and to verify the quantities and types of dampers, operators, alarms, etc., he has to provide.
4. All interlocking wiring and installation of control devices associated with the boilers, pumps, etc., shall be provided by the ATC Contractor. Close coordination shall be exercised between the ATC sub-contractor and the HVAC Contractor and equipment manufacturers so that installation is provided in a manner to result in fully operable systems, as intended in these specifications.
5. All cutting, patching and touch up finish painting required for the temperature control piping and equipment shall be done by the temperature control subcontractor.

D. Incidental Work by Others under the supervision of the ATC Contractor.

1. Any concrete work required for completion of the temperature control portion of the work shall be provided by the General Contractor in accordance with dimensional drawings supplied by the Temperature Control Subcontractor.

E. The following incidental work shall be furnished by the designated HVAC Contractor under the supervision of the ATC Contractor:

1. The HVAC Contractor shall coordinate required work with ATC and, without limiting the generality thereof, the work he is to perform for ATC

shall include the following:

- a. Furnish and install all necessary valved pressure taps, water, drain and overflow connections and piping.
- b. Provide, on magnetic starters furnished, all necessary auxiliary contacts, with buttons and switches in required configurations.
- c. Install all automatic dampers, and duct smoke detectors to control smoke dampers where applicable. Install unit discharge dampers.
- d. Provide necessary blank-off plates (safing) required to install dampers that are smaller than duct size.
- e. Assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper motors.
- f. Provide access doors or other approved means of access through ceiling and walls for service to control equipment.

F. The Electrical Contractor shall:

1. Provide all power wiring to motors, heat trace of exposed piping and ATC panel, except as otherwise noted.
2. Furnish smoke detectors and wire to the building fire alarm systems.

G. Electric Wiring

1. All electric wiring, wiring connections, and all interlocking required for the installation of the temperature control system, as herein specified, shall be provided by the ATC Contractor unless specifically shown on the Electrical Drawings or called for in the Electrical Specifications. Power to valves and actuators shall be by this ATC sub-contractor, except as specifically noted in the Electrical Drawings and Specifications.
2. All wiring shall comply with the requirements of the National Electrical code and the Electrical Section of the Specifications.

H. Submittal Brochure

1. The following shall be submitted for approval:
  - a. Control Drawings with detailed wiring diagrams, including bill of material and description of operation for all systems including

interfaces with unit manufacturers and other suppliers of equipment and systems.

- b. Panel layouts and nameplate lists for all local and central panels.
- c. Valve and damper schedules showing size, configuration, capacity and location of all equipment.
- d. Data sheets for all control system components.

#### I. Instruction and Adjustment

- 1. Upon completion of the project, the ATC Contractor shall:
  - a. Completely adjust and make ready for use, all transmitters, relays, damper operators, valves, etc., provided under this Section.
  - b. Furnish one complete set-of system operation manuals, including standard manufacturers' operating manuals and complete as-built installation diagrams.
  - c. Provide an on-site training program for the owner's staff in the operation and use of the control system.

#### I. Guarantee

- 1. The control system designated on drawings and plans and herein specified shall be guaranteed to be free from original defects in both material and workmanship for a period of one (1) year of normal use and service, excepting damages from the other causes.
- 2. This guarantee shall become effective starting the date the building is accepted as complete by the Owner, as determined by the Engineer.

#### J. Equipment

- 1. Bulb Type Thermostats
  - a. Electric insertion thermostats shall have vapor or liquid filled flexible elements of not less than 41 in length and shall be of the modulating type unless otherwise specified. They shall be supplied with a well if mounted in liquid lines.
- 2. Sensors
  - a. Temperature sensors shall be 1000 OHM resistance type providing a linear OHM per degrees F characteristic change, and shall be housed

as required (room, immersion, duct, etc.) for the particular application. Averaging sensors shall be a minimum of five (5) feet in length, and shall be installed in such a manner so as to sense a representative sample of the medium being controlled.

3. Transmitters

- a. Temperature transmitters shall receive a variable resistance input from the remote control sensor and be equipped with a dual output. One output is to be used for transmission of the condition at the control sensor to a high level signal meter indicator located on the panel door. Meter ranges may be selected from ranges of 50-100 Deg. for room or 0-200 Deg. For duct applications. The second output signal shall be applied to the input of the controller, which in turn will drive the controlled device such as dampers, valves, etc.

4. Dampers

- a. Automatic dampers, furnished by the ATC Contractor, shall be single or multiple blades as required. Dampers shall be installed by the Sheet Metal Contractor under the supervision of the ATC Contractor. All blank-off plates and conversions necessary to install smaller than duct size dampers are the responsibility of the HVAC Contractor.
- b. All damper frames shall be constructed of 13 gauge galvanized sheet metal and shall have flanges for duct mounting.
- c. Damper blades shall not exceed 6 inches in width. All blades shall be of corrugated type construction, fabricated from two sheets of 22 galvanized sheet steel, spot welded together. Blades are to be suitable for high velocity performance. Damper leakage shall be less than 1% of total CFM.
- d. All dampers bearings shall be made of nylon. Bushings that turn in the bearings are to be oil impregnated sintered metal.
- e. Replaceable butyl rubber seals shall be provided with the damper. Seals shall be installed along the top, bottom and sides of the frame and along each blade edge. Seals shall provide a tight closing, low leakage damper. Leakage and flow characteristic charts must be submitted to the Contracting officer prior to approval of dampers. All damper linkages exposed to weather shall be protected with weatherproof enclosures.

## 5. Valve and Damper Actuators (Electronic)

- a. All actuators shall be sized by the ATC Subcontractor and guaranteed to provide torque and stroke characteristics for the applied duty. Output shall be compatible with outputs of the FMCS or controlling device. All actuators shall be of the spring return type, linked normally open or closed as applicable and common to the application.
- b. The actuator shall be direct-coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The fastening clamp assembly shall be of a "V" bolt design with associated "V" shaped toothed cradle attaching to the shaft for maximum strength and eliminating slippage. Spring return actuators shall have a "V" clamp assembly of sufficient size to be directly mounted to an integral jackshaft of up to 1.05 inches when the damper is constructed in this manner. Single bolt or set screw type fasteners are not acceptable.
- c. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the entire rotation of the actuator. Mechanical end switches or magnetic clutch to deactivate the actuator at the end of rotation are not acceptable.
- d. For power-failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Non-mechanical forms of fail-safe operation are not acceptable.
- e. All spring return actuators shall be capable of both clockwise and counterclockwise spring return operation by simply changing the mounting orientation.
- f. Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control input and provide a 2 to 10 VDC or 4 to 20 mA operating range. An actuator capable of accepting a pulse width modulating control signal and providing full proportional operation of the damper is acceptable. All actuators shall provide a 2 to 10 VDC position feedback signal.
- g. All 24 VAC/VDC actuators shall operate on Class 2 wiring and shall not require more than 10VA for AC or more than 8 watts for DC applications. Actuators operating on 120 VAC power shall not require more than 10 VA. Actuators operating on 230 VAC power shall not require more than 11 VA.

- h. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb torque capacity shall have a manual crank for this purpose.
- i. All modulating actuators shall have an external, built in switch to allow the reversing of direction of rotation.
- j. Actuators shall be provided with a conduit fitting and a minimum three-foot electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
- k. Actuators shall be Underwriters Laboratories Standard 873 listed and Canadian Standards Association Class 4813 02 certified as meeting correct safety requirements and recognized industry standards.
- l. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuators rated torque and shall have a two year manufacturer's warranty, starting from the date of installation. Actuators shall be as manufactured by BELIMO or approved equal.

#### 6. Pressure Switches

- a. The pressure switches shall meet but not be limited to the following Specifications:
  - 1.) Sensing elements shall be capsule, diaphragm, bellows, bourdon tube, or solid state capable or withstanding 150% of rated pressure (sensor).
  - 2.) Switch actuation shall be adjustable for the specified application.
  - 3.) Switch shall have a snap-action Form C contact rated for the application.
  - 4.) Pressure Switches

#### 8. Sequence of operation

- a. Heating pump(s) shall be started and stopped manually - and automatically, by the boiler outdoor air temperature sensor, or via the starter HOA switches furnished by the HVAC Contractor.
- b. The future domestic water heater hot water supply pump shall start/stop via the immersion aqua-stat and shall have “priority” when domestic water demand is called. This shall be part of the boiler control package.
- c. Boilers/Combustion Air Ventilation
  - 1.) Standalone, unit mounted controls furnished by the boiler manufacturer. Boiler shall be provided with a complete operating and temperature control package as required for a fully functioning system.
- d. Kitchen exhaust
  - 1) Insert.
- e. Unit heaters
  - 1.) Manual fan speed control to be adjustable via speed switch mounted within the unit cabinet. A programmable thermostat (one each, per zone) shall operate the unit in either occupied or unoccupied mode. A strap on t-stat shall prevent the fan from operating when boiler temp drop below an adjustable set point.

## 2.25 MOTOR STARTERS

- A. All HVAC equipment furnished under this Section shall be equipped with an integral motor starter or furnished with a motor starter for installation under Section 16B ELECTRICAL.
- B. Motor starters shall be across-the-line magnetic type rated in accordance with NEMA Standards, sizes and horsepower ratings.
- C. Starters shall be mounted in general purpose enclosures unless otherwise indicated on plans.
- D. Contacts: Across-the-line magnetic starters shall be equipped with double break silver alloy contacts. All contacts shall be replaceable without removing power wiring or removing starter from panel. The starter must have straight-through wiring.

- E. Coils: Coils shall be of molded construction. Coils on size eight starters shall be form wound, taped, varnished and baked.
- F. All coils shall be replaceable from the front without removing the starter from the panel.
- G. Overload Relays and Thermal Units: Overload relays shall be the melting alloy type with a replaceable control circuit module.
- H. Thermal units shall be of one piece construction and interchangeable. The starter shall be inoperative if the thermal unit is removed.
- I. Auxiliary Contacts: NEMA Size 0 thru 7 starters shall be suitable for the addition of at least four external auxiliary contacts of any arrangement normally open or normally closed external auxiliary contacts shall be field convertible size B.
- J. Starters shall be suitable for the addition of up to three external auxiliary contacts of any arrangement normally open or normally closed.
- K. Three-Phase Starter Specifications:
  - 1. All MAGNETIC STARTERS shall be Square D Class 8536, three-pole, three-phase of NEMA size applicable with three melting alloy overload relays and general purpose enclosure.
  - 2. All MAGNETIC STARTERS WITH "HAND-OFF-AUTO" SELECTOR SWITCH shall be Square D Class 8536, Form C. Three-pole, three-phase of NEMA size applicable with three melting alloy overload relays and three position H-0-A switch in cover of general purpose enclosure.
  - 3. All MAGNETIC STARTERS WITH "START-STOP" PUSH BUTTONS shall be Square D Class 8536, Form A, three pole, three-phase of NEMA size applicable with three melting alloy overload relays and "START-STOP" momentary push buttons in cover of general purpose enclosure.
  - 4. All MAGNETIC STARTERS WITH PILOT LIGHT shall be Square D Class 8536 or Class 8736, Form P, three-pole, three-phase of NEMA size applicable with three melting alloy overload relays and pilot light in cover of general purpose enclosure.
  - 5. All MAGNETIC STARTERS WITH "HAND-OFF-AUTO" SELECTOR SWITCH AND PILOT LIGHT shall be Square D Class 8536, Form CP, three

pole, three-phase of NEMA size applicable with three melting alloy overload relays and three-position H-0-A switch and pilot light in cover of general purpose enclosure.

6. All MAGNETIC STARTERS WITH "START STOP" PUSH BUTTONS AND PILOT LIGHT shall be Square D Class 8536, Form AP, three-pole, three-phase of NEMA size applicable with three melting alloy overload relays and "START STOP" push buttons and pilot light in cover of general purpose enclosure. The above shall be Square D or approved equal.
7. Motors 1/2 hp and larger will require starters if not provided in unit.

## 2.26 FAN COIL UNITS

- A. They shall be manufactured by International Environmental Inc. IEC, Carrier, McQuay, Trane or approved equal.
- B. Cabinets: Cabinets shall be thoroughly cleaned, phosphatized and provided with a high quality baked enamel finish with color as selected by Engineer. The cabinet shall be 18 gauge steel with exposed corners rounded, easily removable panels, and aluminum double deflection air outlet grille. Insulate the cabinet with 1/2 inch heavy density fiberglass, air stream side shall be protected with a high density erosion proof material for use in air streams, insulation assembly shall be UL listed.
- C. Coils: shall be evenly spaces aluminum fins mechanically bonded to copper tubes, designed for 200 psi and 220 F. They shall be designed to deliver the indicated heat emission with hot water in the coils as scheduled on the drawings.
- D. Fan: Centrifugal wheel, forward curved double-width, double inlet, corrosion resistant, statically and dynamically balanced, direct driven.
- E. Electrical motors shall be split capacitor, wound for operation at 120 volts, single phase, 60 cycles; they shall be provided with overload protection.
- F. Provide tapping for air vent on each coil.
- G. Provide an air filter – MERV-7 of the throw-away type in each unit and one spare filter for each unit.
- H. Control: Multiple speed switch, factory wired, electronically tested, located in cabinet units.
- I. Sound Criteria: The installation of all fan coils shall meet the minimum noise criteria level of NC-35 as installed. Furred in units shall be installed as

detailed and as specified on the Mechanical and Architectural drawings and specifications.

## 2.27 UNIT HEATERS

- A. They shall be manufactured by International Environmental Inc., IEC, McQuay, Trane, Carrier or approved equal as scheduled on drawings. After fabrication, all cabinets shall be thoroughly cleaned, phosphatized and provided with high quality baked enamel, color to be as selected by Engineer. Knock-outs shall be provided in sides of cabinets where appropriate.
- B. They shall be designed to deliver the indicated heat emission with water in the coils at an entering temperature of 180 degrees F., and 20 degrees F., temperature drop.
- C. Electrical motors shall be split capacitor, wound for operation at 120 volts, single phase, 60 cycles; they shall be provided with overload protection.
- D. Provide tapping for air vent on each coil.
- E. Provide an air filter – MERV-7 of the throw-away type in each cabinet unit and one spare filter for each unit.

## 2.28 MINI-SPLIT DUCTLESS AIRCONDITIONERS

- A. Unit specifications are based on Mitsubishi, or approved equal units as manufactured by Daikin or LG.
- B. General unit characteristics include; high SEER efficiency, inverter driven variable speed twin rotary compressors for precise load matching, with quiet operation, longer run times for improved dehumidification, single power point supply connection, 7 year compressor warranty and 5 year parts warranty.
- C. Indoor unit shall be ceiling suspended type with outdoor unit mounted where shown on the drawings. Unit shall be microprocessor controlled, with self-diagnostic function, and wireless remote control (T-series). Unit shall include a restart function after power failure.
- D. Indoor unit remote control shall include; three speeds and automatic fan operation, air sweep control, louver control, night setback, and 24 hour clock with on/off program timer.
- E. Indoor unit shall include anti-mold filter, and built-in condensate drain pump, and quiet mode (low-low speed) feature.
- F. Outdoor unit shall include electric expansion valve, with refrigerant type R-410A.
- G. Provide an exterior cover system for piping running between indoor and outdoor units. The system shall be designed for exterior use and include end covers and splice covers as required. Similar to “Slim duct” or approved equal.

H. See schedules on the drawings for unit capacity and design characteristics.

## 2.29 ENERGY RECOVERY VENTILATORS

- A. Energy Recovery Ventilator (ERV) shall be a packaged unit as manufactured by RenewAire and shall transfer both heat and humidity using static plate core technology.
- B. The ERV shall be capable of transferring both sensible and latent energy between airstreams. Latent energy transfer shall be accomplished by direct water vapor transfer from one airstream to the other, without exposing transfer media in succeeding cycles directly to the exhaust air and then to the fresh air.
- C. Passive Frost Control - The ERV core shall perform without condensing or frosting under normal operating conditions (defined as outside temperatures above -10°F and inside relative humidity below 40%). Occasional more extreme conditions shall not affect the usual function, performance or durability of the core. No condensate drains will be allowed.
- D. Continuous Ventilation - Unit shall have the capacity to operate continuously without the need for bypass, recirculation, pre-heaters, or defrost cycles under normal operating conditions.
- E. Positive Airstream Separation - Water vapor transfer shall be through molecular transport by hygroscopic resin and shall not be accomplished by “porous plate” mechanisms. Exhaust and fresh airstreams shall travel at all times in separate passages, and airstreams shall not mix.

## 2.30 FIN TUBE RADIATION

- A. Furnish and install Sterling Versa-line assemblies as follows. Substitutions shall comply with this specifications and shall be I=B=R approved ratings.
- B. Copper Aluminum heating elements shall be manufactured of seamless copper tube permanently mechanically bonded to aluminum fins.
- C. Full backplate shall be die formed steel and shall allow for removal of the enclosure.
- D. All hangers for heating elements shall be ball bearing cradle type or rod type die formed, providing for length wise movement of the element for expansion and contraction. Additionally vertical adjustment shall be provided.
- E. Pipe hangers for internal runs shall be noiseless and allow for expansion and contraction.
- F. Provide brackets for support of the backplate at the top and front skirt.

- G. Enclosure shall include accessories for end wall to end wall, such as splice plates, corners, and end caps. Provide access doors for access to valves. See schedule for size and construction requirements.

### 2.31 CONVECTORS

- A. Furnish and install Sterling Convectors as follows. Substitutions shall comply with this specifications and shall be I=B=R approved ratings.
- B. Heating elements shall be non-ferrous consisting of copper tube and 0.10 thickness aluminum fins with full flanged collars. Fins shall be protected by full length formed shields. The elements shall be supported by internal brackets on sides of the cabinets.
- C. Cabinets shall be cold rolled steel and shall be reinforced for stiffness. Top edges shall be rounded. Inlet and outlet louvers shall be Venetian type. All enclosure shall be factory primed
- D. See schedule on the drawings for Type, size and accessory requirements.

### 2.32 INLINE EXHAUST FANS

- A. Provide belt driven or direct drive inline centrifugal fan as shown on the drawings and on the schedules. Fans shall be factory assembled for field installation. Fan assemblies shall consist of the following.
  - 1. Non-overloading, backward inclined, statically and dynamically balanced wheels, keyed and locked to drive shaft.
  - 2. Aluminum construction.
  - 3. Externally mounted, NEMA design, drip-proof, ball-bearing motors.
  - 4. Companion rings.
  - 5. Belt guards, OSHA approved.
  - 6. Spring type isolators.
  - 7. Disconnect switch.
  - 8. Permanently lubricated bearings.
  - 9. All welded steel frame.
  - 10. Baked enamel finish over primer coat.
  - 11. Gravity back draft dampers.
  - 12. Provide starters for fans ½ HP or larger.
  - 13. Provide flexible rubberized connection at all duct attachments.

### 2.33 DIFFUSERS, REGISTERS, AND GRILLES

- A. Provide diffusers, registers and grilles for supply return and exhaust outlets, of size, type and design as shown on the drawings in schedules. Acceptable manufacturers are Titus, Metalaire, Kruger or Tuttle & Bailey.
- B. Equipment shall be tested and rated according to ASHRAE 91.

- C. Equipment shall handle air quantities at operating velocities:
  - 1. With maximum diffusion within the space delivered or removed.
  - 2. Without objectionable air movement as determined by the Architect.
  - 3. With sound pressure levels not exceeding NC 30.
- D. Supply, return and exhaust outlets shall have opposed blade volume dampers accessible from the front.
- E. Finish shall be as directed by the Architect.

## **PART 3 - EXECUTION**

### **3.1 WORK COORDINATION AND JOB OPERATIONS**

- A. HVAC equipment shall not be installed in congested and possible problem areas without first coordinating the installation of same with the other trades. Relocate all HVAC equipment should it interfere with the proper installation of equipment to be installed by the other trades.
- B. Particular attention shall be directed to the coordination of sheet metal work with all equipment of other trades installed in walls and above the ceiling areas. Conflicts in mounting heights and clearances in walls and above hung ceilings shall be brought to the attention of the Architect for a decision before the equipment is installed.
- C. Furnish to the other trades all information relative to the portion of the HV installation that will affect them, so that they may plan their work and installations accordingly.

### **3.2 LOCATION OF EQUIPMENT**

- A. The Engineer will establish the exact location of all mechanical equipment and devices to be located in those spaces of the building for which interior elevations are given on the Drawings. This includes, but is not limited to, heating units, grilles, registers, thermostats, and other controls, access panels and any other visible parts of appurtenances of the mechanical systems. Such precise locations are for the most part indicated on the interior elevations of the various drawings.

### **3.3 INSTALLATION INSTRUCTIONS**

- A. Installation of all equipment and systems shall be in strict accordance with the instructions of the manufacturers as approved by the Engineer.
- B. Installation of all systems shall conform to the requirements of the National Fire Protection Association, state and local codes and other agencies having jurisdiction.

### **3.4 PIPING SYSTEMS**

- A. Installation of pipe, fittings and valves:
  - 1. Furnish and install piping approximately as indicated, straight, plumb and as direct as possible. Form right angles or parallel lines with building walls.
  - 2. Keep pipes close to walls, partitions, and ceiling, offset only where necessary to follow walls as indicated.
  - 3. Locate groups of pipes parallel to each other, space them at a distance to permit applying full insulation and to permit access for servicing valves.

4. Piping shall be accurately cut to measurements established in the field and worked into place without springing or forcing.
  5. All piping shall be reamed to be free of burrs.
  6. Keep piping free from scale and dirt; protect open ends wherever work is suspended during construction to prevent foreign bodies entering and lodging there; use temporary plug, burlap, or other approved material for protection.
- B. Preserve access to all valves and equipment.
  - C. Make provisions for expansion and contraction with offsets loops and anchors. Piping shall be installed to allow freedom of movement in all planes without imposing undue stress or strain in the piping, equipment, or structure. Expansion joints shall be designed for the intended service temperature and pressure and sized for the amount of movement required from the maximum to minimum temperatures encountered by the system.
  - D. At the low points in the piping system provide a drain valve with hose bibb, sized 1/2 inch.
  - E. The system shall be installed so as to provide proper access for operation and maintenance. In cases where it appears that insufficient space is available, they shall be referred to the Engineer for a decision before installation.
  - F. Mains or risers with loops or offsets shall be securely anchored to the building construction, in such a manner as to throw all expansion toward the above mentioned offsets and loops. Anchors shall be constructed from heavy, forged wrought iron, secured to the piping and to the building construction.

### 3.5 ACCESS AND ACCESS PANELS

- A. Provide proper access to materials and equipment that require inspection, replacement, repair or service and coordinate their delivery with the installing Trade. If proper access cannot be provided, confer with the Designer as to best method of approach for minimizing effect of reduced access which may result.
- B. Coordinate and prepare a location, size, and function schedule of access panels required to fully service equipment and deliver to a representative of the installing Trade.
- C. Furnish access panels for installation under other Sections where fire dampers, volume dampers, controls, shut-off valves, control valves, check valves, filters or other items that require access and are concealed in floor, wall, furred space or above ceiling.
- D. Ceilings consisting of lay-in or removable splined tiles do not require access panels and dampers, splitters, or test hole openings above ceiling shall have location marked with thumb tack on finished ceiling panel. Location shall be noted on record drawings.

- E. Access panels shall have the same fire rating classification as the construction assembly into which it is installed.
- F. Panels shall be at least 12-in. x 12-in. Access panels at VAV boxes, fan boxes, fan coil units, inline fans shall be 24-in. x 24-in.
- G. Refer to Section 08310 — ACCESS DOORS AND FRAMES, for all product requirements for furnishing access panels.

### 3.6 PERFORMANCE

- A. All fans, motors, drives, pumps and valves shall be properly aligned and oiled so as to operate quietly; they shall be placed in a working condition satisfactory to the Engineer.
- B. After the respective piping and air handling systems have been completely installed, tested and cleaned, all manual control devices shall be adjusted.
- C. All manual dampers shall be securely locked in position with the final position of the damper quadrant clearly marked upon the side of the duct.
- D. After the manual adjustments have been completed those for the automatic temperature control system shall be conducted until all elements are placed in proper operating condition.
- E. Records of air flow through each louver, register, grille and diffuser, as determined by accurate velometer tests, shall be indicated on the Record Drawings prior to submittal for approval.
- F. The adjusting period shall be of sufficient duration to place the systems in satisfactory operating condition subject to the approval of the Engineer.

### 3.7 START-UP, TESTING, BALANCING AND ADJUSTING

- A. Provide qualified personnel, equipment, apparatus and services for testing, inspection, balancing and adjusting of mechanical systems, to performance data shown in schedules, as specified, and as required by codes, standards, regulations and authorities having jurisdiction including Inspectors, Owner and Engineer. Notify Engineer and involved authorities at least 48 hours prior to testing or inspection. Do not cover work (this includes backfilling and application of insulation) prior to testing or inspection.
- B. Testing, inspection, balancing and adjusting shall in no way relieve or reduce guarantee requirements.
- C. Submit proposed test procedures, recording forms and test equipment for review prior to testing and balancing.

- D. Prior to date of acceptance furnish Engineer with certificates of testing and inspection for HVAC systems indicating approval of authorities having jurisdiction and conformance with requirements of Contract Documents. Instruments used for testing and balancing shall have been calibrated within six months prior to testing or balancing. Calibration shall be certified.
- E. Leaks, damage and defects discovered or resulting from tests shall be repaired or replaced to like-new condition with acceptable materials. Tests shall be continued until system operates without adjustments or repairs.
- F. Report on standard reporting forms.
- G. Submit six copies of testing and balancing reports to Engineer for approval.
- H. Prove capacity and performance of equipment by field testing.
- I. Install equipment and instruments required for testing, including thermo-wells and gauge connections at no additional cost to Owner.
- J. Qualified representative of equipment manufacturer shall be present at test.
- K. Tests: No tests shall be started until systems have been cleaned as described under paragraph, CLEANING. Provide temporary piping and connections for testing, flushing, or draining systems to be tested. If leaks develop, repairs shall be made and tests repeated. Tests shall be continued until systems operate without adjustments and repair to equipment or piping.
- L. Balancing shall include both air and water system, Equipment specifically includes, but is not limited to, following:
  - a. Boiler
  - b. Pumps
  - c. Fin tube and convectors
  - d. Unit heater control valves

### 3.8 CLEANING

- A. Piping shall be cleaned to remove mill scale, cutting oil, metal chips, and welding slag. Control valves and devices shall not be installed prior to cleaning.
- B. After several hours of operation, each strainer shall be blown down. This process shall be repeated as necessary to produce a clean discharge from the blow down. Prior to turning the system over to the Owner, the strainers shall be removed and

cleaned.

### 3.9 PRESSURE TESTS

- A. Furnish all labor, material and equipment necessary for testing.
- B. All systems which are to be concealed shall be tested as outlined hereinafter before same are covered.
- C. All joints shall be made tight. All leaking valves shall be made tight.
- D. All piping systems shall be tested at 1 1/2 times the working pressure, and not less than 75 psig hydrostatic pressure; the systems shall remain tight for a period of four (4) consecutive hours.

### 3.10 LABELS AND IDENTIFICATION

- A. All valves shall have permanently affixed identifying tags. Tags shall be stamped metal discs affixed to the valve bodies only by heavy gauge twisted wire. Tags shall be stamped with symbols and numbers identifying the function and area served according to a system approved by the Engineer.
- B. All distribution piping exposed in basement shall have permanent wrap-around self-sealing labels, with words and identifying system and direction of flow printed on colored plastic film, in a coordinated system approved by the Engineer. Sufficient labels shall be applied that the function of all piping within any space may be readily identified, to the satisfaction of the Engineer. Labels shall be as manufactured by Seton, or Brady.
- C. All equipment units, unit controls, gauges, pilot lights, and similar devices shall be labeled with engraved plastic plates riveted or bolted to the item or its mounting surface. Labels shall clearly identify the function of the device to the satisfaction of the Engineer.
- D. The entire system of tags and labels shall be fully coordinated with the As Built Drawings, Operating and Maintenance Manuals, and other instructions and shall be completed to the Architect's satisfaction prior to Substantial Completion.

### 3.11 CUTTING PATCHING AND CORING

- A. Provide drilling, coring, and cutting of holes for HVAC piping. Electrically-powered drilling equipment shall be used to produce clean and neat openings.
- B. Throughout the performance of the cutting and coring work ensure that the structural integrity of the existing walls, floors, overhead structure and structural components, which are to remain, is maintained until permanent work is installed. All cutting and coring is to be performed in accordance with approved shop drawings.

