Parks, Recreation and Community Facilities

Construction and Maintenance Guidelines

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PARKS, RECREATION AND COMMUNITY FACILITIES

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Parks, Recreation and Community Facilities Construction and Maintenance Guidelines

Introduction

Parks, Recreation and Community Facilities (PRCF) Construction and Maintenance Guidelines is a summary of procedures and standards for the construction, remodeling, or alteration of the facilities and related infrastructure in the City of Mesa, Arizona. In addition to providing guidelines for the Facilities Maintenance Department, this manual is intended to direct consultants, facilitate coordination, and improve communication among the design team(s) and all City Departments involved in facilities design and construction.

This document consists of guidelines and general specifications. The guidelines provide insight into the City's operation and maintenance objectives and their impact on facilities design. The specifications provide specific direction regarding the materials, systems, and equipment preferred by the City. Please note, that the selections for systems, equipment, and materials specifications are the sole responsibility of the consultant, but are subject to PRCF approval.

This guideline provides consultants with information such as general administration and design considerations, performance criteria, materials and equipment specifications, acceptable manufacturers, installation and testing procedures, etc. It must be underscored that these are not "boilerplate specifications" and are not intended to be a substitute for standard project specifications. Also, these guidelines do not address every aspect of design considerations; those are the responsibility of the consultant, subject to the City's review and approval process described herein.

The consultant has the obligation to request variances whenever the exercise of professional judgment or regulatory implications leads to a conclusion different from the one(s) outlined or suggested in this document. All proposed variations and deviations from these guidelines must be approved in writing by the City's representative and/or the assigned PRCF Project Manager (PM) before incorporation into the project.

Guidelines and standards change from time to time as new methods and procedures are implemented. Each consultant is responsible for determining the appropriateness of any revisions to the project for which the consultant is retained. The consultant is responsible for notifying PRCF when any deviations from this document are made.

All work shall conform to Mesa City Code requirements and current building code requirements.

Section 1

General Design Considerations

Design Approach and Objectives

It is recognized that the designer of any project is constantly faced with decisions regarding the selection of materials and methods to achieve an economical, aesthetically pleasing, and well-functioning end product. While these objectives may be universally applicable on an industry-wide basis, there are several design objectives for City projects to which the designer must devote special attention. These objectives are listed below, and they must all be considered of equal importance.

Design Integration

Architectural design for City of Mesa facilities must respond to the environmental characteristics and unique opportunities that characterize the Southern Arizona region and the City as a whole. PRCF will approve the use of all colors.

Overall Economy

While the City constantly seeks ways of reducing construction costs, the increasing sophistication of building systems often tends to obscure the fact that they require proportionately increased operation and/or maintenance costs. Because the lowest first cost does not necessarily mean the lowest total cost, life-cycle cost analyses are an important component of the overall design process.

Adaptability

A building and/or park is not something you finish; it is something you start. In design, this requires that the emphasis be placed on a solid structure, accessible services, and maintenance of the facility — not on features that change at a faster pace within the space. Adaptability should not be confused with flexibility, which often adds undue expense. Consultants should strive to create adaptive buildings and parks that will survive both the client departments and citizens who will occupy them on a day-to-day basis and PRCF which who is tasked with maintaining the building and park throughout its life cycle.

Operations and Maintenance Guidelines

SECTION II of this document provides technical aspects for building materials, methods, and performance against which projects will be evaluated. Designers are encouraged to make suggestions for alternative approaches to meet or improve upon these standards as may be justified by engineering factors, operational criteria, or cost. Among the operational factors to be considered in designing building systems are the following:

- Functionality and cost considerations
- Reliability and durability
- Energy conservation
- Water efficiency
- Maintenance requirements minimization
- Simplicity of operation and adequacy of control systems

- Accessibility and serviceability of mechanical and electrical components
- Availability of replacement parts

Americans with Disabilities Act (ADA) Compliance

All City buildings and parks will comply with the most recently adopted ADA standards. In new structures, this effort is built into the code review process. These guidelines are for new and renovated projects, it must be stressed that any replacement of devices, hardware, doors, ramps, plumbing fixtures, and other elements that are covered under ADA for new buildings and parks will need to be replaced with new products that will meet all applicable ADA standards.