### 3.12 FIRE SAFING AND SMOKE SEAL

- A. Fire safing and smoke seal is required at all penetrations through floors, rated fire walls and smoke partitions.
- B. Sealants shall provide 1 – 3 hour rating as appropriate for the assembly being penetrated.
- C. Product shall be 3M Fire Protection Products, or approved equal, in the form of caulking, putty or rope. The product shall be installed in accordance with the recommended practices and procedures of the manufacturer.
- D. All sealants shall be noncombustible per NFPA 220 and shall be classified per ASTM E814 and UL test method 1479, or ASTM E119 and UL263.

### 3.13 DEMOLITION

- A. The Contractor shall be responsible for all demolition and removal shown on heating plans, unless otherwise noted.
- B. All equipment and materials taken out of service shall be removed from the premises unless otherwise noted.
- C. The Contractor shall obtain and secure all permits for burning and cutting combustible material storage (gas for cutting torches) from the Fire Department.
- D. The Contractor shall assign a "fire watch" person responsible for the oversight of proper fire precaution practice for the duration of the work.
- E. Fire extinguisher must be provided. The number, location, type and size of such devices shall be as required/directed, approved and located by the Fire Department.
- F. All work shall be in strict compliance with MGL 454 CMR 10.00 - Prevention of Accidents in Construction Operations and OSHA Regulation.
- G. All demolition operations must also comply with MGL 310 CMR 7.09 (3) and (4) (dust, odor, noxious gas control during construction demolition).

**END OF SECTION**

## **SECTION 26 00 00 – ELECTRICAL DESIGN DEVELOPMENT**

### **PART 1 - GENERAL**

#### **1.01 FILED SUB-BID**

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- A. ELECTRICAL WORK is stipulated as a filed sub-bid under Part D, Item 2 of the GENERAL BID FORM.
- B. All sub-bids shall be submitted on the SUB-BID FORM furnished by the Awarding Authority. Sub-bids shall be submitted in accordance with the provisions of Sections 44A-J inclusive of Chapter 149 of the Massachusetts General Laws, as amended.
- C. Sub-bids must be filed with the Awarding Authority in a sealed envelope before the local time and the date stipulated in the Advertisement.
- D. Specified information relating to sub-bidders is set forth in the Contract Documents under the heading "INSTRUCTIONS TO BIDDERS", including "Sub-Bidders" and the attention of sub-bidders is directed thereto.

#### **1.02 GENERAL PROVISIONS**

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- A. The Conditions of the Contract and Division 1, General Requirements shall be part of this Section.
- B. Examine all Drawings and all other Sections of the Specifications for requirements affecting the work of this Section.

#### **1.03 WORK INCLUDED**

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- A. The scope of the work consists of the installation of all materials to be furnished under this Section, and without limiting the generality thereof, includes all materials, equipment, hoisting, rigging, staging, labor and services required for furnishing, delivering, and installing the principal items of work hereinafter, and all items incidental thereto, as specified herein and as shown on the drawings under the base bid, except where there is specific reference of exclusion and incorporation in other quotations.
- B. The scope of work shall also include the complete removal and disconnection of all existing electrical components, as required (unless otherwise noted). Reference section 3.02, "DEMOLITION, RELOCATION AND REMOVAL OF EXISTING WIRING," for additional requirements.
- C. Electrical work shall include, but not be limited to, the following systems:
  - 1. Miscellaneous materials to ensure complete installation
  - 2. Wireways and pullboxes
  - 3. Raceway systems
  - 4. Wire and cable systems
  - 5. Wiring devices and device plates and outlet boxes
  - 6. Temporary light and power
  - 7. Electrical service
  - 8. CT cabinet
  - 9. Meter socket

10. Main distribution panelboard
11. Panelboards
12. Nameplates
13. Motor wiring
14. Disconnect switches
15. Dry type transformers
16. All grounding required by the National Electrical Code
17. Telephone and data raceway system
18. Lighting fixtures and wiring devices on building interior and exterior
19. Emergency lighting
20. Emergency generator
21. Automatic Transfer Switch
22. Fire detection and alarm system
23. Operating and maintenance manuals
24. Record Drawings
25. Testing

#### **1.04 RELATED WORK**

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- A. The following work or equipment shall be furnished and installed by the Electrical Contractor:
  1. Power wiring to all mechanical equipment and control panels
  2. Power to sprinkler compressor
  3. Connection of duct smoke detectors to fire alarm system
- B. The following work is not included in this Section and shall be furnished and installed by others:
  1. All temperature control wiring shall be furnished and installed by the HVAC Contractor.
  2. Motor starters shall be supplied by the Mechanical Contractor, installed and wired by the Electrical Contractor.
  3. Shutdown wiring from the auxiliary contacts on duct smoke detectors to the associated motor controller shall be provided by the Mechanical Contractor.
  4. Duct smoke detectors shall be supplied by the Electrical Contractor for installation by the Mechanical Contractor.
  5. Charges for current consumed by the temporary light and power system for construction will be paid by the Owner.
  6. Painting (except for factory finished items) specified under Section "Painting".
  7. Access panels, where required, are furnished under this Section, but shall be installed under the related trades of the surface in which they are installed.
  8. All cutting and patching required for the electrical installation shall be done by the General Contractor.
  9. The installation cost of the temporary electrical distribution system shall be included in the General Contractor's price.

10. Final connection of telephone and data system shall be provided by the Owner.
11. Excavation, backfill and resurfacing required for underground electrical systems: Earthwork and Site Preparation.
12. Establishment of finished grades for site lighting: Earthwork.
13. Concrete work required for electrical systems to include poured-in-place concrete for underground conduit, and pads for main distribution panelboard, emergency generator and transformer: Concrete.
14. Electric door release units will be furnished and installed under Finish Hardware, but shall be wired under this Section.
15. Fireproofing will be furnished and installed under Sprayed Fireproofing. Patching and repairing of fireproofing due to cutting or damage during course of work of this Section shall be performed by installer of fireproofing and paid for under this Section.
16. Cutouts in casework and furniture for mounting electrical devices and equipment where specified and indicated on architectural and/or Equipment Drawings: Prefabricated Casework. Refer also to prefabricated casework, which will be supplied with pre-wired lighting fixture, switch and other such electrical devices. Such pre-wired casework shall be wired to 120V, 60Hz. Supply circuit under this Section.
17. Elevator final motor connections and elevator control wiring: Elevators.
18. Remote safety disconnect switch, located at room entrance, for heater burners, including furnishing and installing power wiring beyond burner disconnect and burner control wiring: Heating, Ventilating and Air-Conditioning.
19. Fire rated plywood backboards shall be installed in telephone closets: Rough Carpentry.
20. Staging, planking and scaffolding over 8 feet will be furnished, installed and maintained under Section 1500: Temporary Facilities.
21. Two-hour enclosures around emergency feeders run exposed: Section 09250-Gypsum Drywall.
22. Water flow switches and valve supervisory switches for sprinkler system shall be wired to fire alarm system under this Section, but furnished and installed under Section 15530 – Fire Protection.
23. Certain work provided by the local utility companies.

#### **1.05 REFERENCE**

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- A. Installation shall comply with the latest revisions of the National Electrical Code and with all prevailing federal, state, and local codes.
- B. All material and equipment shall be Underwriters' Laboratories, Inc. listed, where a standard has been established.
- C. Manufacturers' names and nomenclature facilitates descriptions of certain materials and equipment, and are used to establish type, quality and function.
- D. Unless otherwise specified, all work shall be manufactured, tested and installed in accordance with the latest editions of applicable publications and standards of the following organizations:
  1. International Building Code
  2. Commonwealth of Massachusetts State Building Code (SBC).
  3. American Society of Testing and Material (ASTM).

4. Underwriters' Laboratories, Inc. (UL)
  5. Insulated Power Cable Engineers Associates (IPCEA).
  6. National Electrical Manufacturers Associates (NEMA).
  7. Institute of Electrical and Electronic Engineers (IEEE).
  8. American National Standards Institute (ANSI).
  9. National Fire Protection Association (NFPA).
  10. National Electrical Code (NEC).
  11. Massachusetts Electrical Code (MEC).
  12. Americans with Disabilities Act (ADA), Public Law 101-336.
  13. Insulated Cable Engineers Association.
- E. Should specifications, Architects' instructions, laws, ordinances, or public authority require any special tests or approvals arrange for these and give the Engineer timely notice. If the inspection is by another authority other than the Engineer, notify the Engineer of the dates fixed for such inspection.
- F. Where reference is made to Codes and Standards, these shall be interpreted as minimum requirements. Requirements in excess of these codes and standards may be indicated on the Drawings or in the Specifications and shall be so included in the contract work. Compliance with such code requirements only shall not be construed as fulfillment of the contract work, where the plans and/or Specifications indicate additional work, which may exceed such code standards.

#### **1.06 SUBMITTALS**

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- A. Submit complete Product Data Sheets in accordance with the provisions of the GENERAL CONDITIONS AND SPECIAL CONDITIONS.
- B. Product Data Sheets shall be complete and include manufacturers name, factory assembly drawings and field installation drawings as required for a complete explanation and description of all items and equipment.
- C. Data sheets shall include - but are not necessarily limited to - the following items:
1. Panelboards
  2. Wiring devices (receptacles)
  3. Wiring device plates (indicate color)
  4. Lighting fixtures and poles
  5. Wires, cables and raceways
  6. Metering equipment (CT cabinets and meter sockets)
  7. Main distribution panelboard
  8. Special support equipment
  9. Outlet boxes
  10. Conduit
  11. Anchoring systems
  12. Fire alarm devices and panels
  13. Motor starters

14. Disconnect switches
  15. Fuses
  16. Time clock
  17. Dry type transformers
  18. Generator
  19. Automatic Transfer Switch
  20. Pad-mounted transformers
  21. Operating and maintenance manuals
  22. Record Drawings
  23. Fire alarm certification
  24. Test results
  25. Guarantee
- D. The Acceptance of systems, equipment and data sheets is a general approval subject to the contract Drawings, Specifications, and verification of all measurements at the job. Acceptance does not relieve the Electrical Contractor from the responsibility of data sheet errors or omissions. Quantity of items indicated on submittal is the responsibility of the Electrical Contractor.
- E. All equipment and materials shall be new and without blemish or defect.
- F. It is the intent of these specifications that whenever a manufacturer of a product is specified, and the terms "other approved" or "or approved equal" or "equal" are used, the substituted item must conform in all respects to the specified item.
- G. Substituted equipment or optional equipment where permitted and approved, must conform to space requirements. Any substituted equipment that cannot meet space requirements, whether approved or not, shall be replaced at the Contractor's expense. Any modification of related systems as a result of substitutions shall be made at the Contractor's expense.

#### **1.07 SAMPLES**

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- A. Submit samples of all materials requested by the Engineer.
- B. Samples shall be prepared and submitted in accordance with the requirements of GENERAL CONDITIONS AND SPECIAL CONDITIONS with all postage and transportation costs paid by the Contractor submitting same.

#### **1.08 RECORD DRAWINGS**

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- A. In accordance with requirements, furnish and keep in the job at all times, two (2) complete and separate sets of blackline prints of the electrical work on which shall be clearly, neatly and accurately noted, promptly as the work progresses, all electrical changes, revisions and additions to the work. Whenever work is installed otherwise than as shown on the Contract Drawings, such changes shall be noted.
- B. At the conclusion of work, prepare Record Drawings in accordance with General Conditions.

#### **1.09 COORDINATION DRAWINGS**

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- A. Before materials are purchased or work is begun, this Contractor shall prepare coordination drawings showing the size and location of his equipment and conduit runs.

- B. Coordination drawings are for the General Contractor's and the Engineer's use during construction and shall not be construed as replacing any shop, as-built or record drawings required elsewhere in the Contract Document.

#### **1.10 OPERATING INSTRUCTIONS AND MAINTENANCE MANUALS**

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- A. Instruct to the Owner's satisfaction, such persons as the Owner designates, in the proper operation and maintenance of the systems and their parts.
- B. Furnish operating and maintenance manuals and forward same to the Engineer for transmittal to the Owner.
- C. Operating instructions shall be specific for each system and shall include copies of posted specific instructions.
- D. For maintenance purposes, provide shop Drawings, part lists, specifications and manufacturer's maintenance bulletins for each piece of equipment.
- E. Provide name, address and telephone number of the manufacturer's representative and service company each piece of equipment so that service or spare parts can be readily obtained.

#### **1.11 GUARANTEE**

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- A. Attention is directed to provisions of the GENERAL CONDITIONS AND SPECIAL CONDITIONS regarding guarantees and warranties for work under this Contract.
- B. Manufacturers shall provide their standard guarantee for work under this Section. However, such guarantees shall be in addition to and not in lieu of all other liabilities, which the manufacturer and Contractor may have by law or by other provisions of the Contract Documents.
- C. All material, items of equipment and workmanship furnished under this Section shall carry for this standard warranty against all defects in material and workmanship. Any fault due to defective or improper material, equipment workmanship or design which may develop shall be made good forthwith, by and at the expense of the Electrical Contractor, including all other damage done to areas, materials and other systems resulting from this failure.
- D. Electrical Contractor shall guarantee that all elements of the systems are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.
- E. Upon receipt of notice from the Owner indicating failure of any part of the systems or equipment during the guarantee period, the affected part or parts shall be replaced by the Electrical Contractor at no cost to the Owner.
- F. Furnish, before the final payment is made, a written guarantee covering the above requirements for a period of one year.

#### **1.12 WORKMANSHIP**

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- A. The entire work provided in this Specification shall be constructed and finished in every respect in a workmanlike and substantial manner. Equipment shall be securely installed plumb and/or level. No electrical equipment shall be supported by work of other trades.
- B. Obtain detailed information from the manufacturers of apparatus as to the proper method of installing and connecting equipment. Obtain all information from the General Contractor and other Subcontractors, which may be necessary to facilitate work and the completion of the whole project.

- C. Remove daily, all rubbish and debris and all refuse from workmen's lunches and at completion, remove all their surplus materials, and leave the work in clean condition acceptable to the Engineer.

#### **1.13 PROTECTION**

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- A. This Contractor shall be responsible for the electrical work and equipment until finally inspected, tested and accepted. Carefully store materials and equipment, which are not immediately installed after delivery to site.

#### **1.14 EXAMINATION OF SITE AND CONTRACT DOCUMENTS**

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- A. Before submitting a proposal, this Contractor shall visit the premises and review the entire project, including ballasts in the existing fixtures, existing transformers and other devices classified as hazardous disposal. The Contractor shall determine the difficulties, conditions and disposal requirements, which may be encountered during the work. All charges related to meeting the intent of the Drawings and specifications shall be incorporated into the bid. If discrepancies arise between the Drawings and specifications, the more stringent requirement shall apply. No additional charges will be allowed due to existing conditions.
- B. Drawings, specifications and addenda shall comprise the bid documents. Work as shown on drawings, but not specified, or work specified, but not shown on the drawings shall be included as part of the bid documents. No additional changes will be allowed for failure to incorporate the work addressed in all bid documents.

#### **1.15 DELIVERY/STORAGE**

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- A. The Electrical Contractor shall be responsible for all materials delivered to the site in connection with the work and pay all charges for cartage, scaffolds, planking, rigging, and erecting. Take every precaution necessary to protect equipment and installation, in addition to plugging and protecting open ends of all pipes, outlet boxes, panelboxes, and junction boxes. All equipment shall be stored in a clean, dry place to preserve the quality of materials being use. Equipment and/or materials damaged during construction shall be replaced at no additional cost to the Owner.
- B. All materials and equipment required by this Specification shall be new, clean and free from defects at the time of installation. The Manufacturer's and Underwriter' label shall appear on all material and equipment, unless otherwise approved in writing by the Owner.

#### **1.16 SUBSTITUTION OF MATERIALS OR EQUIPMENT**

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- A. If the Electrical Contractor wishes to use materials or equipment other than those specifically designated herein, as being equal to those so specifically designated BEFORE PURCHASING AND/OR FABRICATION, the Electrical Contractor shall submit the proposed substitution in accordance with the requirements of the GENERAL CONDITIONS, and the decision of whether or not it is equal to that specified shall be determined by the Engineer.
- B. Unless requests for substitution are made in accordance with the above instructions and the instructions of the GENERAL CONDITIONS, supported by sufficient proof of equality, the successful Contractor will be required to furnish the specifically named items designated under the base bid.
- C. If the apparatus or materials substituted for those specified necessitate changes or additional connections, piping supports or construction, same shall be provided and the Electrical Contractor shall assume the cost and the entire responsibility thereto.
- D. The Engineer's permission to make such substitution shall not relieve the Electrical Contractor from full responsibility for the work.

### **1.17 DRAWINGS**

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- A. The Drawings are generally diagrammatic and are intended to convey the scope of work and indicate general arrangements of equipment, ducts, conduits, piping, and fixtures. The locations of all items shown on the Drawings or called for in the Specifications that are not definitely fixed by dimensions are approximate only.
- B. The Drawings showing layout of the electrical systems indicated the approximate location of outlets and equipment. The outlets as shown on the Drawings, are not intended to show the routing of the wire. The final determination as to the design of the system may change. It merely refers to the exact run of raceway between two points. Exact location of components shall be determined in the field by actual building conditions. Equipment or piping interfering with other installations shall be relocated at no additional cost to owner.

### **1.18 FIELD MEASUREMENTS**

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- A. The Electrical Contractor shall verify, in the field, all measurements necessary for the work and shall assume responsibility for their accuracy.

### **1.19 PERMITS, LAWS, ORDINANCES AND CODES**

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- A. The Electrical Contractor shall give all necessary notices, obtain all permits, and pay all taxes, fees, and other costs in connection with his work; file all necessary plans, prepare all necessary documents and obtain all necessary approvals of state authorities, all local town, city, or county departments having jurisdiction; obtain all required certificates of inspection for his work.
- B. The Electrical Contractor shall include in the work, without extra cost to the Owner, any labor, materials, services, apparatus, or drawings in addition to Contract Drawings and Documents, in order to comply with all applicable laws, ordinances, rules, and regulations whether or not shown on the Drawings and/or specified.

### **1.20 DEFINITIONS**

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- A. "This Contractor" means specifically the Electrical Contractor working under this Section of the Specifications.
- B. "Furnish and Install" means to supply, erect, install and connect up, complete for regular operation, the particular item referred to, unless otherwise specified.
- C. "Install" means to mount, erect and connect up, complete for regular operation, the particular item referred to, unless otherwise specified.
- D. "Piping includes, in addition to pipe, all fittings, boxes, hangers and other accessories relating to such piping.
- E. "Provide" means to furnish and install.
- F. "Concealed" means hidden from sight as in trenches, chases, furred spaces, shafts, hung ceilings, embedded into construction, ground or concealed as defined above.

### **1.21 CLEANING UP**

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- A. The Electrical Contractor shall, at the completion of the work, clean, polish and/or wash all exposed items of material, equipment and fixtures in his contract so as to leave such items bright and clean. Special attention shall be given to interiors and exteriors of all panels, electrical equipment and enclosures.
- B. All painted metal surfaces, which have been scratched, dented, or marred shall be repainted by the Electrical Contractor.

### **1.22 DAMAGE TO OTHER WORK**

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- A. Each Contractor shall be held responsible for and shall pay for all damage to other work caused by his work or workmen.
- B. Repairing of such damage shall be done by the General Contractor or Contractors who installed the work, and so directed by the Engineer.

### **1.23 TEMPORARY ELECTRIC SERVICE**

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- A. The Electrical Contractor shall provide a complete temporary lighting and power system for the construction of the project and shall pay for the cost of installation.
- B. The Electrical Contractor may utilize the existing service to support the needs of temporary construction power. Temporary connections within the Owner's panels shall be made in a safe and secure manner and shall not affect the Owner's operation.
- C. The Electrical Contractor shall provide all transformers, plywood, panelboards, cables, circuit breaker wiring, and other electrical equipment to support the needs of temporary power and light for construction. All lighting and power receptacles required for temporary power shall be included.
- D. All temporary electrical work shall be rigidly built in conformity with the National Electrical Code and in accordance with all state and local requirements.
- E. At the completion of the project, the Electrical Contractor shall completely remove the service and all cables and other devices and materials used for temporary construction power.

### **1.24 ELECTRIC SERVICE**

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- A. The building will be served from a new pad mounted transformer. Below grade primary conduits and below grade secondary conduit and cable shall be provided by electrical contractor.
- B. **National Grid** will invoice the Owner directly for installation of the new service. Specifically, **National Grid** will provide the following:
  - 1. After conduit installation by Electrical Contractor, **National Grid** will provide and install the underground primary cable.
  - 2. Terminate primary cable on both ends.
  - 3. Provide and install a new transformer with 120/208 volt wye connected secondary windings.
  - 4. Provide the electric meter.
  - 5. Terminate the low voltage cables at the transformer secondary.
  - 6. Install CT's in the main CT cabinet and install wiring for electric meter.
- C. The Electrical Contractor shall include in his bid the following work:
  - 1. Installation of the schedule 40 PVC conduit and the GRC elbows, supplied by EC.
  - 2. Installation of the secondary, underground cable and conduit from the new building transformer to the main distribution switchboard.
  - 3. Terminate the secondary cable connections at the main distribution switchboard.
  - 4. Supply and install a meter base in accordance with **National Grid** requirements with 1-1/4" conduit to the main distribution switchboard.

- D. The General Contractor shall include in his bid the following work:
1. The General Contractor shall provide trenching, backfill and installation of new asphalt to allow installation of the new electrical primary and secondary conduit runs.
  2. The General Contractor shall provide concrete encasement around primary conduits in accordance with **National Grid** requirements.
  3. The General Contractor shall provide new concrete transformer pad.
  4. The General Contractor shall core drill foundation wall, remove and replace concrete floor slab to allow installation of secondary conduits.
  5. The General Contractor shall provide concrete transformer pad and concrete encasement for primary conduits in accordance with **National Grid** requirements.

### 1.25 GROUNDING

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- A. A complete grounding system shall be furnished and installed in full compliance with the latest edition of the NEC.
- B. The equipment and materials required under this Section are included under PART 2 – PRODUCTS.
- C. Ground all systems and equipment in accordance with the best industry practice. Size all conductors per the latest addition of the NEC.
- D. Conductors utilized for grounding and bonding shall have type “THHN” or better insulation, color-coded green.
- E. For each feeder or run of lighting and appliance branch circuitry, include equipment and raceway grounding conductors run within the raceways. The indicated quantities of conductors do not include the ground wires.
- F. The central equipment for the fire protection alarm system shall have its grounding terminal connected to the nearest metallic cold water main by means of a #6 green coded insulated conductor, run in ¾” threaded metallic conduit. Utilize a ground clamp of a type specifically manufactured for the purpose.
- G. Provide supplementary ground bonding where metallic conduits terminate at metal clad equipment (or at the metal pull box of equipment) for which a ground bus is specified. Accomplish this by equipping the conduits with bushings of the grounding type connected individually by means of jumpers to the ground bus.

The grounding stud of each three-phase dry type transformer shall be connected separately to the building steel or cold water pipe. Connection shall be by means of an insulated conductor, run in steel conduit size in accordance with the following:

Transformer kVA	Grounding Conductor & Conduit Size	
0 – 45	1 #6	¾”c
46 – 75	1 #2	¾”c
76 – 150	1 #3/0	1”c
151 and larger	1 #250 mcm	1¼”c

- H. The ground bus of the main distribution switchboard and generator control switchgear shall be connected to the main grounding electrode specified below by means of insulated conductors run in threaded steel conduit. The main grounding system shall consist of a loop connecting the following items together:
  1. Water service pipe on the street side. Provide bonding jumpers around water meters.

2. Metal frame of the building, at two different locations.
3. Concrete encased electrode consisting of 20 feet of bare #4 conductor installed within the footing of the building, i.e., concrete encased.
4. Ground ring consisting of 20 feet of bare #4 conductor around the exterior building perimeter.
5. Copper ground rod, 8 feet x ½ inch, shall be provided and installed exterior to the building foundation.

Two connections from the ground loop to the main switchboard shall be provided.

- I. The neutral lead of emergency generator shall not be grounded.

#### **1.26 NEUTRAL WIRING**

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- A. For 120-volt branch circuit wiring to receptacles, common neutrals shall not be permitted.
- B. Individual neutral conductors shall be installed within the raceways and be run with the branch circuit.
- C. Conductors utilized for neutral wiring shall have type “TW” or better insulation, color coded white.

## **PART 2 - PRODUCTS**

#### **2.01 GENERAL**

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- A. All materials and equipment necessary to make the installation complete in every detail shall be furnished and installed under this Contract, whether or not specifically indicated on the Drawings or specified herein. All materials and equipment shall be new.
- B. It is the intent of the Specifications that one manufacturer be selected, not a combination, for any particular classification of material; for example, all wire of one manufacturer, all switches of one manufacturer, etc., except specific material classifications in which delivery time becomes a problem. The Engineer may give specific exemption from the requirements.
- C. Where materials, equipment, apparatus, or other products are specified by manufacturer, brand name, type or catalog number, such designation is to establish standards of performance, quality, type, and style.

#### **2.02 PULLBOXES, WIREWAYS AND CHANNELS**

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- A. Pull boxes shall be code gauge galvanized steel with screw covers to match. Pull boxes and wireways shall be as shown on Drawings and/or as required by NEC and/or job conditions, with steel barriers separating systems.
- B. Wireways shall be galvanized steel, manufactured standard sections and fittings, with combination hinged and screw covers.
- C. Steel channel supports shall be minimum 1-5/8” mold strip steel with minimum .105” wall thickness, Unistrut P1000, Kindorf, Husky Products, or equal.
- D. Steel support rods or support bolts for conduits shall be 1/8" diameter for each inch or fraction thereof of diameter of conduit size, but no rod or bolt shall be less than 1/4" in diameter.

- E. Metal conduit fittings shall be of cast malleable iron, cadmium plated with neoprene gaskets and cast malleable iron covers. Fitting for use with conduit 1-1/4" diameter and smaller shall be "Form 35", those for use with conduit 1/1/2" diameter and larger shall be Mogol. Fitting shall be as manufactured by Appleton Electrical Co., Steel City, Crouse-Hinds, or approved equal.
- F. Expansion fitting shall be as manufactured by O. Z. Gedney, Electrical Manufacturing Co., Inc., or approved equal as manufactured by Crouse-Hinds or Appleton.

### **2.03 OUTLET BOXES AND ACCESSORIES**

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- A. Provide PVC or galvanized sheet steel outlet boxes for all outlets unless otherwise noted.
- B. All outlet boxes for pendant-mounted fixtures shall be galvanized, stamped steel furnished with a fixture stud, securely mounted to framing
- C. All outlet boxes for concealed work shall be galvanized, stamped steel; those for fixtures, furnished with a fixture stud.
- D. Outlet boxes shall be of size and type to accommodate (1) structural conditions, (2) size and number of raceways, conductors or cables entering, and (3) devices or fixtures for which they are required.
- E. Install blank plates on all outlet boxes, in which no apparatus is installed, which do not integrally provide a cover for the box.
- F. Special care shall be taken to set all boxes correctly square and true with the building finish.
- G. Fixture outlet boxes shall have 3/8" solid male fixture studs and auxiliary fixture stems shall be supported from 3/8" male fixture studs.
- H. Outlet boxes and accessories shall be as manufactured by Steel City, Appleton, Raco, or equal.

### **2.04 ACCESS PANELS**

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- A. Access panels shall be provided for all electrical equipment which requires access by National Electric Code above ceilings or behind walls which are constructed of materials of the type which are not readily removable.
- B. Access panels shall be furnished by the Electrical Contractor and installed by the General Contractor.
- C. Access panels shall be prime painted, have cylinder lock and two keys, as manufactured by Island Steel Products, Walsh-Hannon-Gladwin, Way Locktor, or equal. Type shall be similar to Milcor Type A.

### **2.05 RACEWAYS**

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- A. Electric metallic tubing (EMT) shall be electrogalvanized or sheradized steel. EMT shall be used in all exposed areas which are not subject to physical abuse. Couplings and connectors for electrical metallic tubing shall be galvanized steel set-screw. Tubing shall be as manufactured by Pyle National, Allied Tube and Conduit Corp., Wheatland Tube Company, or equal.
- B. Liquid-tight flexible metal conduit shall be galvanized steel with separate copper grounding conductor. The outer jacket shall be an extruded, moisture and oil proof, covering of polyvinyl chloride. Liquid-tight flexible metal conduit shall be used for the final connections to all roof top equipment and in all areas where motors and other equipment are subject to an oil or moisture type environment. Liquid-tight flexible metal conduit shall be

manufactured by American Flexible Conduit, Eastern Wiring Conduit, International Metal Hose Company, or equal.

- C. Polyvinyl Chloride (PVC) Conduit, schedule 40 shall be used for encased applications as specifically stated on the Drawings. Conduit shall be rated for 90°C, UL rated and shall comply with NEMA specification TC-2 (Conduit), TC-3 (Fittings) and UL-651 Standard for rigid nonmetallic conduit. Conduit fittings shall be homogeneous plastic material free from visible cracks, holes or foreign inclusions. Conduit shall be manufactured by Carlon, Cal Pipe, Kraloy, or approved equal.
- D. Galvanized Rigid Steel Conduit (GRC) shall be made of zinc coated steel. GRC conduit shall be installed as shown on the Drawings, as specified, and in all areas subject to physical abuse. Galvanized Rigid Conduit shall be manufactured by Allied Tube and Conduit, Wheatland Tube Company, Republic Conduit or equal.
- E. Steel support rods or support bolts for conduits shall be 1/8" diameter for each inch or fraction thereof of diameter of conduit size, but no rod or bolt shall be less than 1/4" in diameter.
- F. For 20 ampere branch circuit wiring furnish and install the number of individual conduits required to limit the number of conductors in each conduit to a number which will not require derating to a value below 100 percent of the current rating of the circuit overcurrent protective device.

## **2.06 FIRESTOPPING**

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- A. Firestopping shall be installed by the Electrical Contractor for all new or existing electrical conduits which enter or pass through fire rated walls or floors. Fire seal fittings shall be used around cable, in sleeves, or in core drilled holes passing through fire rated walls and floors. Firestopping shall be T&B Fire-Seal, or equal by O.Z. Gedney or Minnesota Mining and Manufacturing Company.

## **2.07 BRANCH CIRCUIT WIRING – TYPE MC**

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- A. All branch circuit wiring shall be installed concealed, unless otherwise noted.
- B. Branch circuit wiring which is installed in concealed spaces shall be type MC flexible cable. Branch circuit wiring in exposed spaces shall be installed in type EMT conduit.
- C. Minimum wire size within type MC cable shall be #12.
- D. All wiring within MC cable shall be copper, no aluminum is permitted.
- E. Flexible metal conduit, type MC, shall have aluminum armor with current carrying conductors as required. MC cable shall have full size separate copper grounding conductor.
- F. Flexible cable, type MC, shall be manufactured by American Flexible Conduit, Eastern Wiring Conduit, International Metal Hose Company or approved equal.

## **2.08 BRANCH CIRCUIT WIRING – EXPOSED**

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- A. All exposed branch circuit wiring shall be installed in type EMT conduit.
- B. All wire shall be #12 minimum.
- C. All wire shall be copper, no aluminum is permitted.
- D. Wire installed in conduit shall be type THWN-THHN building wire, 600V, rated for 75°C in wet locations and 90°C in dry locations.
- E. Wire shall be manufactured by Phelps Dodge Copper Products Corp., General Cable Co., Triangle Conduit and Cable Company or approved equal.

## **2.09 FIRE RATED CABLE SYSTEMS**

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- A. Provide two-hour fire rated cable systems as required by the National Electrical Code, Section 700.10, for all emergency feeders.
  - 1. Cable assembly shall be classified by Underwriters Lab as having two hour fire resistive rating and be UL 2196 listed for use in emergency systems.
  - 2. Cable assembly shall be supported both vertically and horizontally, every three or four feet per manufacturers requirements.
  - 3. Conductors shall be solid or stranded, high electrical conductivity copper with a cross section area corresponding to standard AWG sizes.
- B. Two hour fire rated power cables shall be Pentair Pyrotenax MI cable, RSCC Wire and Cable – Vitalink MC, or approved equal.

## **2.10 MAIN SERVICE CUBICAL – (BCT CABINET)**

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- A. Description
  - 1. Provide a main service cubicle consisting of a hot sequence CT cabinet, bottom fed, with main circuit breaker in the top section and SPD device.
  - 2. Dimensions shall be approximately 90" high, 32" wide, 20" deep.
  - 3. Provide integral CT cabinet with tamper proof screw in dead front enclosure, with integral/meter socket. CT cabinet shall meet local utility company requirements, and be capable of accepting current transformers furnished by the local utility company.
  - 4. Provide indoor construction for floor mounting.
  - 5. Main service cubicle and main circuit breaker shall have AIC rating as shown on the Drawings.
- B. Main Circuit Breaker
  - 1. Main circuit breaker shall be mounted within service cubicle and shall have AIC rating equal to or greater than the AIC rating of the cubicle. Current limiting circuit breakers shall not be used.
  - 2. Main circuit breaker shall be 80% rated.
  - 3. Main circuit breaker shall have proper load side lugs to meet project requirements.
- C. Manufacturers
  - 1. Complete service cubicle shall be UL listed and shall be manufactured by Eaton, General Electric, Siemens, or equal.

## **2.11 WIRING DEVICES**

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- A. General
  - 1. All wiring devices shall be of a single manufacturer, as manufactured by Pass and Seymour, General Electric, Hubbell, Bryant Electric Company, Leviton, or equal. Manufacturers listed below establish minimum requirements. Coordinate color with Architect for wiring devices and wiring device plates.
- B. Light Switches
  - 1. All local wall switches shall be commercial grade, white, toggle type, single-pole, or three-way as required.
  - 2. Switches shall be equal to the following:

Single Pole  
Three-Way

Pass & Seymour CS20ACIW  
Pass & Seymour CS20AC3W

**C. Dimmers (Slide Type), Line Voltage and/or Low Voltage**

1. Dimmers shall be provided as shown on the drawings and shall have adequate rating to serve the branch circuit lighting load shown. Dimmers shall have slide knob for full range dimming control and an on/off toggle switch at the base of the dimmer. Provide slide type dimmers similar or equal to Lutron Skylark Series.

**D. Automatic Light Switching - Photocell Sensor (Interior)**

1. Lighting in selected areas shall be controlled by photocell sensor. Sensor shall be ceiling mounted and shall signal control unit off/on as applicable. Sensor shall control lighting fixtures as shown on the Drawings. Control units for interfacing between line voltage and the low voltage sensors shall be provided. Control unit shall be 20 AMP rated. Photocell switch equipment shall be manufactured by Sensor Switch, Watt Stopper, or Universal Energy Control.

**E. Automatic Light Switches - Time Clock and Photo Cell**

1. Time clock shall be Photo/Time control of the seven (7) day calendar type, with input terminals for photocell connections.
2. Provide time clock and photocell for control of exterior lighting fixtures. Time clock shall have output contacts for use with a latching type, mechanically held lighting contactors.
3. Time clock shall have 3 output circuits:
  - a) Circuit 1 shall provide an on signal at dusk from photocell or time clock signal. An off signal shall be provided by the time clock.
  - b) Circuit 2 shall provide an on signal at dusk from the photocell only and an off signal at dawn from the photocell only. This circuit shall be responsive to the photocell only.
  - c) Circuit 3 shall provide individual daily on/off signals from the time clock only.
4. Time clock shall have manual override control for each of the three contactor circuits.
5. Time clock shall have NEMA 1 enclosure and shall be surface-mounted.
6. Spring-driven reserve timing motor shall be provided to operate the time clock up to 16 hours after the power has failed.
7. Photocell shall operate control center when lighting level falls below pre-determined set point. Photo sensor shall have light level control and shall be enclosed in weatherproof polymeric housing.
8. Time clock shall be similar or equal to Intermatic model T51211BC with photocell included.

**F. Receptacles - 20A Commercial Grade**

1. Duplex receptacles shall be grounding type, rated 20 amperes, 125 volts. Receptacles shall be back and side wired with screw type terminals or pressure type, screwless terminals having suitable conductor release arrangement. Receptacles shall be standard grade, Pass & Seymour Model No. **5352**.
2. Special receptacles for single equipment, where required, shall have additional grounding leg and shall be of capacity and configuration for the equipment to be connected.

G. Receptacles - 20A GFI - Commercial Grade

1. Provide GFI duplex receptacles as indicated on the Drawings. Receptacles shall each have GFI tripping (no feed-through is permitted) with self-test. Receptacles shall be rated 20 amp, 125 volt similar, or equal to Pass and Seymour Model No. **2097**.

H. Weatherproof Receptacles

1. Receptacles indicated to be weatherproof shall have an enclosure that is weatherproof when the receptacle is covered (attachment lug not inserted and receptacle covers closed). Damp proof cover shall be similar or equal to Hubbell Model HBL5205WO.

## **2.12 WIRE DEVICE PLATES**

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- A. Wall plates shall be provided for all receptacles, light switches, blank junction boxes, and special purpose outlets. Wall plates shall be:

1. Smooth type, no line, high strength, scratch resistance, thermoplastic.
2. Type 403 stainless steel, 0.032" nominal thickness.
3. Type 302 stainless steel, 0.032" nominal thickness with 18% chromium and 8% nickel content to prevent corrosion ... food processing, dairy, industrial projects.
4. Brush brass, 0.040" thick, 70% copper, 30% zinc alloy. Plates shall have lacquered finish.
5. Aluminum, 0.040" thick, satin finish, with lacquered coating.

All plates shall have color-matched mounting screws and conform to UL, CSA, and NEMA standards.

Wall plate color shall be selected by the Architect.

- B. Device plates shall be by same manufacturer as devices.

## **2.13 SERVICE ENTRANCE GROUND BAR**

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- A. Provide wall mounted service entrance ground bar. Minimum size shall be 24" x 4" x 1/4" or larger to meet code minimum sizing and/or job requirements.
- B. Ground bar shall be solid copper with pre-drilled mounting holes for cable lugs.
- C. Stand-off insulators and mountign brackets shall be provided.
- D. Ground bus shall be manufactured by Georgia Copper, Panduit, Storm Copper Components, Co. or approved equal.

## **2.14 MAIN DISTRIBUTION PANELBOARDS**

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- A. Provide dead-front main distribution panelboard, with proper voltage and amp rating as required. Panelboard shall be surface-mounted and be rated for service entrance.
- B. Provide copper bus bars and full size insulated neutral bus. Panel buswork shall be rated to carry, as minimum, ampere rating of overcurrent device that serves panel.
- C. Provide anti-turn, solderless lugs suitable for copper or aluminum wire.
- D. Provide separately mounted ground bus. Ground bus shall be bonded to panelboard enclosure.
- E. Provide bolt-on, molded case, circuit breakers with thermal – magnetic trips. Multiple pole breakers shall be single handle, common trip.
- F. Main Distribution panelboard shall be provided as MLO (Main Lug Only).

- G. Current limiting circuit breakers shall not be used, Series rated breakers shall not be used to achieve required interrupting rating.
- H. Main distribution panelboard shall be capable of supporting additional bolt-on circuit breakers without modification up to the frame size, as follows:
  - Panel Size: 800 amp
  - Branch Circuit Breaker Frame Size: 400 amp
- I. Provide fully rated circuit breakers equal to short circuit interrupting current specified.
- J. Provide typed name card in each panelboard. Card shall indicate equipment, fed by each circuit breaker.
- K. Panelboard Main Distribution shall be manufactured by Eaton, Model PRL4A or approved equal by Siemens or General Electric.

**2.15 PANELBOARDS**

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- A. Provide dead-front lighting and power panelboards, with proper voltage and amp rating as required. Panelboards shall be surface- or flush-mounted as required.
- B. Provide copper bus bars and full size insulated neutral bus. Panel buswork shall be rated to carry, as minimum, ampere rating of overcurrent device that serves panel.
- C. Panels with feed-through busing shall not be used.
- D. Provide anti-turn, solderless lugs suitable for copper or aluminum wire.
- E. Provide separately mounted ground bus for each panelboard. Ground bus shall be bonded to panelboard enclosure.
- F. Provide bolt-on, molded case, circuit breakers with thermal - magnetic trips. Multiple pole breakers shall be single handle, common trip.
- G. Provide handle locks for emergency lighting circuits, fire alarm, security, or other similar functions.
- H. Main circuit breakers shall be mounted vertically, separate from the branch breakers.
- I. Current limiting circuit breakers shall not be used, series rated circuit breakers shall not be used to achieve required interrupting rating.
- J. Panelboard trim shall be provided with door-in-door construction.
- K. Panelboard shall be capable of supporting additional bolt-on circuit breakers without modification up to the frame size, as follows:

Panel Size	Branch Circuit Breaker Frame Size
100 amp	60 amp
200 amp	100 amp
225 amp	150 amp
400 amp	225 amp
600 amp	400 amp
800 amp	600 amp

- L. Provide fully rated circuit breakers equal to short circuit interrupting current specified.
- M. Provide typed name card in each panelboard. Card shall indicate equipment, lighting areas, or receptacle areas fed by each branch circuit breaker.

- N. Panelboard doors shall have flush mounted catch and lock with two keys. All keys for panelboards shall be keyed alike.
- O. Panelboards shall be manufactured by Eaton, General Electric, Siemens, or approved equal.

#### **2.16 EXISTING PANELBOARDS**

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- A. The existing panelboards are suitable for 120/208 volts, 3-phase, 4-wire as previously installed.
- B. Where connections are made in existing panelboards, the panel index shall be revised to indicate the new loads served. All existing panelboards that do not have a circuit directory card mounted in a frame with noncombustible plastic cover shall have one installed on the inside of the door. All directory cards shall be properly filled in, using a typewriter, and indicate areas and devices served by each unit.
- C. New circuit breakers added to existing panelboards shall be the same frame size and an interrupting capacity as existing panelboards and circuit breakers. Current limiting circuit breakers shall not be used.

#### **2.17 SURGE PROTECTION DEVICE (SPD)**

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- A. Surge Protection Device (SPD) shall be provided within each panelboard as indicated on one-line diagram.
  - 1. The SPD must protect all modes of the electrical system being utilized, L-N, L-G, L-L, and N-G. SPD shall be rated 20KA minimum.
  - 2. Within panelboard provide Surge Protection Device (SPD). SPD device shall be direct bus bar connected. SPD shall be tested and demonstrate suitability for application with ANSI/IEEE C62.41 Category B environments for distribution panelboards and Category A environments for panelboards.
  - 3. The SPD shall be installed immediately following the load side of the main circuit breaker or in MLO panelboards immediately following the incoming main lugs.
  - 4. The SPD shall be mounted within the panelboard by the panelboard manufacturer and the complete panelboard including the SPD shall be UL67 listed.

#### **2.18 CLEARANCES**

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- A. Spaces for electrical panelboards and switchboards shall include an exclusively dedicated space extending from the floor to the structural ceiling with a width that of the the equipment (30 inches minimum) and a depth of 36 inches. No piping, ductwork or equipment foreign to the elctrical equipment shall be permitted to be installed in, enter or pass through such space. All panelboards shall be mounted so that the distance from the top circuit breaker operating handle to the floor shall not exceed 6'-6". Provide circuit breaker handle lock-on accessory for each constantly powered circuit such as exit lighting, emergency lighting and night lighting. Provide typewritten directory cards in each panel; identify loads served by each circuit breaker.

#### **2.19 AIRTIGHT VAPOR BARRIER BOXES**

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- A. Provide airtight vapor barrier boxes to seal against air and moisture infiltration. Air vapor barrier boxes shall house all electrical backboxes located on exterior walls and ceilings.
- B. Air vapor barrier boxes shall be polyethylene construction and shall protect the seal made around wires exiting the box.
- C. Airtight vapor barrier box shall be manufactured by LESSCO or approved equal.

## 2.20 ELECTRICAL IDENTIFICATION

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### A. General

1. The purpose of this section is to provide identification for electrical equipment, raceway and conductors.
2. Provide labels, nameplates, panel directories and color-coding as specified herein.

### B. Engraved Nameplates

1. Provide nameplates constructed of 1/16-inch thick plastic laminated material. Engrave through colored surface material to contrasting colored sub-layer. Provide white lettering on black background.
2. Provide nameplates for all electrical equipment including, but not limited to, switchboards, panels, transfer switches, disconnect switches, transformers, capacitors, fixed equipment, motor starters and MCC's.

### C. Electrical Labels (P-Touch)

1. Receptacle and toggle switch labels shall be printed using electronic labeler Brother P-Touch, model PT-20/25, Dymo-Tape or approved equal.
2. Provide electronic P-Touch labels for all motor toggle switches, light switches and receptacles.
3. Electronic labels shall state the panelboard and circuit number, example PP1-6 and, for motor toggle switches, shall also state the load served – example EF-4.

### D. Raceway Labels

1. Use stenciling labels, 2" high lettering for all empty conduits.
2. Stencil shall include source equipment name or room name.
3. Provide labels with description of purpose, and location of opposite end, on each end of conduits provided for future.
4. Note accurately on as-built drawings.

### E. Panelboard Directories

1. Provide neatly typed schedule under plastic jacket or protective cover for protection from damage or dirt.
  - a) Number each single pole space: Odd-numbered circuits on left side even on right side.
  - b) Securely mount on inside face of panelboard door.
  - c) When no cover, provide individual engraved type nameplates for each overcurrent and other device.
  - d) Define briefly, but accurately, nature of connected load (i.e. Lighting Office, Receptacles, Mechanical/Electrical Room, etc) as approved.
  - e) Provide room locations for all loads and indicate panel name on schedule.
  - f) Multipole circuits to utilized first pole space number as its circuit number.
  - g) Panel schedules and as-built circuit numbers shall agree.

### F. Wire and Cable Labeling

1. Feeders cables shall be properly phased and identified throughout. Individual conductors shall be color coded as noted below.

<b>Conductor</b>	<b>120/208V</b>
Phase A	Black
Phase B	Red
Phase C	Blue
Neutral	White
Ground	Green
Isolated Ground	Green/Yellow

2. Buses and connections shall be identified left to right, top to bottom, or front to rear; buses shall read A-B-C; and shall be color coded per the table above.
3. Feeders for all new construction shall have color-coded phase identification at all junction boxes. Where the proper color wire insulation cannot be obtained, black insulation shall be used and the conductors shall be coded with plastic vinyl tape, 3M #190-A, 3/4 inch or equal.

**G. Attachment of Labels**

1. Securely of labels attach engraved labels and nameplates with rivets or screws.
2. Clean surfaces thoroughly before attaching all labels. Use solvent on device plates before attaching electronic or Dymo-tape labels.
3. No temporary markings permitted to remain on equipment. Remove all temporary markings where possible. Where markings cannot be removed, repaint trims, housing, etc. to cover markings. Refinish defaced finishes.

## **2.21 TELEPHONE AND DATA CABLING**

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**A. General**

1. The Electrical Contractor shall provide complete telephone and data cabling. At each telephone and/or data location shown on the Drawings, provide a single-gang backbox, telephone jack, data cable jack, and device plate.
2. Fire-rated plywood backboards shall be provided and installed by the General Contractor, sized as shown on the Drawings.
3. Install cables without kinks or excessive compression from tie wraps or cable support systems. Ensure full compliance with EIA/TIA 606, 568A and 569 standards.
4. Label each voice and data jack at the outlet and in the wiring room with the cable number, unique. Provide as-built Drawings as part of closeout submittals.

**B. Voice System**

1. The Electrical Contractor shall install telephone homerun wiring from the plywood backboard located in the main telephone/data room to each telephone jack. Telephone wiring shall be Category 5E, 24 AWG plenum rated.
2. Telephone outlets shall be provided and shall include a single-gang backbox, single-gang flush faceplate with RJ-45 telephone jack. For wall telephones, provide type 630 faceplate and telephone jack.
3. At main telephone backboard, provide 6'-0" of coiled cable for each telephone homerun for final connection by owner. Label each cable run, jack, and end cable jack with unique number.

4. Test all voice cables with a TEST-ALL-IV unit, or equal. Confirm polarity, pass continuity configuration and compliance. Correct and retest until all pass.
5. Telephone cable shall be manufactured by AT&T, Berktek, Remeo, or equal.
6. Telephone jacks shall be manufactured by AT&T, Hubbell, Leviton, or equal.

C. CATV

1. The electrical contractor shall install CATV homerun wiring from each wall jack location to the CATV backboard. CATV wiring shall be type RG-6.
2. CATV outlets shall be provided and shall include a single gang backbox, reduction ring, and single gang faceplate with one CATV jack.
3. At CATV backboard, coil homerun cables for connection by CATV company. Label each cable run, jack and CATV cable each end, end patch panel termination with unique number
4. CATV cable shall be manufactured by AT&T, Berktek, Remeo or equal.

D. Data System

1. Data cable shall be plenum rated Category 5E, four unshielded twisted pairs.
2. Homerun data cable wiring shall be installed from the plywood backboard located in the main telephone/data room to each data jack.
3. Terminate data cables at outlet locations on flush-mounted Category 5E data jacks using 568 configuration. Combine data jack onto single-gang plate with telephone jack where shown on plans.
4. At main data backboard, provide 6'-0" of coiled cable for each data homerun for final connection by owner. Label each cable rung jack and end jack with a unique number.
5. Test all data cables with a Category 5E cable tester, Scope, or equal. Correct all non-conforming cables and retest until all pass. Provide computer-generated cable test printouts as part of closeout submittals.
6. Data cables shall be manufactured by AT&T, Remeo, Berktec, or equal.
7. Data jacks shall be manufactured by AT&T, Hubbell, Leviton, or equal.

## **2.22 DISCONNECT SWITCH**

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- A. All safety switches shall be NEMA General-Duty Type HD and Underwriters' Laboratories listed.
- B. All switches shall have switchblades which are fully visible in the OFF position with the door open. All current-carrying parts shall be plated through electrolytic processes to resist corrosion and promote cool operation.
- C. Switches shall be quick-make and quick-break such that during normal operation of the switch, the operation of the contacts shall be not capable of being restrained by the operating handle after the closing or opening action of the contacts has started. The handle and mechanism shall be an integral part of the box, not the cover, with positive padlocking provisions in the OFF position.
- D. Switches shall be furnished in NEMA 1 general purpose enclosures unless NEMA 3R (raintight). Enclosures shall be of code gauge (UL 98) sheet steel (NEMA 1) or code gauge phosphate treatment and gray baked enamel finish.
- E. Switches shall be horsepower rated for 600 volts AC and all switches shall be fused type with dual element fuses.

- F. Safety switches shall be Square D Class 3130 or approved equal as manufactured by General Electric or Westinghouse Electric.

## **2.23 LIGHTING FIXTURES**

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### **A. Interior Lighting**

1. Furnish all labor, materials, and equipment required for a complete installation of lighting equipment specified.
2. This Contractor shall assume all responsibility for the safe handling of all lighting fixtures which are furnished under this Section and other accessories and lamps, until the final inspection has been made by the Owner's Architect and Engineer.
3. Special fittings and materials that may be required to support fixtures shall be supplied as well as supports required to secure surface- or pendant-mounted fixtures on suspended ceilings unless otherwise noted. Where duct work, pipes, type of building construction materials, and structural framing members provide obstructions or difficult support means, hanger rods shall be used in association with horizontal sections of steel support channels in a manner approved by the Owner's Engineer. Steel support channels shall be Unistrut, Kindorf, Husky Products Co., or equal.
4. For all 2' x 4' and 2' x 2' fixtures installed by the Electrical Contractor, provide chain supports to the structural deck. Provide two chain supports for each lighting fixture.
5. The exact mounting height of all stem supported lighting fixtures shall be determined on the job by the Owner's Architect and Engineer.
6. Fluorescent Lamp Ballasts
  - a) Ballasts shall be series type, classified for sound rating A, and CBM certified.
  - b) Provide Class P, automatic resetting thermal protection as required by UL.
  - c) Provide two-lamp ballasts whenever possible.
  - d) Ballasts shall have minimum 0.9 power factor.
  - e) Provide low-temperature ballasts for use outdoors or in unheated indoor parking areas, designed for temperature as low as minus 20 degrees Fahrenheit.
  - f) Provide electronic ballasts for indoor fluorescent fixtures. Total harmonic distortion shall not exceed 32 percent and 27.5 percent of third triplens. Ballasts shall be manufactured by Magnetek, Electronic Ballast Technology Inc., or equal.
  - g) Electronic ballasts shall be approved by utility company.
7. Emergency Ballasts
  - a) Emergency ballast shall work in conjunction with the AC ballast to convert new or existing fixtures into emergency lighting fixtures.
  - b) Provide switched fixture circuitry with remote test/monitor plate test switch and indicator light mounted adjacent to light switch.
  - c) When AC power fails, emergency ballast shall immediately switch to the emergency mode, keeping lamps illuminated at a reduced lumen output for a minimum of 90 minutes.

- d) When AC power is restored, emergency ballast shall automatically return to the charging mode.
  - e) Emergency ballasts shall be UL listed.
  - f) Battery shall be nickel cadmium.
  - g) Emergency ballasts shall be Bodine or equal.
8. Lamps
- a) Furnish and install a complete set of new lamps for all fixtures. Lamps used during the construction period shall be removed and replaced with new lamps.
  - b) All fluorescent lamps to be T-5 energy savings type or approved equal.
  - c) Refer to fixture schedule for lamp type, wattage, voltage, and size.
  - d) Lamps shall be manufactured by General Electric, Osram/Sylvania, Phillips, or equal.
9. Fixtures, parts, or parts thereof (including lamps) determined to be defective upon completion of the electrical installation shall be replaced by the Electrical Contractor free of charge.
10. In addition to fixture supports, surface-mounted lighting fixtures shall be secured to the surface to which they mount at a minimum of two points on each 4 foot length of fixture housing, as approved, to prevent rotation or movement of the fixture out of its square and level position of alignment.

## **2.24 ARCHITECTURAL LIGHTING CONTROL SYSTEM**

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### **A. GENERAL**

- 1. Lighting control system shall be manufactured by N-Light.
- 2. Specifications TBD.

## **2.25 ADDRESSABLE FIRE DETECTION AND FIRE ALARM SYSTEM**

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### **A. General**

- 1. The Contractor shall furnish, install, and place in operation a microprocessor-based addressable analog/multiplex fire alarm system.
- 2. The completed fire alarm system shall meet all local and state codes.
- 3. Equipment and completed installation shall be UL listed or approved and shall meet approval of local fire department and state fire marshall, authorities having jurisdiction and shall be in accordance with the applicable sections of the latest edition of the National Electrical Code, ADA Code, NFPA 71, 72, 72E, and Life Safety Code #101.
- 4. Each remote device shall have a unique code. All remote devices shall be under the control of the main system microprocessor.
- 5. Fire Alarm system shall have complete voice evacuation capability.
- 6. The complete system shall contain smoke detection, speaker/horn light alarms, pull stations, duct smoke detectors, water and tamper flow switches, and other devices as required for a complete system.
- 7. The Owner shall be responsible for telephone company lease charges.

8. The Owner shall be responsible for selection of and monthly payments to an approved fire alarm third party monitoring company.
  9. The Contractor shall be responsible for telephone installation charges.
  10. The Contractor shall be responsible for all fire alarm testing and certification charges.
  11. The Contractor shall be responsible for keeping the existing fire alarm system operational during construction.
  12. The Contractor shall provide the local Fire Department an impairment affidavit and impairment plan documenting the process they shall take keeping the building fully protected during construction. The local Fire Department must be notified prior to any disruption to the fire alarm system.
- B. Main Fire Alarm Control Panel (FACP)
1. The main fire alarm control panel shall include - but not be limited to - system cabinet, communications equipment, power supply unit, system control unit, or analog loop unit. Fire alarm power supply shall be 24 volt dc.
  2. All circuit boards, control panels, battery chargers, batteries, and other equipment at the main panel location shall be contained within 16-gauge steel cabinets. Doors shall be lockable type.
  3. Descriptive display of device in alarm shall be an 80-character minimum, liquid crystal type (LCD) display.
  4. Secondary power supply shall have the capacity to operate the fire alarm system in the non-alarm mode for 24 hours and at the end of that period shall be capable of operating all alarm notification appliances for five minutes (or 15 minutes) per NFPA 72, Section 4.4.1.5.3.1. In addition, provide 20% additional battery capacity.
  5. Lightning protection shall be included within the FACP to protect the panel from lightning strike on the 120 volt supply circuit.
  6. The FACP shall have a digital electronic telephone autodialer to enable automatic transmission of alarm signal to the approved fire alarm third party monitoring company via local telephone lines. Two telephone lines are required.
  7. System trouble conditions shall appear as an amber "System Trouble" LED and shall cause an audible signal at the panel to steadily sound. System trouble signals shall include normal power failure, failure of the microprocessor, failure of remote processor/identification module, or open or shorted wiring conditions on the alarm initiating circuit or the alarm notification circuit.
  8. The FACP shall have reset switch, alarm silence switch, and trouble silence switch for silencing the panel-mounted alarm horns.
  9. A green "Power On" LED shall normally be lit, indicating that the system is receiving 120 volt AC.
  10. Red LEDs shall be provided to indicate alarm conditions.
  11. Each alarm initiating circuit shall be electrically supervised for open circuits, short circuits, and ground faults in the wiring.
  12. Auxiliary control outputs, operated by toggle switches within the FACP, shall be provided for elevator recall, stair pressurization fans, smoke exhaust fans, outside air fans, dampers, door holder and stair door unlocking circuits. All auxiliary circuits will not be affected by the operation of either "Alarm Silence" or "Manual

Select" controls. A separate panel section shall be provided for fire department manually operated switches for atrium smoke control.