Acceptance Walk Form

The PRCF PM will not sign off on an Acceptance Walk form until all punch list items have been completed. PRCF will perform a final inspection to verify that all items have been accomplished. Once all items have been completed and inspected a letter of acceptance will be issued by PRCF. Engineering-led projects will follow Engineering processes.

Energy Conservation

The City of Mesa, as a large user of energy in the operation of its facilities, is extremely conscious of the need to minimize its consumption of energy within the bounds of safe and functional requirements. In general, this requires a comprehensive, interdisciplinary approach to energy-efficient design. Examples include the use of native, drought-tolerant vegetation in landscaping, proper building orientation, adequate fenestration, appropriate design and performance of mechanical systems, etc. In general, the consultants should complete a comprehensive analysis of existing and new building performance and an interdisciplinary approach to energy-efficient design. Examples Include:

- Replacing failed/failing equipment with high-performance mechanical systems and appliances.
- Modify building control and operation to better meet functional requirements while optimizing efficiency.
- Adding functional interconnected building controls to optimize efficiency and operational management (Energy Management System).
- Modifying building elements to reduce solar heat gain or wind exposure due to poor building orientation and inadequate fenestration.
- Installing appropriate building envelope components.
- Use of “cool” roofing materials.
- Supporting appropriate design and selection of mechanical, electrical, and plumbing systems.
- Evaluate multiple energy sources when available, such as electric and gas, in order to select the fuel that is more cost-effective for the life of the project.
- Conducting commissioning of building systems.
- Replacing obsolete plumbing fixtures with low water use, WaterSense labelled fixtures.
- Installing native, drought-tolerant vegetation.
- Adding irrigation central control systems, master valves, and flow sensors to optimize water usage.

All renovation and replacement work shall comply with Mesa City Code, including compliance with the most current International Energy Conservation Code. The latest IECC incorporates ASHRAE 90.1, which is a performance-based system. The City encourages the use of alternatives that improve energy efficiency as long as life-cycle costs analysis accompany the recommendations.

Signage

Approval for the signage, whether interior or exterior, is the responsibility of the City's representative. All proposed signage must be reviewed and approved by the PRCF PM prior to inclusion in the contract documents. The design consultant shall include exterior monument signage or signage attached to buildings in the contract documents. Signage must conform to the City of Mesa sign ordinance and be ADA compliant.

Asbestos-Containing Material

No asbestos-containing material will be allowed in any City project. An asbestos-free certificate (AFC) will be issued by the contractor as part of the final completion process.

Acoustical Privacy

These guidelines apply to all rooms requiring acoustical protection. Each of the issues below is also extremely important for existing structures. Existing structures present an extra challenge, but designers are encouraged to creatively retrofit proposed tenant improvements to accomplish the desired acoustical privacy. The items are to be considered as general design considerations are as follows:

All plumbing penetrations in walls must be caulked airtight using acoustical caulk.

Where recessed fixtures of any type are installed (e.g., medicine cabinets, fire extinguishers, electric panels, drinking fountains, bookcases, etc.), the design consultant must ensure that the required acoustical wall construction extends behind these elements.

Installation of noise-generating equipment (such as telephones, drinking fountains, etc.) should be avoided on walls or rooms requiring acoustical protection.

Use surface-mounted rather than recessed lighting fixtures and fans at ceilings of rooms requiring acoustical protection to minimize sound transference to adjacent spaces.

Locate doors to rooms requiring acoustical protection so that neighboring rooms do not have directly adjoining doors and in such a manner that doors on the opposite side of corridors do not face each other. In cases where acoustical isolation is imperative at each side of the corridors, all doors need to be staggered.

Avoid placing doors to rooms requiring acoustical isolation opposite to stairwells, elevator lobbies, or bathroom doors.

Whenever possible, the gap at the bottom of all doors should not exceed 1/2 inch.

Do not locate toilets (public or private) or lounges directly over rooms requiring acoustical protection, especially rooms having uncarpeted floors.

Separate studs, with a structural in-wall air gap, must isolate the jambs of all heavily used corridor doors from any adjacent rooms requiring acoustical isolation.