13. Provide a firefighter's one-way communication control system. The communications panel shall provide automatic operation and manual control, signal transmission, amplification and supervision as herein specified. The voice command center shall be contained within the FACP and shall include:
  - a) The capability of manually transmitting the fire alarm evacuation signal and voice announcement to any or all speaker appliance circuits by manual selection of the associated speaker selector switches.
  - b) A manual override feature via a hand-held microphone which shall take priority over any and all alarm signals to assure communication of one-way voice instructions. "Manual Select" operation will allow the operator to bypass all automatic signaling in favor of manual signaling.
  - c) One (1) speaker circuit (minimum) for each level/floor, each stairwell, and each bank of elevator cars. Circuit select switches shall be provided for manual selection of any or all circuits.
  - d) "All-Call" and "Alarm Silence" controls to simplify firefighter's general system operations.
  - e) A "Phone Patch" control for the firefighter in command to allow voice instructions to be initiated from any remote telephone.
  - f) Alarm speaker amplification equipment of a size to provide sufficient power to all loudspeaker appliances shown, plus an additional 20 percent to accommodate final testing power adjustments.
14. The firefighter's communication control panel shall have its own separate audible and visual trouble circuit with resound (multiple trouble conditions will "resound" the trouble audible after initial silencing via the momentary "Trouble Silence" push-button) to help isolate trouble conditions. All "trouble" signals are suppressed during alarm conditions.
15. Provide a firefighter's two-way private intercom system for manual control of simultaneous communication to multiple zones from a master telephone handset. Operations shall be as follows:
  - a) Removing an installed phone from its cradle or insertion of a portable handset into a jack shall sound a pulsing call signal and flash an individual line LED light within the fire command center. A "busy" tone shall be heard at the remote phone.
  - b) Depressing the Momentary Phone Acknowledge Switch or picking up the Master Phone shall silence the audible call signal.
  - c) Activation of the corresponding phone circuit switch to the "ON" position shall light the LED continuously and put the remote phone in direct private contact with the Master Phone. Additional remote phones, up to five, may be switched in by the operator for common "party line" operation.
  - d) Any remote telephone shall have the capability of operating in a remote command or paging mode at the operators discretion by activating the "Phone Patch" switch.

- e) The firefighter's auxiliary control system shall provide complete manual and/or automatic control functions (i.e., fans, dampers, door holders, etc.). Each auxiliary function shall have:
  - (1) ON/NORM/OFF" controls to provide automatic programming from the fire alarm panel with manual override capability by the system operator.
  - (2) A red "ON" LED and amber "OFF" LED shall be provided which may be programmed to give a positive indication of actual auxiliary circuit operation.
- 16. Redundant Tone Generator Modules shall be furnished for alarm and auxiliary tone generation. RTM modules shall be continuously supervised for operation and against removal and will be interchangeable with versions which include slow whoop, temporal patter, chime, or horn tones.
- 17. Power amplifiers shall be in 60, 120 and 250 watt RMS increments at either 70 VRMS or 25 VRMS output voltage levels. PA amplifiers shall be single or dual channel operation and redundant for 5% to 100% backup. All amplifiers shall have 50 to 15 kHz frequency response.
- 18. The Speaker Appliance Circuit Module shall be rated 60 watts minimum at 70 VRMS and shall provide a Style Y (Class "B") supervision plug-in module. All speaker appliance circuits shall have short circuit protection built in to automatically disconnect the individual speaker appliance circuit from the system amplifier(s) when a short-circuit is detected to assure the integrity of all other speaker appliance circuits. Each speaker appliance circuit shall have an individual manual control toggle switch, red "Alarm" LED, and yellow "Trouble" LED to isolate individual circuit functions and status. A dedicated wiring area shall be provided for all appliance circuits to simplify contractor interconnections.
- 19. Auxiliary Control Circuit Module shall be equipped with form "A" or "B" contacts rated at 2 amperes DC (resistive). Each auxiliary control circuit shall have an individual "ON/NORM/OFF" 3-position manual switch to isolate individual circuit functions and status, together with an "ON" LED and "OFF" LED to monitor remote auxiliary circuit contacts giving a positive indication of circuit status to the system operator. A dedicated wiring area shall be provided for all auxiliary circuits to simplify contractor interconnections.
- 20. A Firefighter's Intercom shall provide individual 2-way simultaneous communication between the master handset and remote phones. Each supervised Style Y (Class "B") circuit shall have an individual manual control toggle switch, red "ON" LED, and yellow "NORM" LED to isolate individual circuit functions and status. A dedicated wiring area shall be provided for all phone circuits to simplify contractor interconnections.
- 21. A Digital Repeater Module shall be furnished when a pre-recorded general instruction message is required as part of the system. The standard operating sequence shall be thirty seconds of alarm tone, followed by a 30-60 second general instruction message. After the message is sent, or interrupted by the hand-held microphone before the tape message is completed, or failure of the Digital Repeater Module, the alarm tone will again sound continuously until the system is reset or the tone silenced. The Digital Repeater Module will be supervised, microprocessor controlled, and store a digitized recording of a human voice. It shall be capable of storing up to eight (8) programmable messages.
- 22. Smoke detector alarm verification shall be provided to prevent nuisance alarms. Pre-alarm window of 15 seconds, zone reset of 5 seconds and a 90-second alarm

verification window shall be provided. System shall alarm from a second alarm from the same smoke detector within this 90-second window.

#### C. Operation

1. The operation of any manual pull station, automatic heat detector, smoke detector, or water flow switch shall result in the following:
  - a) All alarm notification devices (speaker strobes) shall sound and strobe lights shall flash.
  - b) Main fire alarm local buzzer shall sound.
  - c) Indicate on the main fire alarm control panel the description of the specific analog/addressable device in alarm via an 80-character alpha-numeric display.
  - d) Release all magnetically held doors.
  - e) Transmit signal to remote annunciator.
  - f) Transmit signal to the local Fire Department via third party local monitoring company.
  - g) Capture all elevators.
2. The control panel shall indicate the device in alarm until manually reset. This shall silence the panel buzzer.
3. The FACP shall signal the elevator controller to recall the elevator to the main floor level. Elevator recall to main level shall occur when any elevator lobby smoke detector (except main level), or top of shaft elevator smoke detector or elevator machine room smoke detector is activated.

The FACP shall also signal the elevator controller to recall the elevator to the alternate floor level upon activation of the main level elevator lobby smoke detector.

The Electrical Contractor shall provide two addressable relays in the elevator machine room with wiring back to the FACP. One relay shall be activated to enable elevator recall to the main level and the second relay shall be activated to enable elevator recall to the alternate level.
4. All alarm notification devices shall be silenced by actuating a "silence" switch.
5. Activation of rescue assistance system shall cause local FACP alarm and trouble condition.

#### D. Remote Devices

1. Smoke detectors shall be addressable solid state, photoelectric type with 3.0% nominal sensitivity. Smoke detectors shall be a plug-in unit which mounts to a twistlock base.
2. Remote Alarm Indicator (LED) shall be provided as shown on the Drawings. LED shall have stainless steel faceplate and shall be engraved "alarm" unless otherwise noted.
3. Duct smoke detectors shall be addressable photoelectric type, complete with remote test station and sampling tubes. Remote test station shall have red LED indicating light and stainless steel faceplate. Duct smoke detectors shall, upon alarm condition, cause FACP to alarm and shall cause the FACP to activate the associated control relay to shutdown the associated air handling unit. Duct detectors shall be supplied by the Electrical Contractor, installed by the Mechanical

Contractor and wired to the fire alarm control panel by the Electrical Contractor. Shutdown wiring from the control relay to the motor starter shall be done by the Mechanical Contractor.

4. Combination heat detector/rate-of-rise heat detectors shall be provided as shown on the Drawings. Heat detectors shall be addressable and shall have an air chamber, a vent, and a flexible metal diaphragm. Units shall have a fixed temperature setting of 135°F or 200°F as specified on the Drawings. Rate-of-rise capabilities shall be provided via the air chamber, vent, and diaphragm. Expanded diaphragm shall cause normally open contacts to close and signal alarm condition.
5. Heat detectors shall be addressable, low-profile, matte white, rated 135°F fixed temperature as shown on the Drawings.
6. Heat detectors rated 200°F as shown on the Drawings shall be conventional type detectors. Fixed temperature 200°F detectors shall be low-profile, matte white, and shall be zoned together as shown on the Drawings utilizing a conventional to addressable conversion module.
7. Provide carbon monoxide detectors as shown on the drawings. Detector shall operate on 24 VAC power from FACP. Provide addressable module for each co-detector. Coordinate exact location of module prior to installation. Co-detector shall be similar or equal to Macurco, Inc. detector model CM-15/15A.
8. Provide liquid propane gas detection in basement areas. Provide detectors as shown on the drawings. Detectors shall detect toxic and combustible gas and shall operate on 24 VAC power from the FACP. Provide addressable model for each detector. Liquid propane gas detectors shall be similar or equal to Macurco Model GD-1.
9. Pull stations shall be flush-mounted. Provide addressable, double-action break rod stations. Pull stations shall mechanically latch upon activation and remain so until being mechanically reset by opening with a key. Pull stations in public areas shall, at the option of the Superintendent of Fire Alarm, have an accepted protection cover with an integral sounding device. The operable part of the manual pull station shall be mounted between 3½ feet and 4½ feet above finish floor per NFPA 5.12.4. Pull stations shall be mounted within five feet of exit doorways on each floor level per NFPA 5.12.6. Pull stations shall be mounted on both sides of grouped door openings exceeding 40 feet in width per NFPA 5.12.7. Travel distance to any pull station shall not exceed 200 feet per NFPA 5.12.8.
10. Provide piezoelectric Mini Horns in the living areas of the residence as shown on the drawings. Horns shall operate on 24 VAC and be powered from the FACP. Provide mini horns similar or equal to Wheelock series MIZ-TC24-W. Mini horns or mini speakers, as required, shall provide 75 dba at the pillow per NFPA 7.4.4.
11. Horn strobe units shall be installed flush-mounted. The visual strobe shall meet all requirements of the ADA Code. Strobe shall be rated as follows:
  - a) The lamp shall be a xenon strobe type or equivalent.
  - b) The color shall be clear or nominal white, i.e., non-filtered, or clear filtered white light.
  - c) The maximum pulse duration shall be two-tenths of one second (0.2 second) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
  - d) The intensity shall be a minimum of 75 candela.
  - e) The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.

- f) Horn strobe units shall flash synchronously with other horn strobes and other strobe only devices in the same zone. System shall hold synchronization for a minimum of 15 minutes.

The audible portion of the device shall be rated to meet ADA Codes and shall meet the following criterion:

Horns shall produce a sound that exceeds the prevailing equivalent sound level in the room or space by at least 15 dba or exceeds any maximum sound level with a duration of 60 seconds, by 5 dba, whichever is louder. Sound levels for alarms shall not exceed 120 dba.

Speaker strobe units shall be located as shown on the Drawings. Speaker strobes shall be mounted at 90 inches above the highest floor level within the space or 6 inches below the ceiling, whichever is lower, per NFPA 7.4.6.1. Strobe mounting height shall not exceed 96 inches per NFPA 7.5.4.

No place in common corridors or hallways in which visual alarm signaling appliances are required shall be more than 50 feet from the signal. In corridors, visible notification appliances shall be provided not more than 15 feet from the end with a separation not greater than 100 feet per NFPA 7.5.4.2.5.

12. Provide a supervised exterior rotating beacon 24 VDC with a red lens. Beacon shall operate on battery standby power 24 VDC for 15 minutes of alarm. Beacon shall be of non-corrosive Lexan plastic construction with an optically designed red lens, a wall-mounting bracket; Neoprene weatherproof gaskets shall also be included. Beacon shall measure over five (5) inches in height for visibility. Location shall be determined by the local fire department.
13. Knox-Box shall be recessed mounted near the front entry. Box shall be aluminum with tamper switch.
14. Addressable magnetic door hold open devices shall be furnished and installed as shown on the plans. Magnetic door hold open devices shall be wall-mounted with 24 VDC coils powered from the fire alarm control panel. Door holders shall have brushed aluminum finish.
15. Strobe-only units shall be provided and shall meet all requirements of NFPA and ADA codes. Strobe shall be rated as follows:
  - a) The lamp shall be a xenon strobe type or equivalent.
  - b) The color shall be clear or nominal white, i.e., non-filtered, or clear filtered white light.
  - c) The maximum pulse duration shall be two-tenths of one second (0.2 second) with a maximum duty cycle of 40 percent. The pulse duration is defined as the time interval between initial and final points of 10 percent of maximum signal.
  - d) The intensity shall be a minimum of 75 candela.
  - e) The flash rate shall be a minimum of 1 Hz and a maximum of 3 Hz.
16. Provide LCD type remote annunciator, positioned as shown on the Drawings. The annunciator shall be flush-mounted type and shall be supervised for system trouble. Remote annunciator shall have silence switch and reset switch. Remote annunciator shall have 80-character LCD display which repeats alarm message on FACP.

17. Remote relays shall be provided for AC unit shutdown. Relay circuits shall be powered and supervised from the main fire alarm control panel. Operating coils shall be 24 volts dc.
18. Firefighters Emergency Telephones shall be (flush/surface) mounted with a locked door located at each floor exit and elsewhere as indicated on the drawing. Permanently installed phones shall be supplied with a coil cord or in areas of anticipated high vandalism, with durable security type armored cable.
19. Remote handsets/jacks shall be flush/surface-mounted on stainless steel plates and located where indicated on the Drawings. Jacks shall be "break glass" version to deter vandalism.
20. Portable firefighters telephone handsets shall be supplied with a coiled cord and a three-circuit plug that is compatible with remote jacks. A total of portable handsets shall be provided.
21. The sprinkler contractor shall provide water flow switches on the wet sprinkler piping systems. Should a sprinkler head release, water flow will cause a contact closure on the flow switch. The Electrical Contractor shall provide an addressable module adjacent to each water flow switch as shown on the Drawings. Activation of water flow switch shall cause fire alarm control panel to alarm and transmit call to the Fire Department.
22. The sprinkler contractor shall provide a tamper switch on each control valve of the sprinkler system. Should valve be moved from its preset condition, this shall cause contact closure on the tamper switch. The Electrical Contractor shall provide an addressable module adjacent to each tamper switch as shown on the Drawings. Activation of tamper switch shall cause trouble alarm at the fire alarm control panel.
23. The sprinkler contractor shall provide a low pressure alarm device on the incoming sprinkler line for monitoring external street pressure. Should the street pressure drop below a predetermined value, low-pressure device shall cause a contact closure. The Electrical Contractor shall provide an addressable control module adjacent to the low pressure switch as shown on the Drawings. Activation of the low pressure switch shall cause a trouble condition at the main fire alarm control panel.
24. The sprinkler contractor shall provide a low pressure alarm device on the dry pipe sprinkler piping. Should air pressure drop below a predetermined value, low alarm pressure device will activate, causing a contact closure. The Electrical Contractor shall provide an addressable control module at each low-pressure switch as shown on the Drawings. Activation of low pressure device shall be annunciated as a trouble condition at the fire alarm control panel.
25. The sprinkler contractor shall provide a water pressure device on the dry pipe sprinkler system which acts like a water flow switch. Activation of a dry sprinkler head will cause contact closure at the water pressure device. The Electrical Contractor shall provide an addressable control module at each water pressure device as shown on the Drawings. Activation of the water pressure device shall cause the fire alarm panel to activate and transmit fire condition to the Fire Department.

E. Wiring and Conduit

1. All fire alarm wire and cable shall be UL listed for fire alarm use.
2. The electrical contractor shall coordinate the installation of the fire alarm equipment with the manufacturer. All conductors and wiring shall be installed per the manufacturers' recommendations.

3. The fire alarm system wiring shall be Class "A" with end-of-line resistors located in the FACP. Both alarm initiating circuits and communications loop circuits shall be Class "A" type.
  4. All fire alarm wiring shall be installed concealed. Fire alarm conduit and wire may be installed surface-mounted only in the following area:
    - a) Utility rooms
    - b) Unfinished basement areas
  5. For fire alarm wiring in concealed areas, fire alarm cable shall be plenum rated type FPLP, with red outer jacket. Installation shall meet requirements of NEC Article 770 and 725. Conductors shall be solid copper #14 minimum, with low-smoke, low-flame type jacket.
  6. For fire alarm wiring in exposed areas, fire alarm wiring shall be type THHN insulation. Wire size shall be #14 AWG minimum. All wiring related to the fire alarm system shall be installed in type EMT conduit.
  7. All junction boxes shall be sprayed red and labeled "fire alarm".
  8. City Tie-in - The Electrical Contractor shall provide IMSA 19-5 red-jacketed fire alarm cable from the master box to the service pole. Provide slack cable at pole for connection to the municipal loop.
- F. Programming
1. The system shall be field programmable, either by programming switches on the system control unit, or by locally connected PC.
  2. A hard copy of the final system configuration showing all inputs, outputs, descriptions, addresses, and programming matrixes shall be provided at final acceptance test.
  3. A supervised RS-232 serial port shall be provided to operate a remote printer to print all alarms, trouble conditions, local descriptions, time, and date of occurrence. The remote printer itself is not required.
- G. Shop Drawings
1. Shop Drawings shall include both equipment catalog cuts (product data sheets) and one-line riser/interconnect diagrams.
  2. Provide battery calculations showing 20% spare capability.
  3. Catalog cuts shall indicate descriptive information and technical data and shall be supplied for all equipment including main fire alarm control panel and all remote devices.
  4. One-line riser or interconnect drawing shall be supplied on 24"x36" size drawing. All fire alarm devices, power supplies, splice cabinets, and transmitting equipment shall be shown with interconnect wire size.
- H. Testing
1. The Electrical Contractor shall be responsible for all required fire alarm testing.
  2. Prior to formal Fire Department Test, the Contractor shall conduct a preliminary test. The Electrical Contractor and the equipment manufacturer shall completely test the system. The Manufacturer shall issue a letter of acceptability stating that all system components are installed and all remote devices are functioning.
  3. After letter of acceptability has been received for the preliminary test, the Electrical Contractor shall conduct the acceptance test, as many times as required. The

Electrical Contractor, Equipment Manufacturers Representative, Owner's Representative, Fire Department Representative and Service Company Representative shall conduct the acceptance test in accordance with NFPA 72. Every building fire alarm device shall be tested to ensure proper operation and correct annunciation at the control panel. At least one half of all tests shall be performed on battery standby power.

4. Where application of heat would destroy any detector, it may be manually activated.
5. The communication loops and the indicating appliance circuits shall be opened in at least two (2) locations per zone to check for the presence of correct supervisory circuitry.
6. When the testing has been completed to the satisfaction of both the Contractor's Job Foreman and the Representatives of the Manufacturer and Owner, the electrician shall provide a completed Inspection and Testing Form per NFPA 72, Section 10.6.2.3.
7. The Contractor shall leave the fire alarm system in proper working order and, without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within one year (365 days) from the date of final acceptance by the awarding authority.

I. Wall Map

1. The Electrical Contractor shall obtain updated reduced size floor plans from the architect. Provide wall map from reduced floor plans. Wall map shall be picture framed with metal frame and protective see-through glass front. All floors of the building shall be shown in accordance with fire department requirements. The fire alarm panel programming (initiating device location room names) shall match the room names initiated on the wall map.

J. Manufacturers

1. All system devices including all fire alarm initiating devices, notification devices, and main panels shall be labeled with the Manufacturer's name and logo type. "Hybridized" system (containing equipment from several different manufacturers) are not acceptable.
2. Complete system shall be manufactured by Notifier (NFS2-640 with DVC) or similar by Edwards or approved equal.

## **2.26 EMERGENCY GENERATOR - GAS**

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A. Generator Rating/Performance.

1. The stand-by generator shall have a circuit breaker and kVA/kW rating as shown on the drawings. Generator set shall be continuously rated for standby power to provide back-up power to selected equipment. Generator ratings are based on 500 feet above sea level, 115°F maximum ambient temperature and -20°F minimum ambient temperature. Generator set output voltage shall be 120/208 volt, 3 phase, 4 wire. Complete emergency loads shall be connected as shown on the drawings. Generator shall meet all requirements of the National Electrical Code, and all other applicable codes.
2. Generator shall be stand-by rated, of adequate capacity to serve the required load, 0.80 power factor. Time lag from normal power failure to system full voltage and rated frequency shall be a maximum of 10 seconds. Generator shall be built in accordance with applicable IEEE, NEMA and ANSI standards.

3. Frequency regulation shall be isochronous, regulated to within +/- 0.25% from no load to full load.
  4. Voltage regulation shall be +/- 0.5% for any steady state load between no load and full load.
  5. Engine generator, at normal operating temperatures, shall accept block load of 100% less applicable derating factors in accordance with NFPA 110. To meet this requirement engine must be naturally aspirated.
- B. Weatherproof Enclosure
1. Generator shall have a weatherproof, sound attenuated enclosure. Enclosure shall meet sound level requirement of 75db maximum at 50 feet (operation at full load).
- C. Prototype Test
1. The manufacturer must certify that engine, generator, controls, and switchgear have been tested as complete system of representative engineering models (not on equipment sold). Prototype testing shall include:
    - a.) Fuel consumption at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , and full load
    - b.) Exhaust emissions
    - c.) Mechanical and exhaust noise
    - d.) Governor speed regulation at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , and full load; and during transients
    - e.) Motor starting kVA
    - f.) Generator temperature rise in accordance with NEMA MG 1-22.40
    - g.) Voltage regulation at  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , and full load; and during transients Harmonic analysis, voltage waveform deviation, and telephone influence factor
    - h.) Generator short circuit capability
    - i.) Cooling system performance
    - j.) Torsional analysis
    - k.) Linear vibration and analysis
    - l.) Generator revolving field assembly for 2 hours at 2700 rpm (150% overspeed) and 70C, and each production unit tested at 2250 (125% overspeed) at room temperature.
- D. Factory Test
1. The generator set manufacturer shall perform production tests on the complete generator set supplied at the generator set manufacturers facility. A certified report of these tests shall be provided at the time of generator shipping from the factory. The manufacturer's test shall include but not be limited to the following:
    - a.) Operation at rated kW
    - b.) Operation at rated kVA
    - c.) Transient and steady state governing
    - d.) Transient and steady state voltage regulation
    - e.) Operation of all alarm and shutdown devices
    - f.) Single step load pickup of rated kW
    - g.) Operation at 2250 rpm (125% overspeed) at room temperature

E. Engine

1. Engine shall be a propane gas fueled, stationary, turbo charged, liquid cooled, 1800 RPM, four cycle design. Engine shall have water-cooled engine mounted radiator. Engine shall be complete and have:
  - a.) Lube oil, as required.
  - b.) Lube oil pump with replaceable full flow filters.
  - c.) Fuel transfer pump with replaceable full flow filters.
  - d.) Engine mounted vertical radiator with blower fan.
  - e.) Engine driven jacket water pump and controls, to operate when engine is running.
  - f.) Jacket water heater and thermostat.
  - g.) Ethylene glycol for engine freeze-up protection to  $-20^{\circ}\text{F}$  ambient.
  - h.) Electric starting motor and control circuit capable of three complete starting cycles without overheating
  - i.) Fuel filter
  - j.) Replaceable air filter
  - k.) Stainless steel exhaust connector
  - l.) Battery charging alternator with regulator and charge rate ammeter
  - m.) Propane gas fuel carburetor
  - n.) Critical grade silencer

F. Generator

1. The generator shall be stand-by rated to serve selected building loads and have the following features:
  - a.) Constructed to NEMA 1 and IP22 standards
  - b.) Drip proof, salient pole, revolving field.
  - c.) Standby plant control panel (unit mounted).
  - d.) Batteries and rack.
  - e.) Battery charger.
  - f.) Generator output circuit breaker
  - g.) Generator temperatures shall be limited to Class F levels ( $130^{\circ}\text{C}$  rise by resistance over  $40^{\circ}\text{C}$  ambient).
  - h.) Automatic voltage regulator to maintain generator output voltage within  $\pm 0.5\%$  for any constant load. Voltage regulator shall be totally solid state.
  - i.) Generator shall be capable of delivering rated kVA at 60 Hz and .8 pf within  $\pm 1\%$  of rate voltage.

G. Controls and Alarms

3. Engine control panel shall be mounted on the generator set and shall include:
  - a) Overspeed LED.
  - b) Overcrank LED.

- c) High coolant temperature LED.
- d) Low oil pressure LED.
- e) Low coolant level LED.
- f) Emergency stop LED.
- g) Four-position switch for automatic start, manual start, reset, or stop capability for control of engine generator.
- h) Voltage adjustment potentiometer to adjust voltage to +10 to –25% of rated voltage.
- i) Emergency stop pushbutton.
- j) Adjustable cooldown timer.
- k) AC volt meter with 3 position selector switch to read each phase.
- l) AC amp meter with 3 position selector switch to read each phase.
- m) Frequency meter.
- n) Engine RPM meter.
- o) DC voltage meter.
- p) Oil pressure meter.
- q) Coolant temperature meter.
- r) Elapsed running time meter.

It shall be acceptable to combine meters to a single digital display with selector switches.

- 4. The engine generator shall also be equipped with an alarm module meeting NFPA 110 requirements. Alarm module shall include:
  - a) Common alarm horn
  - b) Silence switch
  - c) Approach high coolant temperature LED
  - d) Approach low oil pressure LED
  - e) Low water temperature LED
  - f) Low DC volts.

5. Provide flush mounted remote annunciator to meet NFPA 110.

#### H. Vibration Isolators

- 1. Engine and generator shall be assembled to the base using pad type vibration isolators.

#### I. Battery Charger

- 1. A battery charger shall be provided to accept 120 VAC input and provide 12 volt DC output. Battery charger shall have DC ammeter and voltmeter. Provide 12 volt starting batteries, sized as recommended by the manufacturer, complete with battery cables and terminations.

#### J. Exhaust Silencer

- 1. Exhaust silencer shall be sized and supplied by the manufacturer. Exhaust silencer shall be critical grade and shall have provision for draining moisture.

K. On-Site Installation and Test

1. On-site installation shall be provided by the generator manufacturer to assemble all unconnected, loose shipped items.
2. Generator shall be tested at the site for final acceptance. Proper operation shall be demonstrated as follows:
  - a.) Cold start test to verify engine start.
  - b.) Test of jacket water heater properly functioning.
  - c.) Test of automatic transfer switch.
  - d.) Operation of generator at 100% full load. After the first ½ hour stabilization period, the following shall be recorded at 15 minute intervals:
  - e.) Voltage, amperage, frequency
  - f.) Fuel pressure, oil pressure, and water temperature
  - g.) Exhaust gas temperature at engine exhaust outlet
  - h.) Ambient temperature.

L. Manuals

1. Provide the following:
  - a.) Operating instructions
  - b.) Parts book
  - c.) Preventative maintenance instructions
  - d.) Routing test procedures
  - e.) Troubleshooting chart.

M. Engine generator shall be manufactured by Caterpillar, Kohler, or equal.

**2.27 AUTOMATIC TRANSFER SWITCHES**

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- A. The Automatic Transfer Switches shall be mechanically held and electronically operated by a single solenoid mechanism energized from the source to which the load is to be transferred. The switch shall be rated for continuous duty and be inherently double throw. The switch shall be mechanically interlocked to ensure only one (1) of two (2) possible positions - normal or emergency.
- B. Transfer switch shall be closed transition type.
- C. All main contacts shall be of silver composition. They shall be protected by arcing contacts. They shall be of the blow-on configuration and of segmented or brush construction. The operating transfer time in either direction shall not exceed one-sixth (1/6) of a second.
- D. All contacts, coils, springs, and control elements shall be conveniently removable from the front of the transfer switch without major disassembly or disconnection of power conductors.
- E. Automatic Transfer Switches utilizing components of molded case circuit breakers, contactors or parts thereof which have not been intended for continuous duty or repetitive load transfer switching are not acceptable.
- F. The Automatic Transfer Switches shall conform to the requirements of NEMA Standard ICS 2-447 and Underwriters' Laboratories, Incorporated UL-1008 and shall be UL listed as follows:

1. For use in emergency systems in accordance with Article 517 and 700 of the National Electric Code.
  2. Rated in amperes for total system transfer including control of motors, electric discharge, lamps, electric heating and tungsten-filament lamp loads are referred to in Paragraph 30.9 of UL-1008.
  3. Transfer switches rated 400 amperes and less shall be suitable for 100 percent tungsten-filament lamp load. Switches rated above 400 amperes shall be suitable for 30 percent or 400 amperes tungsten-filament lamp load, whichever is higher.
- G. The Automatic Transfer Switches shall be mounted in NEMA I non-ventilated, wall-mounted enclosures. Switches shall be rated for use with (480 volt, 3-phase, 4-wire) (208 volt, 3-phase, 4-wire), 60 Hertz system and of ratings as indicated on the contract Drawings.
- H. The Automatic Transfer Switch control panel shall utilize solid-state sensing on normal and emergency for automatic positive operation. The following shall be provided:
1. All phases of the normal voltage shall be monitored line-to-line. Close differential voltage sensing shall be provided. The pickup voltage shall be adjustable from 85 percent to 100 percent of nominal and the dropout voltage shall be adjustable from 75 percent to 98 percent of the pickup value. The transfer to emergency will be initiated upon reduction of normal source to 85 percent of nominal voltage and retransfer to normal shall occur when normal source restores to 90 percent of nominal.
  2. Independent single phase voltage and frequency sensing of the emergency source. The pickup voltage shall be adjustable from 85 percent to 100 percent of nominal. Pickup frequency shall be adjustable from 90 percent to 100 percent of nominal. Transfer to emergency upon normal source failure when emergency source voltage is 90 percent or more of nominal and frequency is 95 percent or more of nominal.
  3. A time delay to override momentary normal source outages to delay all transfer switch and engine starting signals. The time delay shall be field adjustable from 0.5 to 6 seconds and factory set at 1 second.
  4. A time delay on retransfer to normal source. The time delay shall be automatically bypassed if the emergency source fails and normal source is available. The time delay shall be field adjustable from 0 to 30 minutes and factory set at 30 minutes.
  5. An unloaded running time delay for emergency generator cool down. The time delay shall be field adjustable from 0 to 5 minutes and factory set at 5 minutes.
  6. A time delay on transfer to emergency. Initially set at zero but field adjustable up to 5 minutes for controlled timing of load transfer to emergency, where indicated.
  7. A contact that closes when normal source fails for initiating engine starting, rated 10 amperes, 32 volts DC. Contacts to be gold plated for low-voltage service.
  8. A white signal light to indicate when the Automatic Transfer Switch is connected to the normal source. A yellow signal light to indicate when the Automatic Transfer Switch is connected to the emergency source.
  9. One auxiliary contact that is closed when the Automatic Transfer Switch is connected to normal, and one auxiliary contact that is closed when the Automatic Transfer Switch is connected to emergency. Rated 10 amperes, 480 volts, 60 Hertz AC.
  10. A test switch to momentarily simulate normal source failure.

- I. The following optional accessories shall be provided:
  - 1. Provide 3-position switch “test/automatic/reset”. The reset position shall bypass the time delays and retransfer the Automatic Transfer Switch to the normal source.
  - 2. Motor Load Transfer: An in-phase monitor shall be provided. The monitor shall control transfer/retransfer operation between live sources so that closure on the alternate source will occur only when the two sources are approaching synchronism, and the two sources are within 60 electrical degrees maximum so that inrush currents do not exceed normal starting currents. The monitor shall function over a frequency difference range of up to  $\pm 2.0$  Hertz with a maximum operating transfer time of one-sixth of a second. If the voltage of the load carrying source drops below 70%, the in-phase function shall be automatically bypassed. The monitor shall not require inter wiring with the generator controls, or active control of the governor.
  - 3. Provide programmable engine exerciser to uniquely program each day of the week or blocks of days from 1 minute to 24 hours with digital readout. Provide ability to program "with or without" Load Control Switch. Provide battery back-up within control unit in order to maintain settings when normal and emergency power is lost.
- J. The control of the transfer switches shall be electrically interlocked with the emergency generator starting control panel so that after a predetermined time delay failure of the normal source at the transfer switches will start the generator.
- K. Transfer switches shall be manufactured by Kohler, Russ Electric, or Automatic Switch Company.

## **PART 3- EXECUTION**

### **3.01 SERVICE TO THE FACILITY**

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- A. Electrical power outages must be minimized so as not to interfere with the building's operation. The time and duration of any power outage must be approved by and scheduled with the building owner/authority. The Electrical Contractor shall notify the owner/authority at least ten calendar days from the date of proposed power outage in the facility.

### **3.02 DEMOLITION, RELOCATION AND REMOVAL OF EXISTING WIRING**

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- A. The Electrical Contractor shall provide all electrical demolition, relocation of circuits, and removal of existing wiring necessary for the electrical work.
- B. The Electrical Contractor shall completely remove all electrical systems within the building, unless otherwise noted on the drawings, including - but not limited to - the following:
  - 1. Remove all existing lighting fixtures, switching and time clocks, and associated branch circuits.
  - 2. Remove all existing branch circuit wiring.
  - 3. Remove all existing disconnect switches.
  - 4. Remove all existing panelboards.
  - 5. Remove all existing fire alarm devices and all existing fire alarm wiring.
  - 6. Remove all existing receptacles.
  - 7. Remove existing security system components including detectors, wiring, annunciators, and main panel.

8. Remove the existing electrical service.
- C. Outlets that are existing for use as lighting or receptacles may be used as junction boxes for the re-wiring of the building if necessary.
- D. The Contractor shall maintain, extend, and connect existing branch circuits which pass through the construction area, maintaining power to all equipment and lighting outside of the construction area.
- E. Devices removed back to the panelboard shall be marked as “spare” on the panel directory and the circuit breaker shall be switched off.

### **3.03 SPECIAL COORDINATION INSTRUCTIONS**

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- A. Coordination with work of other trades is required. The following special instructions shall also be carefully noted:
  1. Locations and mounting height of all wall outlets and lighting fixtures shall be verified with the Engineer prior to roughing-in conduits. Refer to details and wall elevations on the architectural Drawings; mounting heights indicated on these architectural Drawings and/or specific dimensional information given to this Contractor by the Engineer shall take precedence over such information indicated on the electrical Drawings.
  2. All feeder, branch circuit or auxiliary system wiring passing through pull boxes and/or being made up in panelboards shall be properly grouped, bound, and tied together in a neat and orderly manner, in keeping with the highest standards of the trade, with plastic cable ties.
  3. All duplex convenience and power receptacles shall be mounted vertically with the grounding post to the bottom as the outlet is viewed from the front.
  4. All miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws, and other such items, shall be of a galvanized or cadmium plated finish, or of other approved rust-inhibiting coatings. Care should be taken that fixtures shall not be installed on both sides of existing or new building expansion joints.
  5. The Electrical Contractor shall provide all materials, equipment, and workmanship to provide for adequate protection of all electrical equipment during the course of construction of the project.
  6. The Electrical Contractor shall furnish and install approved insulation at terminal connection points for all electrical conducting materials, such as transformer terminals, terminal studs, and at any other special locations as directed by the Engineer.
  7. Prior to installation of conduit and wire, the Electrical Contractor shall coordinate wiring requirements with actual equipment supplied.
  8. The electrical Drawings indicate wire, conduit, and overcurrent protective devices to be installed for certain HVAC units. These sizes are based on certain manufacturer's requirements. Should the General Contractor allow the Mechanical Contractor to substitute HVAC equipment different than specified, then the General Contractor shall provide the required revised electrical wiring, conduit, and overcurrent protective devices in accordance with the manufacturer's recommendations at no additional charge to the owner.

### **3.04 CUTTING, PATCHING AND DRILLING**

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- A. The General Contractor shall perform plaster cutting and channeling and drilling through structural beams necessary for the installation of electrical work. The General Contractor shall be responsible for all painting and patching which shall match existing base materials in

looks and color. The electrical contractor shall provide routine drilling through 2 x 4 and/or 2 x 6 metal frame walls and concrete floors to install wiring.

### **3.05 COOPERATION AND WORK PROGRESS**

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- A. The Electrical work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Electrical Contractor shall cooperate with the Engineer and all Contractors and equipment suppliers working on the site, coordinate the work, and proceed in a manner so as not to delay the progress of the project.
- B. The Electrical Contractor has a responsibility to coordinate the exact mounting arrangement and location of equipment indicated on the Drawings to allow for proper space requirements for equipment access, operation, and maintenance.
- C. It shall be the responsibility of the Electrical Contractor to coordinate the delivery of electrical equipment to the project prior to the time installation of equipment will be required.

### **3.06 INSTALLATION OF WIRING AND CONDUIT**

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- A. All conduits shall be installed concealed.
- B. Unless otherwise indicated, all wiring shall be 2-#12 and 1-#12 ground, 1/2"C.
- C. Conduit ends shall be cut square, threaded, and reamed to remove burrs and sharp edges. Offsets and bends for changes in elevation of exposed conduit runs shall be made at walls or beams and not in open spaces between walls or beams. Conduits shall be routed so as not to interfere with the operation or maintenance of any equipment. The entire job shall be done in a neat and workmanlike manner, as approved by the Engineer. Steel supports or racks shall be galvanized steel channel and fittings. Supports shall be manufactured by Unistrut, Kindorf, Husky Products Company, or equal.
- D. Below grade conduits entering manholes and handholes shall be sealed with approved sealant for conduit/cable entry. Conduits entering building through concrete walls shall be sealed with Link-Seal modular EPDM seal elements with Century line sleeves, typical for all conduit penetrations.
- E. Exposed conduits shall be run parallel to, or at right angles to, the walls of the building, and all bends shall be made with standard conduit ells or conduits bent to - not less than - the same radius. Horizontal runs of exposed conduits shall be close to ceiling beams, passing over water or other piping where possible and shall be supported by pipe straps or by other approved means, not more than 5' apart. Installation of exposed conduits in finished areas of the building shall be checked with the Engineers for layout before installation to conform to the pattern of the structural members, and when completed, is to present the most unobtrusive appearance possible. No exposed conduits will be permitted on walls or partitions in public areas, unless specifically noted.
- F. Conduits shall not be installed within 3" of hot water pipes, or appliances, except where crossing is unavoidable and, in that case, the conduit shall be kept at least 1" from covering or pipe crossed.
- G. Conduits shall be supported on approved type galvanized wall brackets, ceiling trapeze, strap hangers, or pipe straps, secured by means of toggle bolts on hollow masonry units or expansion bolts in concrete or brick.
- H. In general, no splices or joints will be permitted in either feeder or branches except at outlets or accessible junction boxes.
- I. All splices in wire #8 AWG and smaller shall be standard pigtail, made mechanically tight and insulated with proper thickness of insulating tape. Wire splicing nuts as manufactured by Minnesota Mining and Manufacturing Company (Scotch Lock) or Ideal wire nuts may be used, subject to the local wire inspector.

- J. Wire #6 and larger shall be connected to panels and apparatus by means of approved lugs or connectors. Connectors shall be solderless type, sufficiently large to enclose all strands of the conductor and securely fastened.
- K. Provide all required branch circuit wiring for electrical devices and lighting fixtures. Designations shown on Drawings are diagrammatic only. Circuit numbers beside receptacles and lighting fixtures convey that a complete branch circuit is required back to electrical panelboard. Switch control letters adjacent to lighting fixtures indicate branch wiring required from lighting fixture to light switch or dimmer.

### **3.07 COLOR CODING**

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- A. Provide color coding for secondary service, feeders, and branch circuits as follows:

<u>PHASE</u>	<u>COLOR</u>
120/208V, 3-phase, 4-wire, wye:	
A	Black
B	Red
C	Blue
Neutral	White
Equipment Ground	Green

- B. Make connections to terminals from left to right arranged Phase A, B, and C.
- C. Provide same color coding for switch legs as corresponding phase conductor. Provide colored plastic tape of specified color code identification for large size conductors available only in black.

### **3.08 MOTORS, CONNECTIONS AND CONTROLS**

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- A. Splices and Terminations:
  - 1. Make splices and terminations equivalent electrically and mechanically to conductor insulation.
  - 2. Make splices in branch circuit wiring with solderless, screw-on connectors Ideal, Scotchlok, T&B or equal, rated 600V, of size and type required by manufacturer's recommendation, with temperature ratings equal to those of cable insulation. Insulate splices with integral covers or with plastic, rubber, or friction tape, Permacal or equal, to maintain integrity of cable insulation.
  - 3. Make splices and terminations to conductors #8 and larger with corrosion-resistant, high conductivity, pressure indent, hex screw or bolt clamp connections, with or without tongues, designed specifically for intended service. Connectors for cables 250 MCM and larger shall have two clamping elements or compression indents. Terminals for bus connections shall have two bolt holes. Split bolt connectors, Burndy or equal, shall be acceptable for all splices of conductors #8 and larger.
  - 4. Make splices at motor junction boxes with pressure indent connectors or split-bolt connectors as specified herein.
  - 5. Provide standard bolt-on lugs with Allen cap screws to attach copper wire and cable to disconnect switches and other electrical equipment.

### **3.09 TEMPERATURE CONTROL WIRING**

---

- A. The temperature control system shall be an electric system installed by the Heating and Air-Conditioning Contractor.

- B. All electric wiring and wiring connections required for the installation of the temperature control system shall be provided by the Temperature Control Contractor.

### **3.10 SLEEVES, INSERTS AND SUPPORTS**

---

- A. Furnish and install all inserts, conduit hangers, anchors and steel supports necessary for the support and installation of all electrical equipment.
- B. Where openings are required in walls and floors for the passing of raceways, the Electrical Contractor shall furnish the General Contractor with the necessary information regarding dimensions and locations so that he may install suitable concrete stops to provide these openings. Such openings shall be by the General Contractor in such a manner so as not to interfere with the fireproof integrity of the building.
- C. The Electrical Contractor is responsible for the location of - and maintaining the proper position of sleeves - inserts and anchor bolts supplied and/or set in place. In the event that failure to do so requires cutting and patching of finished work, such work shall be done by the General Contractor at the Electrical Contractor's expense.

### **3.11 SALVAGE**

---

- A. The Electrical Contractor shall remove all electrical equipment not to be used.
- B. All electrical equipment removed and deemed salvageable by the Owner shall be stored in an area designated by the Owner.
- C. Any electrical equipment removed that is not desired by the Owner shall be disposed of at the expense of the Electrical Contractor.

### **3.12 SUPPORTS AND ATTACHMENTS**

---

- A. Boxes and pendants for surface-mounted fixtures shall be supported in an approved manner. Boxes and supports shall be fastened with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, with machine screws on steel work with locknuts. Threaded studs shall be provided with lock-washers and nuts.

### **3.13 QUIET OPERATION**

---

- A. All equipment and material furnished by the Electrical Contractor shall operate under all conditions of load without objectionable noises or vibrations, which, in the opinion of the Engineer, is objectionable. Where sound or vibration conditions arise which is considered objectionable by the Engineer, the Electrical Contractor shall eliminate same in a manner approved by the Engineer.

### **3.14 TESTS**

---

- A. Furnish all labor, material, instruments, supplies, and services and bear all costs for the accomplishment of tests herein specified. Correct all defects appearing under test. Repeat the tests until no defects are disclosed. Leave the equipment clean and ready for use.
- B. The Electrical Contractor shall perform any test other than herein specified which may be specified by legal authorities or by agencies to whose requirements this work is to conform.

### **3.15 DIG SAFE**

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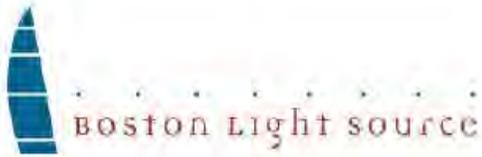
- A. Prior to excavation, the GC shall pre-mark proposed locations of new below grade electrical ductbanks. The GC shall contact and meet with dig safe utility operators to explain proposed routing and determine location of all existing below grade utilities.

### **3.16 FINAL INSPECTION AND TEST**

---

- A. Prior to test, feeders and branches shall be continuous from service contact point to each outlet; all panels, feeders, and devices connected and fuses in place. Test system free from short circuits and grounds with insulation resistances not less than outlines in the National Electrical Code. Provide testing equipment necessary and conduct test in presence of the Owner's authorized representative.
- B. The final inspection and test shall include the following:
  - 1. Testing of the emergency lighting system.
  - 2. Testing of the impedance of the grounding system.
  - 3. Testing of each outlet.
  - 4. Testing of the fire alarm system.
  - 5. Testing of branch and feeder conductors for continuity.
  - 6. Testing of panelboards to verify proper current balance and voltage.
  - 7. Testing of motors, verifying proper current balance and voltage.
  - 8. Testing, targeting, and focusing of all adjustable lighting fixtures.
  - 9. Testing of all ground fault protective devices in accordance with the National Electrical Code, Section 230-95.

**END OF SECTION**



BOSTON LIGHT SOURCE  
64 COMMERCIAL WHARF  
BOSTON, MA 02110  
Phone: 617-788-2400  
Fax: 617-367-0925  
Contact: Michael Chabot

## Westford Roudenbush

15-27581  
9/3/2015

### Submission Type

Prior Approval

Resubmittal for Approval

Approval

Corrections

Your Use

Other



Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Type	Manufacturer	Catalog Number
G1	ABL-CONSUMER PRODUCTS	DSXW1LED 20C 700 30K T4M 120 BBW PE DMG X X FINISH
G2	ABL-CONSUMER PRODUCTS	DSXW2 LED 30C 1000 30K TFTM MVOLT PE DM XX FINISH
P1	Litecontrol	PID L65 LENGTH PER PLANS SGL LPA 35K ID 1000 CWM D10 1CWQ 120V LK
P2ALT2	Visa Lighting	CP5387 LNW DIM FINISH STAR
P3	Spectrum	SS12LEDGV 26W 35K DO101 CM FINISH
R1	ConTech	RA2LRM235KMVD2F CST2322 CLR
R3	Litecontrol	GD LHEL 2 4 35K 3000 HE CWM D10 X 120
S1	ABL-CONSUMER PRODUCTS	STL4 30L EZ1 LP835 X X
S2	Digital Lumens	DLE 12 ST W 840 DHHRM
W1	Visa Lighting	CV1804 LWW2700 FINISH DIM XPS

	Project 15-27581 Westford Roudenbushr Submitted By <b>BOSTON LIGHT SOURCE</b>	Catalog Number <b>DSXW1LED 20C 700 30K T4M 120 BBW PE DMG X X          FINISH</b> Notes:	Type <h1 style="text-align: center;">G1</h1>



## D-Series Size 2 LED Wall Luminaire



Catalog Number
Access
Type

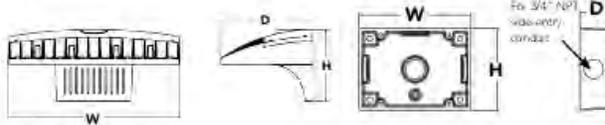
d<sup>series</sup>

### Specifications Luminaire

**Width:** 18-1/2" (47.0 cm)  
**Weight:** 21 lbs (9.5 kg)  
**Depth:** 10" (25.4 cm)  
**Height:** 7-5/8" (19.4 cm)

### Back Box (BBW)

**Width:** 5-1/2" (14.0 cm)  
**Depth:** 1-1/2" (3.8 cm)  
**Height:** 4" (10.2 cm)  
**BBW Weight:** 1 lbs (0.5 kg)



### Introduction

The D-Series Wall luminaire is a stylish, fully integrated LED solution for building-mount applications. It features a sleek, modern design and is carefully engineered to provide long-lasting, energy-efficient lighting with a variety of optical and control options for customized performance.

With an expected service life of over 20 years of nighttime use and up to 76% in energy savings over comparable 400W metal halide luminaires, the D-Series Wall is a reliable, low-maintenance lighting solution that produces sites that are exceptionally illuminated.

### Ordering Information

**EXAMPLE: DSXW2 LED 30C 700 40K T3M MVOLT DDBTDX**

#### DSXW2 LED

Series	LEDs	Drive Current	Color Temperature	Discharge Temp	Voltage	Mounting	Control Options	Other Options	Finish (optional)	
DSXW2 LED	20C 20 LEDs (two engines)	350 350mA	30K 1000K	T2S Type II Short	MVOLT 120 <sup>1</sup>	Shipped included (blank) Surface mounting bracket	PE Photoelectric cell, button type <sup>4</sup>	SF Single fuse (120, 277, 347V)	DBKD Dark bronze	
		530 530mA	40K 4000K	T2M Type II Medium	208 <sup>1</sup>					DF Double fuse (208, 240, 480V) <sup>7</sup>
	30C 30 LEDs (three engines)	700 700mA	30K 5000K	T3S Type III Short	240 <sup>1</sup>	Shipped separately <sup>8</sup> BBW Surface mounted back box (for conduit only)	PER High-precision lock (resets only for controls)	HF Hood-style shield <sup>1</sup>	DWHXD White	
		1000 1000mA (1 A)	40K 5000K	T3M Type III Medium	277 <sup>1</sup>					SPO Separate surge protection <sup>1</sup>
					T4M Type IV Medium	347 <sup>1</sup>	DMG 15-10W dimming driver (for controls)	DGR Dimmable and compatible with DALI <sup>9</sup> (for controls)	SWS Bidirectional spikes <sup>1</sup>	DBBXD Bronze/black
					TFTM Forward Throw Medium	480 <sup>1</sup>				
									WG Wind guard <sup>1</sup>	DBALD Brushed aluminum
									VG Wind guard <sup>1</sup>	DWHGD Bronze/white
										DSSDQ Bronze/sandstone

#### NOTES

- MVOLT drive operates on any line voltage from 120-277V (50/60Hz). Specify 120, 208, 240 or 277 options only when ordering with fusing (SF, DF option), or photocell (PE option).
- Available with 30 LED/100mA options only (DSXW2 LED 30C 700).
- Also available as a separate accessory, see Accessories information.
- Photocell (PE) requires 120, 208, 240 or 277 voltage option. Not available with incandescent/ambient light sensors (PER or PRBL).
- Specifies a RQAMW enabled luminaire with 0-10V dimming capability. PER option required. Not available with 347 or 480V. Additional hardware and services required for RQAMW deployment, must be purchased separately. Call 1-800-442-6143 or email sales@lithonia.com.
- Specifies the Switch-Select (SS) or DALI control, see Master Series Guide for details. Ind. disambig. light sensor. Not available with "PE" option (button type photocell). Dimming driver standard.
- Single fuse (SF) requires 120, 277 or 347 voltage option. Double fuse (DF) requires 208, 240 or 480 voltage option.
- Requires luminaire to be up-graded with PER option. Ordered and shipped as a separate line item.
- See the electrical section on page 2 for more details.

#### Accessories

(Ordered and shipped separately)

DL177 15-01	PhotoCell - SS, metal (120-277V)
DL147 15-01-30	PhotoCell - SS, metal (347V)
DL180F 15-01-30	PhotoCell - SS, metal (347V)
SOI	Shoring cup
DSXW60	House-side shield (one per light engine)
DSXW50	Bidirectional spikes
DSXW260	Wind guard accessory
DSXW260	Wind guard accessory
DSXW300	Back box accessory (specify finish)





**Project 15-27581**  
**Westford Roudenbush**  
 Submitted By  
**BOSTON LIGHT SOURCE**

Catalog Number  
**DSXW1LED 20C 700 30K T4M 120 BBW PE DMG X X FINISH**  
 Notes

Type  
**G1**

### Performance Data

#### Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-10. Data is considered to be representative of the configurations shown, within the tolerance allowed by Lighting Facts. Actual performance may differ as a result of end-user environment and application. Actual wattage may differ by +/- 8% when operating between 120-480V +/- 10%. Contact factory for performance data on any configurations not shown here.

LEDs	Drive Current (mA)	Performance Package	System Watts	DLC Type	30K (4000K, 3000K)					50K (5000K, 6500K)							
					L80					L90							
					Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
20C (30 LEDs)	530	20C 530-K	36W	T2S	3.533	1.0	1.98	3.860	1.0	1.107	T2S	3.533	1.0	1.98	3.860	1.0	1.107
				T2M	3.407	1.0	1.95	3.725	1.0	1.104	T2M	3.407	1.0	1.95	3.725	1.0	1.104
				T3S	3.409	1.0	1.97	3.811	1.0	1.106	T3S	3.409	1.0	1.97	3.811	1.0	1.106
				T3M	3.545	1.0	2.98	3.873	1.0	2.108	T3M	3.545	1.0	2.98	3.873	1.0	2.108
				T4M	3.498	1.0	1.97	3.822	1.0	1.105	T4M	3.498	1.0	1.97	3.822	1.0	1.105
				TF7M	3.495	1.0	1.97	3.819	1.0	1.106	TF7M	3.495	1.0	1.97	3.819	1.0	1.106
	700	20C 700-K	47W	T2S	4.371	1.0	1.93	4.736	1.0	1.102	T2S	4.371	1.0	1.93	4.736	1.0	1.102
				T2M	4.252	1.0	1.90	4.647	1.0	2.99	T2M	4.252	1.0	1.90	4.647	1.0	2.99
				T3S	4.376	1.0	1.92	4.716	1.0	1.100	T3S	4.376	1.0	1.92	4.716	1.0	1.100
				T3M	4.386	1.0	2.93	4.793	1.0	2.102	T3M	4.386	1.0	2.93	4.793	1.0	2.102
				T4M	4.328	1.0	1.92	4.729	1.0	2.101	T4M	4.328	1.0	1.92	4.729	1.0	2.101
				TF7M	4.324	1.0	1.92	4.725	1.0	2.101	TF7M	4.324	1.0	1.92	4.725	1.0	2.101
1000	20C 1000-K	73W	T2S	5.914	1.0	1.81	6.462	1.0	1.89	T2S	5.914	1.0	1.81	6.462	1.0	1.89	
			T2M	5.754	1.0	2.79	6.287	2.0	2.86	T2M	5.754	1.0	2.79	6.287	2.0	2.86	
			T3S	5.839	1.0	1.80	6.380	1.0	2.87	T3S	5.839	1.0	1.80	6.380	1.0	2.87	
			T3M	5.935	1.0	2.81	6.484	1.0	2.89	T3M	5.935	1.0	2.81	6.484	1.0	2.89	
			T4M	5.855	1.0	2.80	6.398	1.0	2.88	T4M	5.855	1.0	2.80	6.398	1.0	2.88	
			TF7M	5.851	1.0	2.80	6.393	1.0	2.88	TF7M	5.851	1.0	2.80	6.393	1.0	2.88	
30C (30 LEDs)	530	30C 530-K	54W	T2S	5.280	1.0	1.98	5.769	1.0	1.107	T2S	5.280	1.0	1.98	5.769	1.0	1.107
				T2M	5.137	1.0	2.95	5.613	1.0	2.104	T2M	5.137	1.0	2.95	5.613	1.0	2.104
				T3S	5.214	1.0	1.97	5.696	1.0	1.105	T3S	5.214	1.0	1.97	5.696	1.0	1.105
				T3M	5.298	1.0	2.98	5.789	1.0	2.107	T3M	5.298	1.0	2.98	5.789	1.0	2.107
				T4M	5.228	1.0	2.97	5.732	1.0	2.106	T4M	5.228	1.0	2.97	5.732	1.0	2.106
				TF7M	5.223	1.0	2.97	5.707	1.0	2.106	TF7M	5.223	1.0	2.97	5.707	1.0	2.106
	700	30C 700-K	71W	T2S	6.513	1.0	1.92	7.118	2.0	2.100	T2S	6.513	1.0	1.92	7.118	2.0	2.100
				T2M	6.337	2.0	2.89	6.925	2.0	2.98	T2M	6.337	2.0	2.89	6.925	2.0	2.98
				T3S	6.431	1.0	2.91	7.028	1.0	2.99	T3S	6.431	1.0	2.91	7.028	1.0	2.99
				T3M	6.536	1.0	2.92	7.143	2.0	3.101	T3M	6.536	1.0	2.92	7.143	2.0	3.101
				T4M	6.449	1.0	2.91	7.047	1.0	2.99	T4M	6.449	1.0	2.91	7.047	1.0	2.99
				TF7M	6.444	1.0	2.91	7.042	1.0	2.99	TF7M	6.444	1.0	2.91	7.042	1.0	2.99
1000	30C 1000-K	109W	T2S	8.697	2.0	2.80	9.501	2.0	2.87	T2S	8.697	2.0	2.80	9.501	2.0	2.87	
			T2M	8.462	2.0	2.78	9.244	2.0	2.85	T2M	8.462	2.0	2.78	9.244	2.0	2.85	
			T3S	8.388	1.0	2.79	9.381	2.0	2.86	T3S	8.388	1.0	2.79	9.381	2.0	2.86	
			T3M	8.728	2.0	3.80	9.534	2.0	3.87	T3M	8.728	2.0	3.80	9.534	2.0	3.87	
			T4M	8.611	1.0	2.79	9.402	2.0	2.86	T4M	8.611	1.0	2.79	9.402	2.0	2.86	
			TF7M	8.604	2.0	2.79	9.399	2.0	2.86	TF7M	8.604	2.0	2.79	9.399	2.0	2.86	

#### Lumen Ambient Temperature (LAT) Multipliers

Use these factors to determine relative lumen output for average ambient temperatures from 0-40°C (32-104°F)

Ambient	Lumen Multiplier
0°C	1.02
10°C	1.01
20°C	1.00
<b>25°C</b>	<b>1.00</b>
30°C	1.00
40°C	0.98

#### Projected LED Lumen Maintenance

Data references the extrapolated performance projections for the DSXW2 LED 30C 1000 platform in a 25°C ambient, based on 10,000 hours of LED testing (based per IESNA LM-80-08 and projected per IESNA TM-21-11)

To calculate LM, use the lumen maintenance factor that corresponds to the desired number of operating hours, below. For other lumen maintenance values, contact factory.