Mechanical equipment in spaces above, besides, or below rooms requiring acoustical isolation must be vibration isolated, including piping and conduits, from walls, floors, and ceilings. The noise generated by the equipment must be considered.

Demising walls for general purpose offices should have a Sound Transmission Coefficient (STC) rating of 50, although higher ratings may be required depending on the room's proximity to noise-generating spaces such as

mechanical rooms, elevator shafts, restrooms, etc. Ceiling height and material(s) shall provide a Noise Reduction Coefficient (NRC) of .55 to .65.

Special use rooms that need more privacy due to use (e.g., police department interview rooms) should be coordinated with the user group.

Building Configuration

Minimize the ratio of the surface area of walls and roofing to gross building area in order to reduce heat loss and/or heat gain within reasonable design considerations.

Buildings should be designed using Crime Prevention Through Environmental Design (CPTED) concepts. The goal of CPTED is the reduction of opportunities for crime to occur. This reduction is achieved by employing physical design features that discourage crime, while at the same time encouraging legitimate use of the environment. Any conflict between these design concepts and the operational needs of the City user groups should be reviewed by the PRCF PM and CPTED officer assigned to the project.

Glazing and Infiltration

Use appropriate glazing systems to minimize heat gain and reflected glare to adjacent buildings or public areas. The use of projections and roof overhangs is recommended over windows in sunny locations and especially in south and west orientations. The length of the projection shall be calculated to maximize solar gain in winter and shading during the summer. This function may also be achieved by using horizontal louvers, fixed awnings, or other architectural devices. The use of window film is discouraged.

All exterior doors and operable windows shall be weather-stripped, including door thresholds.

Environmental Issues

There may be environmental issues, which must be addressed in the early planning stages of a project. For this purpose, risk management and City safety requirements must be considered. Obtain the asbestos inspection report prior to beginning any design work on renovation projects. Of the greatest concern are environmental regulations imposed at the local, state, and federal levels pertaining to air and water quality. Environmental regulations may mandate that consideration be given to atmospheric emissions and discharges, storm and/or sanitary systems, and the handling of solid and hazardous substances, including their disposal.

Many projects, due to location, may have issues with nesting birds. Designs of buildings should be aware of this maintenance issue and take necessary steps to not provide nesting areas for birds. Bird spikes and other devices for protection of areas that are susceptible to nesting should be discussed during the design process with the PRCF PM and using agency.

Custodial Closets

One custodial closet must be provided for every 10,000 Net Assignable Square Feet (NASF) of floor area. In multistory buildings, provide one custodial closet per floor, minimum. In large floor plates, custodial closets shall not be placed any farther than 300 feet from each other. For all new construction, including remodels and additions, verify any and all particular requirements for custodial closet requirements with the PRCF PM.

Ideally, custodial closets should be located near elevators and toilets or centralized among the areas they will serve. Do not locate custodial closets on stair landings. Entrances to custodial closets through restrooms, mechanical rooms, or similar intermediate spaces and vice versa are not permitted.

The typical custodial closet floor area (varies with building needs) should be approximately 100 square feet (approximate dimensions = 10 feet x 10 feet) with preferably high ceilings (minimum 8 feet). Do not locate components of any telecommunications, electrical, or mechanical systems in custodial closets. Specifically, the following shall not be located inside custodial closets:

- Desks
- Telephone panels
- Electrical panels
- Water heaters
- Circulation pumps
- Mechanical equipment
- Roof hatches/access panels
- IT Equipment

A large-capacity floor sink (48 inches x 48 inches minimum) with hot and cold running water and a floor drain must be provided in each custodial closet. Sinks are best located near the door and should be positioned so cleaning machines and equipment can be maneuvered easily and emptied into the sink prior to being refilled. Walls on all sides of the sink shall be seamless stainless steel, minimum 48 inches high. Floor drain is required.

Provide doors that open outward. A 3-foot-wide single door is adequate except in cases where the closet is wide and relatively shallow in depth. In those cases, double doors may be required.

Provide unistrut or equal, shelving on three walls for a minimum of 15 linear feet with a minimum 14-inch clearance measured vertically between shelves. Mop hangers and racks for mops, hoses, or brooms must also be provided.