Operating Hours	0	15,000	30,000	100,000
Lumen Maintenance Factor	1.0	0.95	0.90	0.87

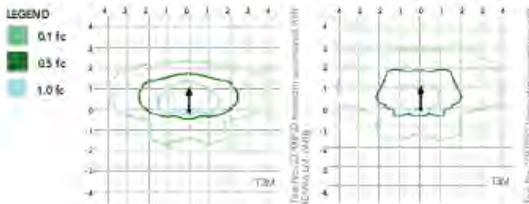
#### Electrical Load

LEDs	Drive Current (mA)	System Watts	Current (A)					
			120	208	240	277	347	480
20C	330	25 W	0.23	0.13	0.12	0.30	-	-
	530	36 W	0.33	0.19	0.17	0.14	-	-
	700	47 W	0.44	0.25	0.22	0.19	-	-
	1000	73 W	0.68	0.39	0.34	0.29	-	-
30C	330	36 W	0.33	0.19	0.17	0.14	-	-
	530	54 W	0.50	0.29	0.25	0.22	-	-
	700	71 W	0.66	0.38	0.33	0.28	0.23	0.16
	1000	109 W	1.01	0.58	0.50	0.44	-	-

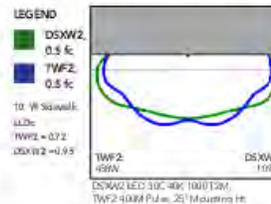
### Photometric Diagrams

To see complete photometric reports or download .ies files for this product, visit Lithonia Lighting's D Series Web Site 2/menue

Isocandela diagrams for the DSXW2 LED 30C 1000 40K. Distances are in units of mounting height (25')



Distribution overlay comparison at 40W (max) beam diameter



### FEATURES & SPECIFICATIONS

#### INTENDED USE

The energy saving, long life and easy-to-install design of the D Series Web Site 2 make it the smart choice for building-mounted, downway and pathway illumination for nearly any facility.

#### CONSTRUCTION

Two-piece die-cast aluminum housing fits integral heat sink to optimize thermal management through conductive and convective cooling. Modular design allows for ease of maintenance. The LED driver is mounted to the door to thermally isolate it from the light engines for low operating temperature and long life. Housing is completely sealed against moisture and environmental contaminants (NEMA).

#### FINISH

Exterior parts are protected by a non-vented Super Durable TBC thermoseal powder coat finish that provides exceptional resistance to corrosion and weathering. A highly controlled multi-stage process ensures a minimum 3-mil thickness for a finish that can withstand extreme climate change without chipping or peeling. Available in textured and non-textured finishes.

#### OPTICS

Precision-molded proprietary acrylic lenses provide multiple photometric distribution patterns specifically to building-mounted applications. Light engines are available in 3000K (80-min. CRI), 4000K (70-min. CRI) or 5000K (65-min. CRI) configurations.

#### ELECTRICAL

Light engines consist of 10 high-efficiency LEDs mounted to a metal-core circuit board to maximize heat dissipation and promote long life (L80/100,000 hrs at 25°C). Class 1 electronic drivers have a power factor >90%, THD <20%, and a minimum 2.5kV surge rating. When ordering the SPD option, a separate surge protection device is installed within the luminaire, which meets a minimum Category C Low (per ANSI/IEEE C62.41.2).

#### INSTALLATION

Included universal mounting bracket attaches securely to any 4" round or square exterior box for quick and easy installation. Luminaire has isolated gasket wireway and attaches to the mounting bracket via corrosion-resistant screws.

#### LISTINGS

CSA certified to U.S. and Canadian standards. Rated for -40°C minimum ambient.

Designlight Consortium (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products List at [www.designlight.org](http://www.designlight.org) to confirm which versions are qualified.

#### WARRANTY

Five-year limited warranty. Full warranty terms located at [www.lithonia.com/warranty](http://www.lithonia.com/warranty). Customer Resources Terms, which apply to this web page.

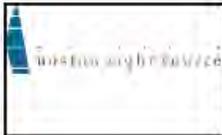
Note: Specifications subject to change without notice.



One Lithonia Way • Conyers, Georgia 30012 • Phone: 800.279.8041 • Fax: 770.918.1209 • [www.lithonia.com](http://www.lithonia.com)  
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DSXW2-LED  
 Rev. 12/04/13





Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Catalog Number:  
DSXW2 LED 30C 1000 30K TFTM MVOLT PE DM XX  
FINISH  
Notes:

Type  
**G2**

## Performance Data

### Lumen Output

Lumen values are from photometric tests performed in accordance with IESNA LM-79-08. Data is considered to be representative of the configurations shown, within the tolerances allowed by Lighting Facts. Contact factory for performance data on any configurations not shown here.

LED	Days Cycles (DC)	System Watts	RFR Type	30C (3000 K, 70 CRI)				40C (4000 K, 70 CRI)				50C (5000 K, 70 CRI)						
				Lumens	U	C	UFW	Lumens	U	C	UFW	Lumens	U	C	UFW			
20C (20 LEDs)	530	36 W	T2S	3,649	1	0	1	101	3,876	1	0	1	108	3,429	1	0	1	95
			T2M	3,478	1	0	1	97	3,694	1	0	1	103	3,267	1	0	1	91
			T3S	3,609	1	0	1	100	3,833	1	0	1	106	3,390	1	0	1	94
			T3M	3,572	1	0	1	99	3,794	1	0	1	105	3,356	1	0	1	93
			T4M	3,500	1	0	2	97	3,717	1	0	2	103	3,288	1	0	1	91
			TFTM	3,638	1	0	1	101	3,864	1	0	1	107	3,418	1	0	1	95
	ASVDF	3,252	1	0	2	90	3,454	1	0	2	96	3,056	1	0	2	85		
	700	47 W	T2S	4,502	1	0	1	96	4,776	1	0	1	102	4,794	1	0	1	102
			T2M	4,290	1	0	1	91	4,552	1	0	1	97	4,569	1	0	1	97
			T3S	4,452	1	0	1	95	4,723	1	0	2	100	4,741	1	0	2	101
			T3M	4,407	1	0	2	94	4,675	1	0	2	99	4,693	1	0	2	100
			T4M	4,318	1	0	2	92	4,581	1	0	2	97	4,598	1	0	2	98
			TFTM	4,468	1	0	2	95	4,761	1	0	2	101	4,779	1	0	2	102
	ASVDF	4,012	1	0	2	85	4,257	1	0	2	91	4,273	1	0	2	91		
	1000	74 W	T2S	5,963	2	0	2	81	6,327	1	0	1	84	6,351	1	0	1	85
T2M			5,683	2	0	2	77	6,029	1	0	2	80	6,052	1	0	2	81	
T3S			5,896	1	0	2	80	6,256	1	0	2	83	6,280	1	0	2	84	
T3M			5,857	2	0	3	79	6,199	1	0	2	83	6,216	1	0	2	83	
T4M			5,719	1	0	2	77	6,067	1	0	2	81	6,090	1	0	2	81	
TFTM			5,944	1	0	2	80	6,307	1	0	2	84	6,330	1	0	2	84	
ASVDF	5,314	1	0	2	72	5,638	2	0	2	75	5,660	2	0	2	75			
30C (30 LEDs)	530	54 W	T2S	4,333	1	0	1	80	5,280	1	0	1	94	5,769	1	0	1	107
			T2M	4,216	1	0	1	78	5,137	1	0	2	95	5,613	1	0	2	104
			T3S	4,279	1	0	1	79	5,214	1	0	1	97	5,696	1	0	1	105
			T3M	4,349	1	0	2	81	5,281	1	0	2	98	5,789	1	0	2	107
			T4M	4,291	1	0	1	79	5,228	1	0	2	97	5,772	1	0	2	106
			TFTM	4,267	1	0	1	78	5,223	1	0	2	97	5,707	1	0	2	106
	700	71 W	T2S	5,346	1	0	1	75	6,513	1	0	1	92	7,118	2	0	2	100
			T2M	5,201	1	0	2	73	6,337	2	0	2	89	6,925	2	0	2	98
			T3S	5,279	1	0	1	74	6,451	1	0	2	91	7,028	1	0	2	99
			T3M	5,365	1	0	2	76	6,536	1	0	2	92	7,143	2	0	3	101
			T4M	5,293	1	0	2	75	6,448	1	0	2	91	7,047	1	0	2	98
			TFTM	5,389	1	0	2	74	6,444	1	0	2	91	7,042	1	0	2	98
	1000	109 W	T2S	7,137	2	0	2	65	8,697	2	0	2	80	9,991	2	0	2	87
			T2M	6,944	2	0	2	64	8,462	2	0	2	78	9,244	2	0	2	85
			T3S	7,047	1	0	2	65	8,581	1	0	2	79	9,381	2	0	2	86
T3M			7,162	2	0	3	66	8,728	2	0	3	80	9,514	2	0	3	87	
T4M			7,066	1	0	2	65	8,611	1	0	2	79	9,407	2	0	2	86	
TFTM			7,060	1	0	2	65	8,604	2	0	2	79	9,399	2	0	2	86	

**Note:**  
Available with phosphor-coated amber LEDs (nominal class AA-BPC). These LEDs produce light with 97+R, 1,550 mV.  
Output can be calculated by applying a 0.7 factor to 4000K lumen values and photometric flux.





Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Catalog Number  
DSXW2 LED 30C 1000 30K TFTM MVOLT PE DM XX  
FINISH  
Notes

Type  
**G2**

## Performance Data

### Lumen Ambient Temperature (LAT) Multipliers

Use these factors to determine relative lumen output for average ambient temperatures from 0-40°C (32-104°F).

Ambient	Lumen Multiplier	
0°C	32°F	1.02
10°C	50°F	1.01
20°C	68°F	1.00
<b>25°C</b>	<b>77°F</b>	<b>1.00</b>
30°C	86°F	1.00
40°C	104°F	0.98

### Electrical Load

LED	Driver Current (mA)	System Watts	Current (A)				
			120V	208V	240V	277V	480V
30C	350	25 W	0.23	0.11	0.12	0.10	-
	530	36 W	0.33	0.19	0.17	0.14	-
	700	47 W	0.44	0.25	0.22	0.19	-
	1000	73 W	0.68	0.39	0.34	0.29	-
30C	350	36 W	0.33	0.19	0.17	0.14	-
	530	54 W	0.50	0.29	0.25	0.22	-
	700	71 W	0.66	0.38	0.33	0.28	0.23
	1000	109 W	1.01	0.58	0.50	0.44	-

### Projected LED Lumen Maintenance

Data references the extrapolated performance projections for the DSXW2 LED 30C 1000 platform in a 25°C ambient, based on 10,000 hours of LED testing (tested per IESNA LM-80-08 and projected per IESNA TM-21-11).

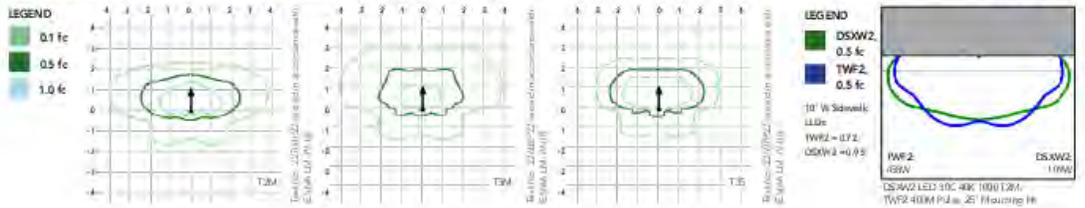
To calculate LMF, use the lumen maintenance factor that corresponds to the desired number of operating hours below. For other lumen maintenance values, contact factory.

Operating Hours	0	25,000	50,000	75,000
Lumen Maintenance Factor	1.0	0.95	0.92	0.87

## Photometric Diagrams

To see complete photometric reports or download .ies files for this product, visit [LithoniaLighting.com](http://LithoniaLighting.com) or visit [LithoniaLighting.com](http://LithoniaLighting.com) website.

Isolux/candle plots for the DSXW2 LED 30C 1000 40K. Distances are in units of mounting height (25').



## FEATURES & SPECIFICATIONS

### INTENDED USE

The energy savings, long life and easy-to-install design of the D-Series Wall Spa 2 make it the smart choice for building-mounted doorway and gateway illumination for nearly any facility.

### CONSTRUCTION

Two-piece die-cast aluminum housing has integral heat sink/fin to optimize thermal management through conductive and convective cooling. Modular design allows for ease of maintenance. The LED driver is mounted to the door to thermally isolate it from the light engines for low operating temperature and long life. Housing is completely gasketed against moisture and environmental contaminants (IP65).

### FINISH

Exterior parts are protected by a zinc-rich Super-Durable TQC thermoplastic powder coat finish that provides superior resistance to corrosion and weathering. A tightly controlled multi-stage process assures a minimum 3 mil thickness for a finish that can withstand extreme climate changes without cracking or peeling. Available in textured and non-textured finishes.

### OPTICS

Precision-molded proprietary acrylic lenses provide multiple photometric distributions tailored specifically to building-mounted applications. Light engines are available in 3000 K (80 nm CRI), 4000 K (70 nm CRI) or 5000 K (90 CRI) configurations.

### ELECTRICAL

Light engines consist of 10 high-efficiency LEDs mounted to a metal-core crash board to minimize heat dissipation and promote long life (LSI/TLM LEDs at 22°C). Class 1 electronic driver has a power factor >90%, THD <20%, and a minimum 2.5KV surge rating. When ordering the SPD option, a separate surge protection device is installed within the luminaire which meets a minimum Category C Low P for ANSI/IEEE C62.41.2.

### INSTALLATION

Included universal mounting bracket attaches securely to any 4" round or square duct/batten for quick and easy installation. Luminaire has a flanged gasket weepway and attaches to the mounting bracket via corrosion-resistant screws.

### LISTINGS

CSA certified to U.S. and Canadian standards. Rated for -40°C minimum ambient. Designlights Consortium® (DLC) qualified product. Not all versions of this product may be DLC qualified. Please check the DLC Qualified Products list at [www.designlights.org](http://www.designlights.org) to confirm which versions are qualified.

### WARRANTY

Five year limited warranty. Full warranty terms located at [www.lithonia.com](http://www.lithonia.com) Customer Resource Terms and Conditions page.

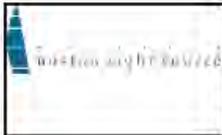
**Note:** Actual performance may differ as a result of end-use environment and application. All values are design of typical glass, measured under laboratory conditions at 25°C. Specifications subject to change without notice.



One Lithonia Way • Conyers, Georgia 30012 • Phone: 800.279.8041 • Fax: 770.918.1209 • [www.lithonia.com](http://www.lithonia.com)  
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DSXW2-LED  
Rev. 03/15





Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

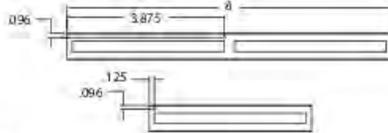
Catalog Number:  
PID L65 LENGTH PER PLANS SGL LPA 35K ID 1000 CWM  
D10 1CWQ 120V LK  
Notes:

Type  
**P1**

# LITECONTROL

## Additional Details

**Control Integration:** Controls are integral to fixture.



### Control Options:

**Daylight Harvesting:** Available. Part# CS/DLH. Wattstopper FD-301.

**Row Joining:** Integral end headers with captive nuts and 1/4-20 machine screws (provided) are accessible without removal of any components.

**End Caps:** Rat style. 14 gauge steel. Attach with same method as row joining.

### Ceiling Canopy

**Non-feed:** 2" diameter  
**Feed:** 5" diameter

**Feed Cord:** White 5-wire.

**Cable Feeds:** Fixtures must be suspended at each row joint. Yoke-style cable mounting.

Cables are 3/64" diameter. 3 lengths available:  
**51" (FA51):** Standard

**87" (FA87):** Available (consult factory)

**219" (FA219):** Available (consult factory)

**Emergency Battery (Integral):** Available. Bodine BSL310LP

**Emergency Battery (Inverter):** Compatible. Provided by others.

**Fixture Weight:** 2.5 lbs per foot

**Ratings:** CSA listed for damp locations

## Output/Wattage Charts

Nomenclature	P-ID-L65		W-ID-L65	
	Lumens/ft	W/ft	Lumens/ft	W/ft
ID055	550	4.5	590	4.7
ID060	600	5.0	600	5.0
ID065	650	5.3	650	5.5
ID070	700	5.8	700	6.0
ID075	750	6.2	750	6.4
ID080	800	6.7	800	7.0
ID085	850	7.0	850	7.5
ID090	900	7.4	900	8.0
ID095	950	7.8	950	8.5
ID100	1000	8.4	1000	8.8
ID105	1050	9.0		
ID110	1100*	9.3		
ID115	1150	9.8		
ID120	1200	10.3		
ID125	1250	10.8		
ID130	1300	11.3		

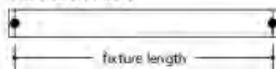
\*Cut off for LEC/LHI Options

## Planning for Installation

### Suspension Mounting Locations

Mounting points are exactly 36", 48", 72" & 96" (3', 4', 6', 8' fixture length respectively).

### Individual Fixture



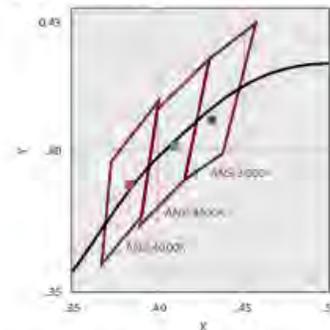
## Technology Details

**CRI:** 80 minimum

CCT	CR1	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15
30K	83	81	90	95	81	81	86	84	82	75	80	88	83	98	75	
35K	83	81	89	93	82	81	85	86	81	78	82	89	83	82	88	75
40K	83	82	90	95	81	81	85	87	86	75	79	89	88	84	97	76

**Color Variation:** 2 step MacAdam ellipse, both within fixture & fixture-to-fixture.

### Color Temperature:



### Rated Life (LED Board):

Tested in accordance to LM79-2008

**L70:** 287,000 (per TM-21 extrapolated curve)

**L70:** >61,000 (per TM-21/LM80 6x's limitation)

**L90:** 74,000 (per TM-21 extrapolated curve)

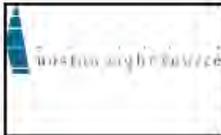
**Rated Life (Driver):** Standard = 100,000 hours

Lutron = 50,000 hours

**Field Accessibility:** LED boards and drivers can be accessed and removed while fixture is installed. If necessary, LED boards can be replaced either individually or as part of light module. See warranty details at [www.litecontrol.com](http://www.litecontrol.com).

**Warranty:** 5 years. Lutron driver: 3 years. See [www.litecontrol.com](http://www.litecontrol.com) for details...

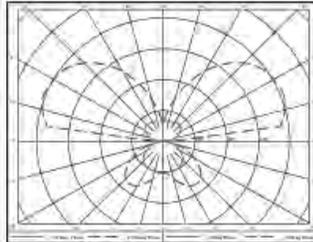


	<b>Project 15-27581</b> <b>Westford Roudenbush</b> Submitted By <b>BOSTON LIGHT SOURCE</b>	<b>Catalog Number:</b> <b>PID L65 LENGTH PER PLANS SGL LPA 35K ID 1000 CWM</b> <b>D10 1CWQ 120V LK</b> Notes:	<b>Type</b> <h1 style="text-align: center;">P1</h1>
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# LITECONTROL

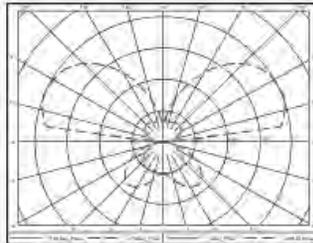
## Photometry

**Fixture:** P-ID-L65-04-SGL-LPA-30K-ID090  
**CCT:** 3000K  
**Output:** ID090  
**Nominal Lumens:** 900 lumens/ft  
**Efficacy:** 118.7 lm/W  
**Test Report:** P-ID-L65-04-SGL-LPA-30K-ID090.IES



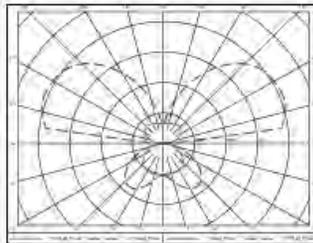
Zonal Lumens		
Zone	Lumens	Lamp %
0-40	374.0	10.1%
0-60	765.8	20.7%
0-90	1026.9	27.8%
90-180	2672.2	72.2%
0-180	3699.1	100%

**Fixture:** P-ID-L65-04-SGL-LPA-35K-ID055  
**CCT:** 3500K  
**Output:** ID055  
**Nominal Lumens:** 550 lumens/ft  
**Efficacy:** 122.9 lm/W  
**Test Report:** P-ID-L65-04-Sgl-LPA-35K-ID055.IES

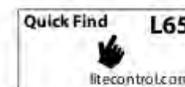


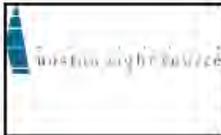
Zonal Lumens		
Zone	Lumens	Lamp %
0-40	235.2	10.2%
0-60	482.0	21.0%
0-90	650.1	28.3%
90-180	1646.7	71.7%
0-180	2296.8	100%

**Fixture:** P-ID-L65-04-SGL-LPA-35K-ID090  
**CCT:** 3500K  
**Output:** ID090  
**Nominal Lumens:** 900 lumens/ft  
**Efficacy:** 121.9 lm/W  
**Test Report:** P-ID-L65-04-SGL-LPA-35K-ID090.IES



Zonal Lumens		
Zone	Lumens	Lamp %
0-40	385.5	10.1%
0-60	789.0	20.7%
0-90	1060.0	27.9%
90-180	2744.4	72.1%
0-180	3804.4	100%

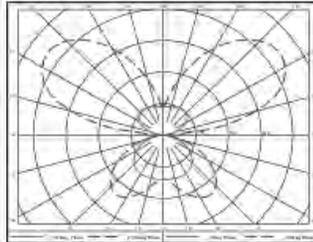


	<b>Project 15-27581</b> <b>Westford Roudenbush</b> Submitted By <b>BOSTON LIGHT SOURCE</b>	<b>Catalog Number:</b> <b>PID L65 LENGTH PER PLANS SGL LPA 35K ID 1000 CWM</b> <b>D10 1CWQ 120V LK</b> Notes:	Type <h1 style="text-align: center;">P1</h1>
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# LITECONTROL

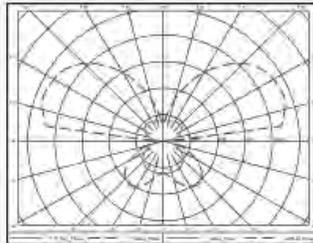
## Photometry

**Fixture:** P-ID-L65-04-SGL-LPA-35K-ID090-LK  
**CCT:** 3500K  
**Output:** ID090  
**Nominal Lumens:** 900 lumens/ft  
**Efficacy:** 113.9 lm/W  
**Test Report:** P-ID-L65-04-SGL-LPA-35K-ID090-LK-IES



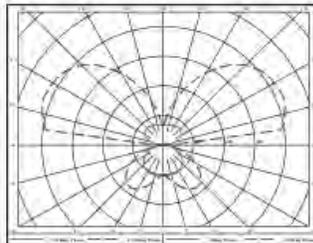
Zonal Lumens		
Zone	Lumens	Lamp %
0-40	452.7	12.7%
0-60	928.9	26.1%
0-90	1248.9	35.1%
90-180	2308.2	64.9%
0-180	3557.1	100%

**Fixture:** P-ID-L65-04-SGL-LPA-35K-ID130  
**CCT:** 3500K  
**Output:** ID130  
**Nominal Lumens:** 1300 lumens/ft  
**Efficacy:** 115.3 lm/W  
**Test Report:** P-ID-L65-04-SGL-LPA-35K-ID130-IES



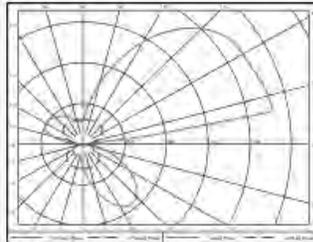
Zonal Lumens		
Zone	Lumens	Lamp %
0-40	557.6	10.3%
0-60	1141.5	21.2%
0-90	1534.2	28.5%
90-180	3854.0	71.5%
0-180	5388.2	100%

**Fixture:** P-ID-L65-04-SGL-LPA-40K-ID090  
**CCT:** 4000K  
**Output:** ID090  
**Nominal Lumens:** 900 lumens/ft  
**Efficacy:** 124.7 lm/W  
**Test Report:** P-ID-L65-04-SGL-LPA-40K-ID090-IES



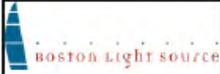
Zonal Lumens		
Zone	Lumens	Lamp %
0-40	385.7	9.9%
0-60	791.4	20.3%
0-90	1063.6	27.3%
90-180	2829.8	72.7%
0-180	3893.4	100%

**Fixture:** W-ID-L65-04-SGL-LPA-35K-ID075  
**CCT:** 3500K  
**Output:** ID075  
**Nominal Lumens:** 750 lumens/ft  
**Efficacy:** 124.7 lm/W  
**Test Report:** W-ID-L65-04-SGL-LPA-35K-ID075-IES



Zonal Lumens		
Zone	Lumens	Lamp %
0-40	286.1	9.2%
0-60	597.1	19.2%
0-90	809.1	26.1%
90-180	2295.4	73.9%
0-180	3104.5	100%





Project 15-27581  
 Westford Roudenbush  
 Submitted By  
 BOSTON LIGHT SOURCE

Catalog Number  
 CP5387 LNW DIM FINISH STAR  
 Notes

Type  
**P2ALT2**

AIR FOL™



Rev: 2014/05/22

293

# Air Foil™

## Imagine the Possibilities

- 2-story corridor
- Atrium
- Church
- Civic
- Airport
- Healthcare
- Education
- Large venue
- Hospitality

## Features

- 5 year product warranty
- Edge lit trim
- Matte white acrylic diffuser
- Optional specialty diffuser materials available, including Vera Kamin's Impressions of Light® images, which are replicated from Kamin's original works of art
- Oven cured no VOC acrylic powder coat for painted finishes; oven cured low VOC clear coat on metal finishes
- Sail formed from 1/4" colored acrylic or 1/8" finished aluminum (Sail models)
- Consistent brightness uniformity gradient minimizes shadowing and source image
- T-5 fluorescent, high performance T-8 fluorescent or long life LED source
- Osram Octron® XPS® Ecologic®3 T-8 lamp/ballast combination (.71 ballast factor) provides up to 42,000 hours of life (rated at 12 hours/start)
- Optional recessed downlight with PAR lamps for beam spread selection
- Ceramic metal halide downlight option
- Remote ballast for fluorescent bodylight; integral ballast for HID downlight (16" models)
- Integral ballast on 24" and 36" models is standard for fluorescent and HID
- 6" tandem fixture separation
- ETL listed to UL standards (US and Canada) for indoor damp locations. Not recommended for exterior applications

## LED Features

- Static color LED or color changing LEDRGB bodylight
- Modular design allowing replacement of the LED source and power supply
- Constant current LED technology to protect LEDs from experiencing "over current" conditions that can cause overheating and premature failure
- Thermally managed within manufacturer specifications to promote long LED life
- No ultraviolet or infrared, alleviating potential damage to art, fabric and materials
- Mercury free LED source reduces impact to waste stream

## Solid Color LED Features

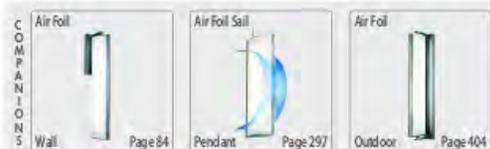
- White source (4000K), 0-10V dimmable
- Remote mountable driver up to 20' maximum (16" models)
- Integral high power factor electronic driver (24" and 36" models)

## Color Changing LED (RGB) Features

- DMX controller is available, see [www.visalighting.com](http://www.visalighting.com) for details
- DMX compliant driver is standard with LEDRGB; remote (20' maximum distance) for 16" models, integral for 24" and 36" models
- DMX driver is field addressable through use of onboard switches
- DMX control cable is separate from power cable to meet code requirements (24" and 36" models)

## Suggested Variations

- Decrease body height
- Tandem separation more or less than 6 inches
- Replaceable signage or photographs
- Alternative single color LED source (red, green or blue)
- See [www.visalighting.com](http://www.visalighting.com) for additional variation suggestions



INDOOR

PENDANT

ADA

KPS

LED

NEW



Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Catalog Number  
CP5387 LNW DIM FINISH STAR  
Notes

Type  
**P2ALT2**

274

Rev: 2014/05/22

Order Code Example: CP5387 - 2FHP17 (12W) - 1CH35R111 - LNW - 050 - 050 - DIM - FUSE - DIM119%

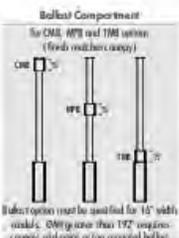
Model Number / Mounting Options: CP5387  
Source: 2FHP17 (12W) + 1CH35R111  
Finish: LNW  
Options: DIM119%

ICW access available 0,10%

Model Number / Mounting Options	Source	Ballast Options	Finish	Canopy	Options	Dimensions
<b>2 Foot Body - 16" Width</b>						
SINGLE						
CP5387 Stem Mount Only	Bodylight	Optional Downlight	Yes	Canopy		
	ICW2000	1CH35R111			DCC	W 16-1/4" (413mm)
	LEDRGB	1PH39PAR20	CMB		FUSE	D 7-1/4" (184mm)
	2FHP17	1T35PAR20	MPS		IBM	OW 192" (4877mm)
	2FS14		TMS		LR111)	X 28-1/2" (724mm)
	2FS24				L(T8)	
Fixure bottom is solid if no downlight is specified						
<b>TANDEM</b>						
CP5388 Stem Mount Only	ICW4000	1CH35R111	CMB		CRD (Painted)	W 16-1/4" (413mm)
	LEDRGB	1PH39PAR20	MPS		DCC	D 7-1/4" (184mm)
	2FHP17	1T35PAR20	RMB		FUSE	OW 192" (4877mm)
	4FS14		TMS		LR111)	X 63" (1600mm)
	4FS24			L(T8)		
Fixure bottom is solid if no downlight is specified No downlight in upper tandem unit						
<b>2 Foot Body - 24" Width</b>						
SINGLE						
CP5389 CBL STM	ICW2500	1T75PAR30			DCC	W 24-1/4" (616mm)
	LEDRGB				FUSE	D 10-1/2" (267mm)
	2FHP17				IBM	OW 192" (4877mm)
	4FS14				L(T8)	X 28-1/2" (724mm)
	4FS24					
Fixure bottom is solid if no downlight is specified						
<b>TANDEM</b>						
CP5390 CBL STM	ICW5000	1T75PAR30			CRD (Painted)	W 24-1/4" (616mm)
	LEDRGB				DCC	D 10-1/2" (267mm)
	2FHP17				FUSE	OW 192" (4877mm)
	8FS14				IBM	X 63" (1600mm)
	8FS24			L(T8)		
Fixure bottom is solid if no downlight is specified No downlight in upper tandem unit						
<b>2 Foot Body - 36" Width</b>						
SINGLE						
CP5391 CBL STM	ICW3500	1T75PAR30			DCC	W 36-1/4" (921mm)
	LEDRGB				FUSE	D 15" (381mm)
	2FHP17				IBM	OW 192" (4877mm)
	4FS14				L(T8)	X 28-1/2" (724mm)
	4FS24					
Fixure bottom is solid if no downlight is specified						
<b>TANDEM</b>						
CP5392 CBL STM	ICW7000	1T75PAR30			CRD (Painted)	W 36-1/4" (921mm)
	LEDRGB				DCC	D 15" (381mm)
	2FHP17				FUSE	OW 192" (4877mm)
	8FS14				IBM	X 63" (1600mm)
	8FS24			L(T8)		
Fixure bottom is solid if no downlight is specified No downlight in upper tandem unit						

FINISH: (Painted), C, S, T, E, M, I, S, P, A, I, N, T, E, D, L, I, N, E, S, S, O, S, T, A, T, E, C, H, C, A, N, O, P, Y

WGM, WMM, WPG, VKSS







Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Catalog Number  
CP5387 LNW DIM FINISH STAR  
Notes

Type  
**P2ALT2**

276

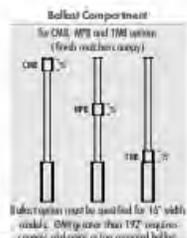
Rev: 2014/05/22

See Page 205 for Abbreviation Key and Line Drawings

Order Code Example	Source	Ballast Options	Fixtures	Diffuser Options	Options	Dimensions	
CP5381	2FHP25 (120V) - 1CH35R111	NFB	36	BSL	VKWD	DCC	QAH1V3
<b>Model Number / Mounting Options</b>	<b>Source</b>	<b>Ballast Options</b>	<b>Fixtures</b>	<b>Diffuser Options</b>	<b>Options</b>	<b>Dimensions</b>	
<b>3 Foot Body - 16" Width</b>	<b>Bodylight</b> - <b>Optional Downlight</b>		<b>Trim</b> <b>Canopy</b>	<b>Diffuser Material and Style</b> <i>(If option selected)</i>		<b>DMF not specified</b> <i>Standard dimensions are shown below</i>	
<b>SINGLE</b>	LCW3000 LEDRGB	1CH35R111 1PH39PAR20	CMB MPB RMB TMB		DCC FUSE IEM L(R)111 L(TB)	W 16-1/4" (413 mm) D 7-1/4" (184 mm) OH 7-1/2" (187 mm) X 40-1/2" (1029 mm)	
CP5381	2FHP25 2FS21 2FS39	113SPAR20					
Future ballast is sold if no downlight is specified							
<b>TANDEM</b>	LCW6000 LEDRGB	1CH35R111 1PH39PAR20	CMB MPB RMB TMB		CRD (Painted) DCC FUSE IEM L(R)111 L(TB)	W 16-1/4" (413 mm) D 7-1/4" (184 mm) OH 7-1/2" (187 mm) X 37" (939 mm)	
CP5382	2FHP25 2FS21 2FS39	113SPAR20					
Future ballast is sold if no downlight is specified No downlight in upper tandem unit							
<b>3 Foot Body - 24" Width</b>							
<b>SINGLE</b>	LCW3300 LEDRGB	1175PAR30					
CP5383	2FHP25 2FS21 2FS39						
Future ballast is sold if no downlight is specified							
<b>TANDEM</b>	LCW7600 LEDRGB	1175PAR30			CRD (Painted) DCC FUSE IEM L(TB)	W 24-1/4" (616 mm) D 10-1/2" (267 mm) OH 10-1/2" (267 mm) X 40-1/2" (1029 mm)	
CP5384	2FHP25 2FS21 2FS39						
Future ballast is sold if no downlight is specified No downlight in upper tandem unit							
<b>3 Foot Body - 36" Width</b>							
<b>SINGLE</b>	LCW5300 LEDRGB	1175PAR30					
CP5385	2FHP25 2FS21 2FS39						
Future ballast is sold if no downlight is specified							
<b>TANDEM</b>	LCW10600 LEDRGB	1175PAR30			CRD (Painted) DCC FUSE IEM L(TB)	W 36-1/4" (921 mm) D 15" (381 mm) OH 10-1/2" (267 mm) X 40-1/2" (1029 mm)	
CP5386	2FHP25 2FS21 2FS39						
Future ballast is sold if no downlight is specified No downlight in upper tandem unit							

AIR FOIL

(Painted)  
 C  
S  
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J  
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Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Catalog Number  
CP5387 LNW DIM FINISH STAR  
Notes

Type  
**P2ALT2**

Rev: 2014/05/22

See Page 295 for Abbreviation Key and Line Drawings

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Model Number / Mounting Options		Source	Ballast Options	Finish	Canopy	Seal	Diffuser Options	Options	Dimensions
<p><b>Air Foil™</b></p>									
<p><i>4 foot body - 16" Width</i></p>									
<p><b>SINGLE</b></p>									
<p>LCW1000 ICH3SR111 CMB LEDRGB IPH39PAR20 MPB 2FHP32 IT35PAR20 2MB 2F528 TMB 2F554</p>									
CP5300	Stem Mount Only					CP5300 Only (Painted) SA CIA CKA WMA	CP5300 Only VKMD VKMM VKPG VKSS	DCC DIM(A) DIM(EB) DIM(B) FLUSE IEM LR(11) LT(B) MLS2	W 16 1/4" (413 mm) D 7 1/4" (184 mm) CWH 1 9/2" (487 mm) X 52 1/2" (1334 mm)
CP5330	Seal Mount Only								
<p>Future ballast is sold if no downlight is specified</p>									
<p><b>TANDEM</b></p>									
CP5302	Stem Mount Only	LCW1000 ICH3SR111 CMB LEDRGB IPH39PAR20 MPB 2FHP32 IT35PAR20 RMB 2F528 TMB 2F554				CP5302 Only (Painted) SA CIA CKA WMA	CP5302 Only VKMD VKMM VKPG VKSS	CBD(Painted) DCC FLUSE LR(11) LT(B)	W 16 1/4" (413 mm) D 7 1/4" (184 mm) CWH 1 9/2" (487 mm) X 111" (2819 mm)
CP5332	Seal Mount Only								
<p>Future ballast is sold if no downlight is specified No downlight in upper tandem unit</p>									
<p><b>4 foot body 24" Width</b></p>									
<p><b>SINGLE</b></p>									
CP5310	Seal Mount Only	LCW5000 ICH3SR111 CMB LEDRGB IPH39PAR30 MPB 2FHP32 ICH7OR111 RMB 2F528 IPH70PAR30 TMB 2F554 IT75PAR30				CP5310 Only (Painted) SA CIA CKA WMA	CP5310 Only VKMD VKMM VKPG VKSS	DCC DIM(A) DIM(EB) DIM(B) FLUSE IEM LR(11) LT(B) MLS2	W 24 1/4" (616 mm) D 10 1/2" (267 mm) CWH 1 9/2" (487 mm) X 52 1/2" (1334 mm)
CP5340	Seal Mount Only								
<p>Future ballast is sold if no downlight is specified</p>									
<p><b>TANDEM</b></p>									
CP5312	Seal Mount Only	LCW10000 ICH3SR111 CMB LEDRGB IPH39PAR30 MPB 2FHP32 ICH7OR111 RMB 2F528 IPH70PAR30 TMB 2F554 IT75PAR30				CP5312 Only (Painted) SA CIA CKA WMA	CP5312 Only VKMD VKMM VKPG VKSS	CBD(Painted) DCC DIM(A) DIM(EB) DIM(B) FLUSE IEM LR(11) LT(B) MLS2	W 24 1/4" (616 mm) D 10 1/2" (267 mm) CWH 1 9/2" (487 mm) X 111" (2819 mm)
CP5342	Seal Mount Only								
<p>Future ballast is sold if no downlight is specified No downlight in upper tandem unit</p>									
<p><b>4 foot body - 35" Width</b></p>									
<p><b>SINGLE</b></p>									
CP5320	Seal Mount Only	LCW7100 ICH3SR111 CMB LEDRGB IPH39PAR30 MPB 2FHP32 ICH7OR111 RMB 2F528 IPH70PAR30 TMB 2F554 IT75PAR30				CP5320 Only (Painted) SA CIA CKA WMA	CP5320 Only VKMD VKMM VKPG VKSS	DCC DIM(A) DIM(EB) DIM(B) FLUSE IEM LR(11) LT(B) MLS2	W 36 1/4" (921 mm) D 15" (381 mm) CWH 1 9/2" (487 mm) X 52 1/2" (1334 mm)
CP5350	Seal Mount Only								
<p>Future ballast is sold if no downlight is specified</p>									
<p><b>TANDEM</b></p>									
CP5322	Seal Mount Only	LCW14200 ICH3SR111 CMB LEDRGB IPH39PAR30 MPB 2FHP32 ICH7OR111 RMB 2F528 IPH70PAR30 TMB 2F554 IT75PAR30				CP5322 Only (Painted) SA CIA CKA WMA	CP5322 Only VKMD VKMM VKPG VKSS	CBD(Painted) DCC DIM(A) DIM(EB) DIM(B) FLUSE IEM LR(11) LT(B) MLS2	W 36 1/4" (921 mm) D 15" (381 mm) CWH 1 9/2" (487 mm) X 111" (2819 mm)
CP5352	Seal Mount Only								
<p>Future ballast is sold if no downlight is specified No downlight in upper tandem unit</p>									

INDOOR

PENDANT

LED

NEW

	<b>Project 15-27581</b> <b>Westford Roudenbush</b> Submitted By <b>BOSTON LIGHT SOURCE</b>	Catalog Number <b>CP5387 LNW DIM FINISH STAR</b> Notes	Type <h1>P2ALT2</h1>
----------------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------	--------------------------------------------------------------	-------------------------

## Finishes and Materials

Specify color code when ordering.  
Individual paint and finish samples  
are available upon request.

### Painted Finishes (standard)

Acrylic Powder Coat



Polyurethane Powder Coat



Polyester Powder Coat



### POWDER COAT PAINTED FINISHES

Powder coating eliminates runs, drips and sags common with liquid paint finishes. It is significantly more durable than conventional paints and is extremely resistant to chips, abrasions, heat up to 400° F, UV light, fuel and chemicals. All of Visa Lighting's colored paint options are powder coat, reducing its overall environmental impact while maintaining the Visa Lighting standard of quality. There are no solvents or hazardous materials used in the process. Paint finishes are blended specifically for Visa Lighting and are powder comb tested to ensure 1-2 mil on interior products for durability and 2-3 mil on exterior products to provide extra protection for outdoor architectural spaces. Antimicrobial coating is standard on patient care products.

RAL Classics, the most recognized samples set, a collection of 210 colors used widely in architecture. Visa Lighting's color palette features RAL colors with a satin surface finish. Additional RAL Classic series colors are available at a slight premium. Custom color matching is also available. Visa's powders are exceptionally durable and corrosion resistant, with excellent chemical, stain and scratch resistance. They also possess superior over-bake resistance and a 2H hardness level. The powders are reclaimable, safe, and environmentally friendly.



Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Catalog Number  
CP5387 LNW DIM FINISH STAR  
Notes

Type  
**P2ALT2**

### Metal Finishes (premium options)

For accurate metal matching use BHMA standard or request finish samples. Individual paint and finish samples are available upon request.



#### METAL FINISHES

Architecture, like light, is a balance of art and science. Proper metal finishing is the essence of art and old world craftsmanship. Visa Lighting's metal finishes are spun, polished and finished by artisans in our Milwaukee, Wisconsin facility. Trust in quality allows Visa Lighting to extend a five year limited warranty on product finishes; guaranteeing the craftsmanship, beauty and durability of each product. The DCC option (Damp Clear Coat) is required for 5 year warranty when used in damp locations.

#### ANSI/BHMA MATERIAL FINISH STANDARDS

Visa recognizes the use of ANSI/BHMA standard. The BHMA reference number is provided below the finish sample. All Visa finishes are grade level 1. Visa also utilizes this standard as a means for specifiers to communicate a desired surface treatment, should one be desired, that is not offered as a standard finish.

### Other Materials (premium options)

#### Standard Matte Acrylic Diffuser Finish

All luminous acrylic diffusers used indoors include a matte finish to enhance softness of illumination and to produce a more glass-like appearance. This scratch resistant surface is specifically designed to be durable and easily cleaned using mild cleansers during routine building maintenance.

#### Lumicon

#### Lumicon® Lens Options —

Dedicated to providing innovative products and solutions, Visa Lighting includes seven resin material options for lensing. This recyclable material transforms the personality of classic Visa Lighting products. Additional material options are available through our variations team.



#### Alabaster

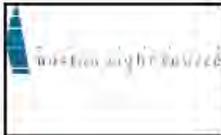
#### Alabaster Alternative (ABA) —

ABA acrylics are hand painted by local artists. Multilayered paint over an acrylic substrate produces a luminous diffuser with the character and natural appearance of alabaster at a fraction of the cost and with less fixture weight. This finish can be applied to designs that cannot be produced in real marble materials.









Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Catalog Number  
SS12LEDGV 26W 35K DO101 CM FINISH  
Notes:

Type  
**P3**



## RLM CEILING MOUNT

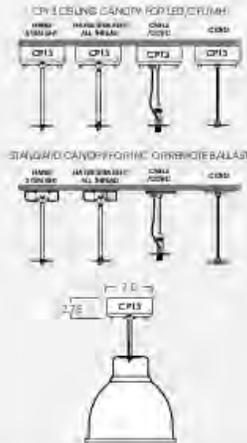


SOME OPTIONS NOT AVAILABLE ON ALL FIXTURES, CONSULT SPECIFICATION SHEETS.  
NOTE: THIS IS TYPICAL OF RLM SPECIFICATION FOR PENDANT MOUNTING. INDIVIDUAL FIXTURES OR PROJECTS MAY HAVE SPECIALIZED REQUIREMENTS.  
SEE INDIVIDUAL SPECIFICATION SHEETS OR CONSULT FACTORY FOR ADDITIONAL INFORMATION.

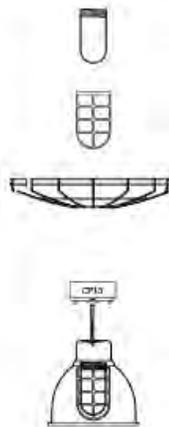
### 1. SPECIFY FIXTURE & LIGHT SOURCE



### 2. SELECT A CEILING CANOPY & STEM/CABLE OR CORD MOUNTING



### 3. SPECIFY OPTIONAL LAMP ENCLOSURES / WIRE GUARDS



### 4. SPECIFY FIXTURE COLOR

- MW- Matte White
- MS- Matte Black
- GW- Gloss White
- GB- Gloss Black
- BZ- Bronze
- CB- Oil Rubbed Bronze
- P1- Polished
- SI- Silver
- GA- Galvanized
- CH- Charcoal
- GH- Graphite
- AM- Anodic Mahogany
- SG- Sun Gold
- EG- Englewood
- VG- Verde Green
- BL- Blue Steel
- RD- Red Baron
- OR- Orange
- CO- Copper Metallic



### HM- HANG STRAIGHT



ORDER: **HM**(length)  
SPECIFY LENGTH:  
HM3-3"  
HM6-6"  
HM12-12"  
HM18-18"  
HM24-24"  
HM36-36"  
HM48-48"  
HM72-72"  
HMLXX- Custom Size  
(specify in inches)

**FINISH**  
Canopy / Stem Finish  
Matches Fixture Finish.

### HMAT- HANG STRAIGHT ALL THREAD



ORDER: **HMAT**(length)  
SPECIFY LENGTH:  
HMAT12-12"  
HMAT24-24"  
HMAT36-36"  
HMAT48-48"  
HMAT72-72"  
HMATL(CXX)- Custom Size  
(specify in inches)

**FINISH**  
Canopy / Stem Finish  
Matches Fixture Finish.

### PM- PENDANT MOUNT



ORDER: **PM**(length)  
SPECIFY LENGTH:  
PM3-3"  
PM6-6"  
PM12-12"  
PM18-18"  
PM24-24"  
PM36-36"  
PM48-48"  
PM72-72"  
PMLC(CXX)- Custom Size  
(specify in inches)

**FINISH**  
Canopy / Stem Finish  
Matches Fixture Finish.

### HC- HOOK / CORD



ORDER: **HC**(length)  
SPECIFY LENGTH:  
HC36-36"  
HC72-72"  
HC144-144"  
HC(CXX)- Custom Size  
(specify in inches)

**PLUG**  
LP 120-120V Twist Lock  
LP277-277V Twist Lock

**FINISH**  
Canopy / Stem Finish  
Matches Fixture Finish.

### CD- CORD / CABLE MOUNT



ORDER: **CD**(length)  
SPECIFY LENGTH:  
CD36-36"  
CD72-72"  
CD144-144"  
CD(CXX)- Custom Size  
(specify in inches)

FIXTURE COLOR	CORD COLOR
White	White
Silver	Gray
All Other	Black

### CM- CORD MOUNT



ORDER: **CM**(length)  
SPECIFY LENGTH:  
CM36-36"  
CM72-72"  
CM144-144"  
CM(CXX)- Custom Size  
(specify in inches)

FIXTURE COLOR	CORD COLOR
White	White
Silver	Gray
All Other	Black

Dimensions shown are nominal. Spectrum Lighting is continually improving products and reserves the right to make changes if or will not be permitted via a replacement with or without written notice.



PROJECT:	TYPE:
CAT. NO.:	

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	Project 15-27581 Westford Roudenbush	Catalog Number SS12LEDGV 26W 35K DO101 CM FINISH	Type  <h1 style="text-align: center;">P3</h1>
	Submitted By BOSTON LIGHT SOURCE	Notes	

## **POWDER COAT PAINT FINISHES**

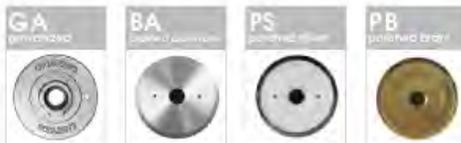


SOME OPTIONS NOT AVAILABLE ON ALL FIXTURES. CONSULT SPECIFICATION SHEETS.  
 NOTE: NO PRINTED IMAGE CAN EQUAL THE EXACT COLOR OF FINISH ON METAL.  
 SEE INDIVIDUAL SPECIFICATION SHEETS OR CONSULT FACTORY FOR ADDITIONAL INFORMATION.



### SPECIAL METAL FINISHES

NOT AVAILABLE ON ALL FIXTURES. PLEASE CONSULT SPECIFICATION SHEETS FOR AVAILABILITY.



Dimensions shown are nominal. Spectrum Lighting is continuously improving products and reserves the right to make changes that will not affect performance or appearance with or without written notice.



PROJECT:	TYPE:
CAT. NO.:	

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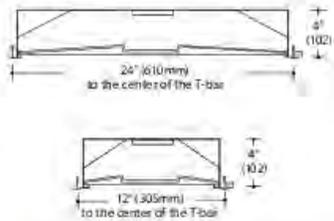




	Project 15-27581 Westford Roudenbushr Submitted By <b>BOSTON LIGHT SOURCE</b>	Catalog Number: <b>GD LHEL 2 4 35K 3000 HE CWM D10 X 120</b> Notes:	Type <div style="font-size: 2em; font-weight: bold; text-align: center;">R3</div>

# LITECONTROL

Fixture Type:  
Project Name:



## Litewave™ HE LED G-D-LHE-LED LED Recessed Direct

### Product Description

Recessed enclosed LED fixture with high efficiency extruded acrylic one-piece diffuser.

Fixture	Output	Wattage	Efficacy
2x2	2000	18	108
	3000	29	102
	3500	35	97
	4000	42	95
2x4	4000	36	112
	5000	46	109
	6000	57	105
1x4	4000	37	107
	5000	48	103



### Ordering Guide

Product Specifications											
Mounting	Distribution	Series	Width (ft)	Length (ft)	CCT	Output	Diffuser	Finish	Dimming	Other options	Volts
<b>G</b> 15/16" grid ceiling <b>NG</b> 9/16" narrow face grid ceiling <b>SS</b> 9/16" screw slot grid ceiling <b>R</b> Drywall ceiling	<b>D</b> Direct	<b>LHEL</b>	2 →	2 →	<b>30K</b> <b>35K</b> <b>40K</b>	Min: 1700 (17) Max: 4900 (49)  *ADVISE	<b>HE</b>	<b>CWM</b> (matte white) is standard	see <b>Dimming</b>	<b>CCEA</b> <b>EF</b> see <b>Other Options</b>	<b>120</b> <b>277</b>
			2 →	4 →							
		<b>LHEL</b>	1 →	4 →	<b>30K</b> <b>35K</b> <b>40K</b>	Min: 1900 (19) Max: 5200 (52)					
			1 →	4 →							

**G-D-LHEL24-30K-40-HE-CWM-D10-120** is a typical catalog number for a LED 2x4, 30K and 4000 lumen fixture with high efficiency diffuser, matte white finish, 120 volts.

### Product Specifications & Options

Mounting: Intended for installation in exposed, inverted T-bar grid ceiling (NEMA type GL). Holes in housing provided for wire on chain mounting support to building structure.

#### Grid Mounting Options



	Project 15-27581 Westford Roudenbushr Submitted By BOSTON LIGHT SOURCE	Catalog Number: GD LHEL 2 4 35K 3000 HE CWM D10 X 120 Notes:	Type  <h1 style="text-align: center;">R3</h1>

# LITECONTROL

## Litewave HE-LED G-D-LHE-LED

### LED Color Temperature:

- 27K: Not available
- 30K: 3000K
- 35K: 3500K
- 40K: 4000K
- 50K: Not available

**Output:** Can be specified to 100 lumens within below range:

	2x2	2x4	1x4
Max:	4900	6100	5200
Min:	1700	2000	1900

**Diffuser:** High-efficiency one piece extruded acrylic lens. Dropped center channel for excellent source diffusion.

**Finish:** Pre-finished matte white.

### Dimming:

#### Driver:

**D10** Low-voltage dimming; fixture will be wired for low-voltage 0-10V dimming control. Dimming range is 100% to 10%.

**Lutron** Not available.

**Circuiting:** 1CWQ. Fixture wired for single circuit only.

### Other Options:

CCEA: City of Chicago environmental air modification

EF: Emergency battery backup installed (see "Emergency battery" below).

**Voltage:** 120V (120)  
277V (277)

### Additional Details:

**Housing:** Die-formed steel. Wiring access plate on top of housing for flexible conduit attachment.

**Reflectors:** High-reflectance prepaint matte white steel.

**Door frame:** Lift and shift steel door frame which rests within housing. Holds pre-installed diffuser. Additionally secured via plastic strapping at two points. Ships separate from housing.

### Emergency battery:

Integral: Available (EF), Iota ILB-CP10.

Inverter: Compatible. Provided by others.