At least 2 GFI electrical duplex outlets are required in each custodial closet. Occupancy sensor lighting control is desired, but not imperative. Lighting level design standard should be figured at 50 to 75 foot-candle level maintained. When occupied, adequate ventilation and exhaust are essential; provide a minimum of 15 air changes per hour. Barring fire-rating restrictions, the door must have a ventilation louver, and a fire extinguisher must be placed immediately outside the door.

Floors should be sealed concrete. Wall finishes should be ceramic tile or other impervious material up to 48 inches above the floor on all walls. Semi-gloss or gloss epoxy paint is the minimum finish requirement.

Mechanical Rooms

All new facilities over 10,000 square feet shall have a mechanical room of 12 feet x 12 feet minimum with data drops and power for connection to the building energy management system and irrigation central control system. Locate the room on an exterior wall with double-door access for service and replacement of equipment. If possible, a personnel door to the interior is desirable. Provide sealed concrete floors and durable wall finishes on the interior. Provide room with floor drains as needed for equipment drainage. Great care shall be taken to sound isolate this room from the rest of building.

Electrical Rooms

Electrical equipment rooms need to be designed to provide working area around electrical/IT equipment and for possible expansion or the addition of electrical panels and equipment. In no case shall an electrical room be located in the basement or next to a “wet” area of the building such as restrooms or laboratories. And no restrooms or wet areas of the building shall be placed over electrical equipment rooms. Avoid the running of any wet utility services above the electrical room. If fire sprinklers are located in the electrical room, provide necessary protection to electrical equipment. ArcFlash labeling and/or Panduit Verisafe loss of voltage system on all panels and SES equipment compliant with NFPA 70E shall be installed.

Material Storage

Ongoing building maintenance is a continual issue in City projects. During the programming or schematic design phase, an adequate building material storage room shall be provided for facilities maintenance use. Size and location should be determined by consulting with the PRCF PM.

Fire Riser Room

Fire riser rooms should be located on exterior walls when possible. The room should be of adequate size to perform maintenance around the equipment.

Loading/Unloading Areas

New facilities may be provided with off-street adequate loading and unloading areas. The design consultant shall verify with the PRCF PM whether the loading/unloading zone requires full loading dock capabilities and to what extent these facilities must be accessible to specific vehicle sizes. Coordinate with local zoning requirements.

It is also noteworthy that many loading and unloading operations may require an indoor or outdoor staging area for packing, unpacking, and/or temporary storage of materials. The project program shall list the space allocation for all loading and unloading facilities and exterior staging areas and consider them at 50% of their total for square foot cost implications. All interior staging areas shall be counted at 100% for cost analysis implications and should not be considered as part of the circulation area or exterior space.

Building Security

All City buildings shall account for the general security of the general public and city employee building spaces, building usage and equipment. At a minimum, provide security 2-inch empty conduit installed from building hub room to building hub room for security system wiring (see SECTION II, City Energy Management System). Limited

access to labs, offices, and main computer rooms is always a concern. Access may be by means of keys or magnetic card system(s). All elevators shall have the capability to be key operated after regular working hours.

City of Mesa uses a C-CURE security system, and all projects need to be coordinated with the City Police Department.

Security Levels: Coordinate with the City of Mesa Police Department requirements.

Section 2

Operations and Maintenance Guidelines

Division 1 - General Conditions

1000 General Conditions of the Construction Contract

Division 2 - Sitework

2060 Demolition
2065 Asbestos Abatement
2115 Underground Utilities
2200 Excavation and Earthwork
2223 Backfilling and Compacting
2500 Paving and Surfacing
2700 Site Drainage
2800 Landscaping Guidelines
2830 Fences and Gates

Division 3 - Concrete

3000 General Concrete Guidelines

Division 4 - Masonry

4000 General Masonry Guidelines

Division 5 - Metals

5500 Special Metal Fabrications

Division 6 - Wood and Plastics

6200 Finish Carpentry
6400 Custom Casework

Division 7 - Thermal and Moisture Protection

7500 Built-up and Membrane Roofing
7700 Roofing Specialties
7800 Skylights

Division 8 - Doors, Windows, and Glass

8100 Steel Doors and Frames
8200 Wood Doors
8300 Glass, Overhead, and Folding Doors
8305 Access Doors
8360 Overhead Doors
8500 Windows
8700 Hardware
8800 Glazing
8960 Sloped Glazing Systems
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Division 9 - Finishes