**Fixture Weight:** 17.5 lbs 2x2.

**Ratings:** CSA listed for damp locations. IBEW, AF of L.

Litecontrol reserves the right to change specifications without notice for product development and improvement. DesignLights Consortium® (DLC) qualified

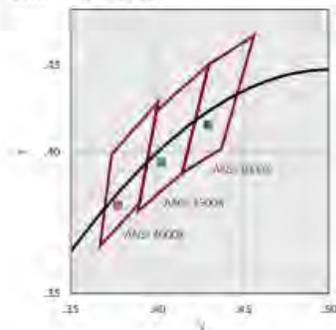
## Technology Details

CRI: 80 minimum

	Ra	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
3000K	83	82	92	96	81	83	90	83	60	10	81	81	76	84	98
3500K	83	90	90	95	83	83	86	86	67	21	77	81	70	84	98
4000K	83	90	95	84	83	86	87	87	67	15	76	83	68	84	97

**Color Variation:** 3-step MacAdam ellipse maximum, both within fixture and fixture-to-fixture.

### Color Temperatures:



**Life:** Tested in accordance to IESNA LM79-2008. Life extrapolations based on IESNA TM-21-11

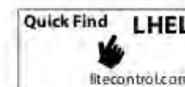
**LED:** 93,000 hours (L70)

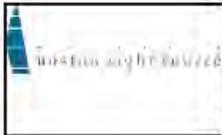
**Driver:** Standard: 100,000 hours

**Warranty:** see [www.litecontrol.com](http://www.litecontrol.com) for warranty details

**LED boards:** 5 years

**LED drivers:** 5 years





Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Catalog Number:  
GD LHEL 2 4 35K 3000 HE CWM D10 X 120  
Notes:

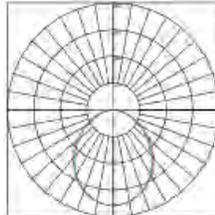
Type  
**R3**

# LITECONTROL

## Litewave HE-LED G-D-LHE-LED

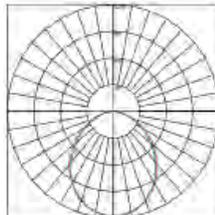
### Photometry

Fixture: G-D-LHEL22-35K-20  
Size: 2x2  
CCT: 3500K  
Output: 20  
Nominal Lumens: 2000  
Efficacy: 108  
Test Report: G-D-LHEL22-35K-20.IES



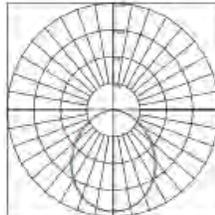
Zonal Lumens Summary		
Zone	Lumens	% Tot
0-30	280.20	14.01
0-40	380.30	19.01
0-50	480.39	24.02
0-60	580.37	29.02
0-70	679.82	34.00
0-80	779.33	39.00
0-90	878.33	44.00
0-100	977.33	49.00
0-110	1076.33	54.00
0-120	1175.33	59.00
0-130	1274.33	64.00
0-140	1373.33	69.00
0-150	1472.33	74.00
0-160	1571.33	79.00
0-180	1770.33	89.00
0-190	1969.33	99.00
0-180	1969.33	100.00

Fixture: G-D-LHEL22-35K-30  
Size: 2x2  
CCT: 3500K  
Output: 30  
Nominal Lumens: 3000  
Efficacy: 103  
Test Report: G-D-LHEL22-35K-30.IES



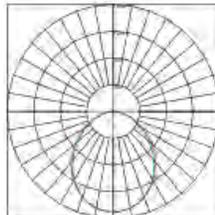
Zonal Lumens Summary		
Zone	Lumens	% Tot
0-30	421.40	14.05
0-40	561.84	18.73
0-50	702.28	23.41
0-60	842.72	28.09
0-70	983.16	32.77
0-80	1123.60	37.45
0-90	1264.04	42.13
0-100	1404.48	46.81
0-110	1544.92	51.49
0-120	1685.36	56.17
0-130	1825.80	60.85
0-140	1966.24	65.53
0-150	2106.68	70.21
0-160	2247.12	74.89
0-180	2487.56	83.26
0-190	2728.00	91.63
0-180	2728.00	100.00

Fixture: G-D-LHEL22-35K-35  
Size: 2x2  
CCT: 3500K  
Output: 35  
Nominal Lumens: 3500  
Efficacy: 100  
Test Report: G-D-LHEL22-35K-35.IES



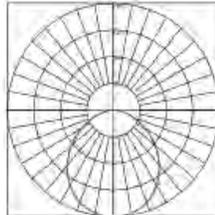
Zonal Lumens Summary		
Zone	Lumens	% Tot
0-30	514.29	14.69
0-40	685.71	19.60
0-50	857.14	24.50
0-60	1028.57	29.40
0-70	1200.00	34.30
0-80	1371.43	39.20
0-90	1542.86	44.10
0-100	1714.29	49.00
0-110	1885.71	53.90
0-120	2057.14	58.80
0-130	2228.57	63.70
0-140	2400.00	68.60
0-150	2571.43	73.50
0-160	2742.86	78.40
0-180	3142.86	90.00
0-190	3542.86	100.00

Fixture: G-D-LHEL22-35K-40  
Size: 2x2  
CCT: 3500K  
Output: 40  
Nominal Lumens: 4000  
Efficacy: 96  
Test Report: G-D-LHEL22-35K-40.IES



Zonal Lumens Summary		
Zone	Lumens	% Tot
0-30	594.72	14.87
0-40	789.60	19.74
0-50	984.48	24.61
0-60	1179.36	29.48
0-70	1374.24	34.35
0-80	1569.12	39.22
0-90	1764.00	44.10
0-100	1958.88	48.97
0-110	2153.76	53.84
0-120	2348.64	58.71
0-130	2543.52	63.58
0-140	2738.40	68.45
0-150	2933.28	73.32
0-160	3128.16	78.19
0-180	3528.16	88.20
0-190	3928.16	98.21
0-180	3928.16	100.00

Fixture: G-D-LHEL24-35K-50  
Size: 2x4  
CCT: 3500K  
Output: 50  
Nominal Lumens: 5000  
Efficacy: 108  
Test Report: G-D-LHEL24-35K-50.IES



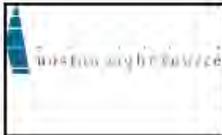
Zonal Lumens Summary		
Zone	Lumens	% Tot
0-30	680.00	13.60
0-40	906.67	18.13
0-50	1133.33	22.67
0-60	1360.00	27.20
0-70	1586.67	31.73
0-80	1813.33	36.27
0-90	2040.00	40.80
0-100	2266.67	45.33
0-110	2493.33	49.87
0-120	2720.00	54.40
0-130	2946.67	58.93
0-140	3173.33	63.47
0-150	3400.00	68.00
0-160	3626.67	72.53
0-180	4026.67	80.53
0-190	4426.67	88.53
0-180	4426.67	100.00



LED / G-D-LHE-LED







Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Catalog Number  
STL4 30L EZ1 LP835 X X  
Notes:

Type  
**S1**

## STL4 LED Surface Volumetric

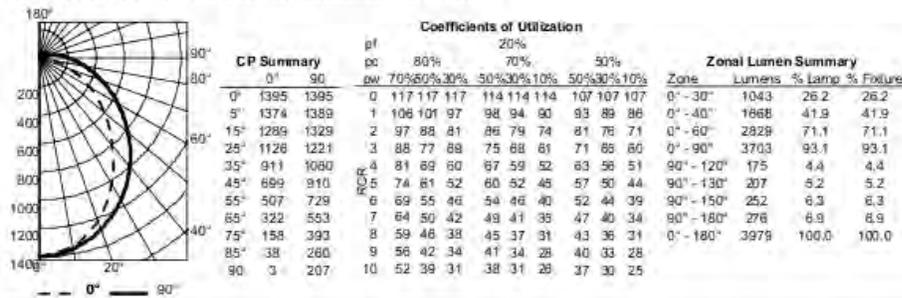
Performance Data			
Lumen Package	Input Watts <sup>1</sup>	Lumens	LPW
30LLP830	26.7	2904	108.8
30LLP835	26.7	3049	114.2
30LLP840	26.7	3195	119.7
30LLP850	26.7	3282	122.9
40LLP830	34.9	3688	105.7
40LLP835	34.9	3834	109.9
40LLP840	34.9	3979	114.0
40LLP850	34.9	4124	118.2
48LLP830	45.2	4615	102.1
48LLP835	45.2	4850	107.3
48LLP840	45.2	5088	112.6
48LLP850	45.2	5184	114.7
60LLP830	53.2	5294	99.5
60LLP835	53.2	5539	104.5
60LLP840	53.2	5811	109.2
60LLP850	53.2	5934	111.9



Sensa Switch LSCF Sensor	
<b>Lens type:</b>	10 - Low Mount 360°
<b>Dimming:</b>	HL - High/Low Occupancy operation
<b>Min Dim Level:</b>	3V - approximately 10% light output when unoccupied
<b>Time Delay:</b>	5M - 5 minutes

## PHOTOMETRICS

STL4 40L EZ1 LP840, 3979 delivered lumens, test no. LD 25690, tested in accordance to IESNA LM-79



## MOUNTING DATA

Suspension Kit Ceiling Types: F1 for use with most T-bar and screw slot grid ceiling applications. Designed for on-grid and off-grid installations.

F2 for use with recessed or surface-mount horizontal I-box applications.

For unit or row installation—surface or suspended mounting.

Individual installation—One double-stem or two single-stem hangers required.

For aircraft cable, one STACG, STACGF, or STACGE required for each suspension point.

Row installation—Order one (1) STOR accessory per fixture for continuous row applications. Not required for last fixture in row. One hanger per fixture plus one per row required.

Note: 2' configurations with emergency option cannot be stem mounted.

See ACCESSORIES below for hanging devices.



## DIMENSIONS

All dimensions are inches (millimeters) unless otherwise noted.

### Specifications

Length:	46-3/8 (1178)	A = 1/4 x 1/2 (L35x L27) Oval Hole
Width:	10-1/8 (25.7)	B = 1/16 (L75) Dia K.O.
Depth:	3-7/8 (9.8)	C = 7/8 (22) Dia K.O.
Weight:	13LB	



	Project 15-27581 Westford Roudenbush	Catalog Number DLE 12 ST W 840 DHHRM	Type  <h1>S2</h1>
	Submitted By BOSTON LIGHT SOURCE	Notes	



Date:	_____
Type:	_____
Firm:	_____
Project:	_____

# DLE 12·18·24·48

## Intelligent LED High Bay Fixtures

### PRODUCT FEATURES:

- Integrated occupancy sensor
- Integrated daylight harvesting sensor
- Granular controls for fine-tuning of lighting settings
- Wireless compatibility with LightRules® software
- Independently aimable and full dimmable LED light bars
- Narrow, wide, aisle, and diffuse optic packages for a wide range of applications

SENSING & CONTROL	
Onboard Intelligence	<ul style="list-style-type: none"> <li>• Built-in sensing with data logging</li> <li>• Energy and fault monitoring</li> </ul>
Sensor Inputs	<ul style="list-style-type: none"> <li>• Integrated occupancy sensor (PIR)</li> <li>• Integrated daylight sensor</li> </ul>
Wireless Networking	ZigBee® Compliant Platform/802.15.4
Control Capabilities	<ul style="list-style-type: none"> <li>• Scheduling via LightRules®</li> <li>• kWh and occupancy logging</li> <li>• Daylight harvesting</li> </ul>

ENVIRONMENTAL	
IP Rating	IP52
Operating Temp.	-22° to 122° F (-30° to 50° C)

CERTIFICATION & WARRANTY	
Certifications	<ul style="list-style-type: none"> <li>• UL 1598, cUL, UL-NOM</li> <li>• FCC Part 15, Class B</li> <li>• CE, CISPR 15</li> <li>• PSE</li> <li>• VDE</li> <li>• C-Tick</li> <li>• DLC</li> </ul>
Warranty	5-year Limited Warranty

*UL-NOM, CE, CISPR, PSE, VDE, and C-Tick certifications applicable to Standard Voltage (57) fixtures only. (International certifications pending for DLE-48.)*



DLE-12-ST/HV



DLE-18-ST/HV



DLE-24-ST/HV



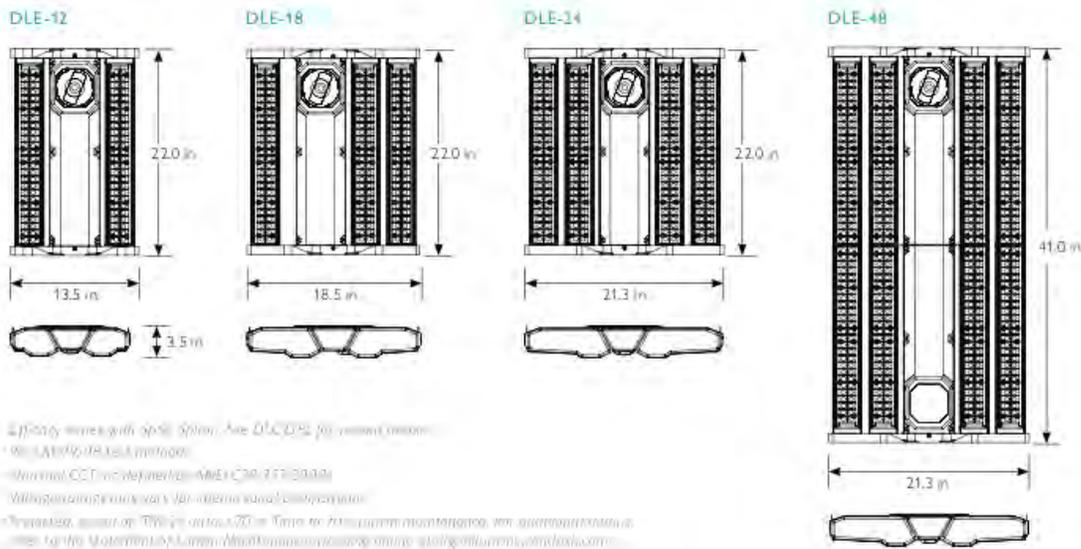
DLE-48-ST/HV

	<b>Project 15-27581</b> <b>Westford Roudenbush</b> Submitted By <b>BOSTON LIGHT SOURCE</b>	Catalog Number <b>DLE 12 ST W 840 DHHRM</b> Notes	Type <h1 style="text-align: center;">S2</h1>

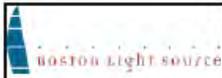
PERFORMANCE	DLE-12		DLE-18		DLE-24		DLE-48	
Lumen Output	12,000 lm		18,000 lm		24,000 lm		48,000 lm	
Power Consumption	120 W		180 W		240 W		480 W	
Color Temperature	5000 K CCT	4000 K CCT	5000 K CCT	4000 K CCT	5000 K CCT	4000 K CCT	5000 K CCT	5000 K CCT
Efficacy	100 lm/W	90 lm/W	100 lm/W	90 lm/W	100 lm/W	90 lm/W	100 lm/W	100 lm/W
CRI	70 min	80 min	70 min	80 min	70 min	80 min	70 min	70 min
Input Ratings	<i>Standard Voltage (ET)</i> 120-277 VAC, 50 Hz, 1.03 A <i>High Voltage (HV)</i> 347-480 VAC, 50/60 Hz, 0.5 A		<i>Standard Voltage (ET)</i> 120-277 VAC, 50 Hz, 1.56 A <i>High Voltage (HV)</i> 347-480 VAC, 50/60 Hz, 0.7 A		<i>Standard Voltage (ET)</i> 120-277 VAC, 50 Hz, 2.07 A <i>High Voltage (HV)</i> 347-480 VAC, 50/60 Hz, 1.0 A		<i>Standard Voltage (ET)</i> 120-277 VAC, 50/60 Hz, 4.14 A <i>High Voltage (HV)</i> 347-480 VAC, 60 Hz, 1.14 A	
Lumen Maintenance (LM-80 @ 122°F (50°C))	<ul style="list-style-type: none"> <li>- L70 (11K): 66,000 hrs</li> <li>- L70 calculated: 200,000+ hrs</li> </ul>							
Power Factor	0.9 min							
Surge Protection	- Per IEC 61517							
Wiring	<ul style="list-style-type: none"> <li>- WAGO Winstar® modular socket</li> <li>- Conduit entry structure for direct wiring</li> </ul>							

PHYSICAL	DLE-12		DLE-18		DLE-24		DLE-48	
Dimensions (H x W x D)	3.5 x 13.5 x 22.0 in (8.9 x 34.3 x 55.9 cm)		3.5 x 18.5 x 22.0 in (8.9 x 47.0 x 55.9 cm)		3.5 x 21.3 x 22.0 in (8.9 x 54.1 x 55.9 cm)		3.5 x 21.3 x 41.0 in (8.9 x 53.8 x 104.2 cm)	
Weight	9.5 lbs (4.3 kg)		12.0 lbs (5.4 kg)		14.6 lbs (6.6 kg)		28.7 lbs (13.0 kg)	
Mounting Options	<ul style="list-style-type: none"> <li>- Standard Aircraft Cable</li> <li>- Fixed Mount</li> </ul>							
Frame	PC/ABS polymer and anodized aluminum, optical grade PMMA							
Power Enclosure	PC/ABS polymer							

### DIMENSIONS



© 2015 Boston Light Source. All rights reserved.  
 • All other trademarks are the property of their respective owners.  
 • Actual CCT may vary from the stated CCT.  
 • All dimensions are in inches unless otherwise noted.  
 • The LM-80 data is based on a 20,000-hour test. The LM-80 data is based on a 20,000-hour test. The LM-80 data is based on a 20,000-hour test.  
 • All other trademarks are the property of their respective owners.



Project 15-27581  
 Westford Roudenbush  
 Submitted By  
 BOSTON LIGHT SOURCE

Catalog Number  
 DLE 12 ST W 840 DHHRM  
 Notes

Type  
**S2**

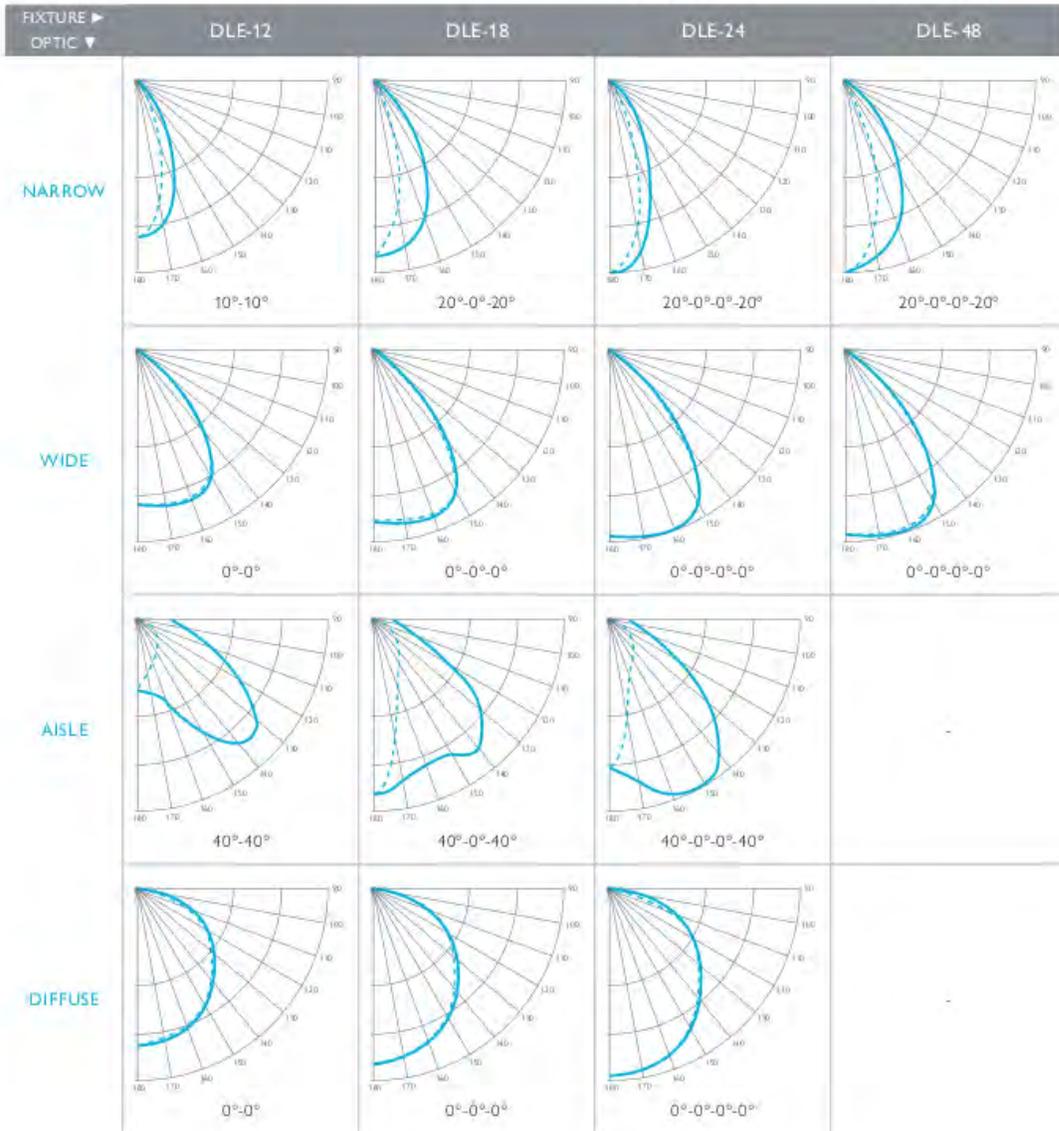
SPACING CRITERIA

FIXTURE TYPE ▶ OPTIC ▼	DLE-12		DLE-18		DLE-24		DLE-48	
	FIXED	ADJUSTABLE	FIXED	ADJUSTABLE	FIXED	ADJUSTABLE	FIXED	ADJUSTABLE
Narrow	0.50	1.40	0.48	1.02	0.56	2.22	.52	.80
Wide	1.32	1.32	1.30	1.32	1.32	1.30	1.32	1.32
Aisle	0.72	2.32	0.42	1.48	0.44	1.72	-	-
Diffuse	1.24	1.28	1.24	1.30	1.24	1.28	-	-

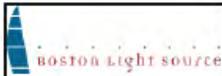
POLAR CANDELA DISTRIBUTION

Fixed Axis - - - - -

Adjustable Axis —————







Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Catalog Number  
CV1804 LWW2700 FINISH DIM XPS  
Notes

Type  
**W1**

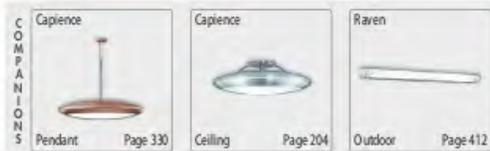
Rev: 2013/11/12

179

Vertical or Horizontal Wall Mount or Ceiling Mount



INDOOR  
WALL / CEILING  
ADA  
XPS  
LED  
NEW



**Features**

- 5 year product warranty
- ADA compliant
- Extruded aluminum backplate/siderails, die-cast end caps and trim bars
- Oven cured no VOC acrylic powder coat
- Extruded white acrylic with 45% DR high impact, F1 rated, UV stable, UL-94 HB Flame Class rated
- LED or fluorescent source
- High power factor electronic ballast
- Easy tool-less relamping (except with VR option)
- Versatile mounting: ceiling mount, horizontal wall, vertical wall
- Mounts to 2 X 4 electrical junction box (by others) with provided hardware. Requires auxiliary mounting fasteners (provided). Box oriented to match fixture's linear dimension (horizontal for horizontal mount, vertical for vertical mount)
- XEM option requires replacement of junction box with proprietary junction box (included with XEM option). The XEM junction box is available as a ship-head component for rough-in if needed
- ETL listed to UL standards (US and Canada) for indoor damp locations. Not recommended for exterior applications

**LED Features**

- White source (3000K, 3500K, 4000K), 0-10V dimmable; LED dimming is not available with CV 1800
- Modular design allowing replacement of the LED source and power supply
- Constant current LED technology to protect LEDs from experiencing "over current" conditions that can cause overheating and premature failure
- Thermally managed within manufacturer specifications to promote long LED life
- No ultraviolet or infrared, alleviating potential damage to art, fabric and materials
- Mercury free LED source reduces impact to waste stream

**Suggested Variations**

- Custom color or material
- Add or remove trim bars



Project 15-27581  
Westford Roudenbush  
Submitted By  
BOSTON LIGHT SOURCE

Catalog Number  
CV1804 LWW2700 FINISH DIM XPS  
Notes

Type  
**W1**

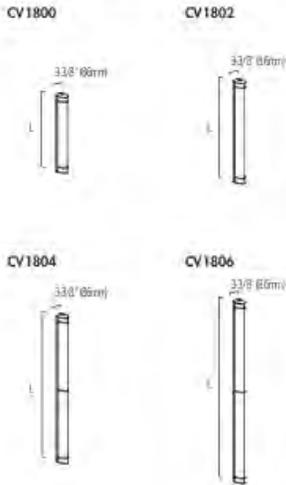
Rev: 2013/12/31

Order Code Example: CV1804 - 1FS28 (MVDL) - WGT03R - 3P5

Model Number	Source	Finish	Options	Dimensions
<b>CV1800</b>	1FS14 1FS24 • LCW950 • LNW950 • LWW950 • LCW1700 • LNW1700 • LWW1700		• DIM(EB) REM • DIM(L) VR • FUSE XEM RB XPS	L 24 1/4" (629 mm) D 4" (102 mm) WC 12 3/8" (314 mm)
<b>CV1802</b>	1FS21 1FS39 • LCW2300 • LNW2300 • LWW2300 • LCW3400 • LNW3400 • LWW3400		• DIM(EB) REM • DIM(L) VR • FUSE XEM RB XPS	L 36 1/2" (927 mm) D 4" (102 mm) WC 18 1/4" (463 mm)
<b>CV1804</b>	1FS28 1FS54 • LCW2700 • LNW2700 • LWW2700 • LCW3900 • LNW3900 • LWW3900	(Painted)	• DIM(A) EBH • DIM(EB) VR • DIM(L) XPS FUSE	L 48 3/8" (1229 mm) D 4" (102 mm) WC 24 1/8" (613 mm)
<b>CV1806</b>	1FS35 1FS80 • LCW3300 • LNW3300 • LWW3300 • LCW4700 • LNW4700 • LWW4700		FUSE VR XPS	L 62 1/8" (1577 mm) D 4" (102 mm) WC 30 1/8" (765 mm)

RAVEN

**Line Drawings**  
Depth is measured from rim to front of fixture or Mounting Center is measured from top of fixture to center of junction box.  
L = Length D = Depth MC = Mounting Center



**Abbreviation Key**  
\* Indicated Finish/Option is not available with XPS

**Source (Voltage)**  
Specify Voltage or MVOLT  
MVOLT fixture accepts 120 through 277 input voltage

- LCW Cool White, 4000K, LED (MVOLT)
- LNW Neutral White, 3500K, LED (MVOLT)
- LWW Warm White, 3000K, LED (MVOLT)
- FS14 14w 1.5, mini bi-pin base, FLR (MVOLT)
- FS21 21w 1.5, mini bi-pin base, FLR (MVOLT)
- FS24 24w 1.5/HO, mini bi-pin base, FLR (MVOLT)
- FS28 28w 1.5, mini bi-pin base, FLR (MVOLT)
- FS35 35w 1.5, mini bi-pin base, FLR (MVOLT)
- FS39 39w 1.5/HO, mini bi-pin base, FLR (MVOLT)
- FS54 54w 1.5/HO, mini bi-pin base, FLR (MVOLT, 347V)
- FS80 80w 1.5/HO, mini bi-pin base, FLR (MVOLT)

**Finishes (see inside back cover)**  
(Painted) Color Code Required - see colorizer

**Options**

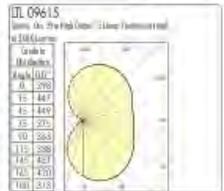
- DIM(A) Advance Mark 10 fluorescent dimming, specify 120V or 277V, for FS54 only
- DIM(EB) lut on EcoSystem digital link fluorescent dimming
- DIM(L) lut on EcoSystem 3-wire fluorescent dimming
- FUSE Fluorescent fusing, specify 120V or 277V
- EM integral emergency battery pack for fluorescent, specify 120V or 277V, for dry location/wall mount only
- RB Pre-ship recessed components (DEM junction box)
- REM Remote emergency battery pack for fluorescent, not available with 347V
- VR Vandal resistant frame fasteners
- XEM Emergency battery pack for fluorescent mounted in provided recessed box (replaces standard junction box), not available with 347V
- XPS Express 10 day shipping

**Photometrics and 3D Modeling**

Complete BIM, Google Sketchup and Photometric files for these models can be downloaded from [www.visualighting.com](http://www.visualighting.com)

**ES File Number LER Report**

CV1800-1FS24	61	
CV1802-1FS39	64	06615
CV1804-1FS54	68	
CV1806-1FS80	66	



**nominal LED Source Waiver**

Model	LUM / LUM / LUM			
	Current	Watts	Lumens	Watts
CV1800	950	10	1100	18
CV1802	2300	24	2800	35
CV1804	2700	28	3000	42
CV1806	3300	35	4000	50