9200	Drywall, Lath, and Plaster
9300	Tile
9410	Terrazzo
9511	Suspended Acoustical Ceilings
9680	Carpeting
9700	Resilient and Vinyl Flooring
9972	Fiberglass Reinforced Plastic Wall Panels
9900	Painting
9990	Adhesives

Division 10 - Specialties

10160	Toilet Compartments and Urinal Screens
10350	Flagpoles
10400	Signage and Graphics
10522	Fire Extinguishers
10800	Toilet and Bath Accessories

Division 11 - Equipment

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11160	Loading/Unloading Dock Equipment
11172	Dumpsters and Waste Compactors
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Division 12 - Furnishings

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12400	Office Furnishings
12500	Louvers, Blinds, and Drapery

Division 13 - Special Construction

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Division 14 - Conveying Systems

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Division 15 - Mechanical and Plumbing

15000	General Requirements
15060	Pipes and Pipe Fittings
15100	Valves, Cleanouts, and Specialties
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15200	Insulation
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15600	Heating, Ventilation, and Air Conditioning (HVAC)
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Division 16 - Electrical

16010 General Provisions
16110 Conduit and Fittings
16120 Wire and Conductors
16140 Wiring Devices
16160 Panelboards
16170 Disconnect Switches
16180 Overcurrent Protection
16200 Static Uninterrupted Power Supply (UPS) Systems
16400 Services Entrance and Distribution Switchgear
16430 Standby/Emergency Engine Generators
16450 Grounding
16460 Dry Type Transformers
16500 Lighting, Accessories, and Controls
16720 Fire Alarm System
16740 Telephone/Data and Conduit-Only System
16800 Electric Gate Operating Equipment

Division 17 - Landscaping

17000 General
17010 Products
17020 Tree Maintenance During Construction
17030 Turf Grass Variety
17040 Pump Systems
17050 Maintenance

Division 18 – City of Mesa Direct Digital Control System Standard

18000 City of Mesa Direct Digital Control System Standard

Division 1

Reserved for future update.

Division 2

Reserved for future update.

Division 3 – Concrete

30.00 INTRODUCTION

This section outlines the requirements for the use of cast in-place concrete and cast-in-place architectural concrete. Concrete components include reinforcement, formwork, concrete materials, mixture design, and exposed concrete finishes.

30.01 CONCRETE JOINTS

A. Plan control joints to be straight and continuous, not staggered. Place joint locations under walls or carpeted areas whenever possible. Plan the joint pattern to avoid re-entrant corners or triangular wedges of concrete which are highly prone to cracking.
B. Sealant to be added to control joints to prevent the transmission of the joint through the floor finish.
C. Show control joints on design drawings for exposed concrete finish.

30.02 CONCRETE REINFORCING

A. Specify corrosion resistant materials for concrete reinforcing at areas of moisture concern.

30.03 CAST-IN-PLACE CONCRETE

A. Avoid the embedment of conduits, pipes and sleeves within concrete structural elements or structural concrete toppings.
B. Cast-in-place concrete colors are to be approved by the PRCF PM.
C. Concrete testing is to be provided by an approved testing firm on the first truck load and each truck load containing the next additional 50th cubic yard.
D. Vapor barriers are to be provided as required by the Design Consultant for the specific circumstances.

30.04 CONCRETE FINISHING

A. Formwork snap tie cone holes should be filled and finished smooth with adjacent surfaces.
B. Specify a slip-resistant finish at exposed concrete floors, ramps, steps, landings, and exterior walks.
C. Exposed concrete used as an interior finish material is to be formed and finished to tolerances and finish requirements that are appropriate for the occupied space.
D. Exposed concrete traffic surfaces are to have a slip resistant broom finish.

30.05 PRECAST CONCRETE

A. Indicate panel joint aesthetic and locations in the construction documents. Outside corner joints that are mitered need to be accompanied with a quirk joint to prevent the 45-degree cut from breaking or chipping.

B. Architectural precast concrete colors are to be approved by the PRCF PM.
C. Indicate and dimension joints and snap tie holes in the contract documents for exposed, poured-in-place concrete.
D. Batch colored concrete may not be used on exterior slabs. E. Coat unpainted, precast concrete with a water repellent to reduce surface absorbency.

30.06 CONCRETE STAIRS

A. Exposed concrete at stairs should have chamfered edges no greater than ½".
B. Incorporate a contrasting nosing finish at stairs to clearly distinguish between steps in descent under all lighting conditions. Incorporate a nosing with an abrasive, non-slip surface at interior stair treads.

30.07 CONCRETE CUTTING AND CORING

A. Indicate that General Contractor is required to use GPR or X-ray at areas required to receive saw cutting or core drilling of existing concrete. The method is to be approved by the PRCF PM.

Division 4 – Masonry

40.00 INTRODUCTION

This section contains the requirements for manufactured units of masonry and cast stone, including masonry cleaning.

Refer to Division 03 – Concrete and Division 07 – Thermal & Moisture Protection for additional information.

40.01 MORTAR

A. For building additions, match existing color.
B. Specify mortar color to match masonry color.

40.02 MASONRY ACCESSORIES

A. Brick ties, plates, fasteners, lintel angles, relieving angles, and other metal accessories are to be galvanized steel (minimum G- 90) or stainless steel.
B. Flashing shall extend beyond openings and have end dams at vertical terminations.
C. At through-wall flashing for brick veneer, extend within the wythe a minimum of 12 inches above the weep location. Coordinate and detail the interface between below-grade waterproofing and through-wall flashing, as well as base flashing and weep vents.
D. For brick masonry veneer above roof areas, through-wall flashing is to be fabricated from copper or stainless-steel sheet metal and have receivers for roof counterflashing.
E. Specify brick ties with built-in drips to prevent water from bridging the cavity.
F. Install weeps at all through-wall flashing locations. G. Open head and sill joints with honeycomb plastic weep inserts are required, rather than cords or tubes.
G. Locate through-wall flashing and weeps a minimum of 12 inches above adjacent roofs, to allow reroofing without interfering with their operation.
H. If water repellent systems are used, provide breathable systems rather than barrier systems.

40.03 COMMISSIONING OF MASONRY

A. The Design Consultant is expected to participate in a building envelope preconstruction conference for all new construction and exterior wall renovation projects.

40.04 UNIT MASONRY

A. Base design and layout of all masonry construction on the module of the unit selected, including brick, concrete masonry units (CMU), and cast stone. Dimension both horizontal and vertical directions, including masonry rough openings, to minimize cutting and material waste. B. Documents representing masonry in a graphic hatch without considering masonry modules and units are prohibited.

40.05 BRICK MASONRY

A. Specify face brick that is a standard size and readily available.

B. Running bond is the preferred pattern for brickwork.
C. New brickwork is to match adjacent existing brickwork in appearance.
D. Custom, special-shaped brick units for outside corners, windowsill, window heads (accommodating steel lintels), string courses, and various angle units are acceptable.
E. Sealant joints are to have backer rods. Match the sealant color to the adjacent mortar joints to the greatest extent possible.
F. For exposed joints that do not receive a coating, silicone-based sealant joint materials are required.
G. The maximum sealant joint is 3/4".
H. Submit brick samples to SRP Project Manager for approval prior to the completion of the construction documents.

40.06 CONCRETE MASONRY UNIT

A. Reinforce and grout hollow cells per structural requirements.

40.07 GLASS UNIT MASONRY

A. Glass unit masonry may only be used when matching existing construction.

40.08 MASONRY RESTORATION AND CLEANING

A. Do not sand blast or acid wash brick surfaces without approval from Environmental Services.

40.09 CAST STONE

A. Windowsills, headers, string courses, lintels, column caps, wall coping, and other accent details may be cast stone or architectural precast (Division 03 - Concrete).
B. Cast stone may be dry cast with zero-slump concrete or wet cast.
C. Provide full width through-wall flashing with end dams.
D. Rake back joints and install backer rod and sealant.
E. Coat cast stone with a water repellent to reduce surface absorbency.

Division 5 – Metals

50.01 INTRODUCTION

Section Includes: Metal fabrications, including items fabricated from iron and steel shapes, plates, bars, strips, tubes, pipes and castings which are not a part of structural steel or other metal systems in other Sections of these Specifications. Types of metal items include, but are not limited to, the following:

- Carpenter's ironwork.
- Steel gratings and frames.
- Steel pipe guards.
- Steel pipe bollards.
- Ladders.
- Miscellaneous framing and supports.
- Miscellaneous steel trim.
- Enclosure gates and hardware.
- Exterior canopies and awnings.
- Fabricated steel accents and ornamentation.
- Other items as indicated.

50.02 SUBMITTALS

A. Shop Drawings: Submit Drawings for the fabrication and erection of assemblies of items which are not completely shown by the Manufacturer's data sheets.
    a. Include plans and elevations at not less than 1 inch to 1'-0" scale, and include details of sections and connections at not less than 3 inches to 1'-0" scale.
    b. Show anchorage and accessory items.

50.03 QUALITY ASSURANCE

A. Standards: Comply with the following, except as otherwise shown and specified:
    a. AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings."
    b. AISI "Specifications for the Design of Cold-Formed Steel Structural Members."
    c. AWS "Structural Welding Code-Steel."
    d. ASTM A6 "General Requirements for Rolled Steel Plates Shapes, Sheet Piping and Bars for Structural Use."
B. Qualifications: Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure."

50.04 DELIVERY, STORAGE AND HANDLING

A. Exercise care during unloading, storage and erection to avoid damage. Dumping on the ground is not permitted.
B. Support material stored at the site completely free of the ground, and cover to avoid damage from the elements.

50.05 PROJECT/SITE CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of Shop Drawings
B. Standard and fabrication, where possible, to ensure proper fitting of the Work. Allow for trimming and fitting wherever the taking of field measurements before fabrication might delay the Work.

50.06 MATERIALS

A. Wide Flange Steel Sections: ASTM A572 or A992 (Fy = 50 ksi).
B. Steel Shapes, Plates, Rod, Bars and Bar-size Shapes: ASTM A36.
C. Steel Tubing (Cold-formed Welded and Seamless): ASTM A500, Grade b (Fy = 42 ksi).
D. Steel Tubing (Hot Formed Welded and Seamless): ASTM A501, (Fy = 36ksi).
E. Cold-Finished Carbon Steel Bars: ASTM A108, Grade as selected by fabricator.
F. Hot-rolled Carbon Steel Sheets and Strips: ASTM A568 and ASTM A1011, pickled and oiled.
G. Cold-rolled Carbon Steel Sheets: ASTM A1008.
H. Hot-dip Galvanized Steel Sheets: ASTM A653, with G90 zinc coating.
I. Ribbed Steel Deck: ASTM A653 steel, 16 gauge ribbed deck comparable to Vulcraft Type 3N, with G90 zinc coating.
J. Cold-drawn Steel Tubing: ASTM A512, sunk drawn, butt welded, cold-finished and stress-relieved.
K. Steel Pipe: ASTM A53, type as selected; Grade A. Black finish unless galvanizing is required. Standard weight, Schedule 40, unless otherwise shown or specified.
L. Anchors:
    a. Toggle bolts: Tumble-wing type, FS FF-B-588; type, class and style as required.
M. Fasteners: Provide zinc-coated fasteners with galvanizing complying with ASTM A153 for exterior use or where built into exterior walls. Select fasteners for the type, grade and class required for the installation of miscellaneous metal items.
    a. Bolts and nuts: ASTM A307, Grade A, regular hexagon head.
    b. Bolts, hexagon and square: ANSI B-18.2.1.
    c. Bolts, round head: ANSI B-18.5.
    d. Lag bolts: Square head type.
    e. Wood screws: ANSI B-18.6.1, flat head carbon steel.
    f. Plain washers: ASTM F844 helical spring type carbon steel.
N. Gratings: Grating shall be electro-pressure welded construction type as shown on Drawings. Exterior gratings shall be hot-dipped galvanized, after fabrication. Furnish perimeter support angles with welded anchors as detailed.
O. Galvanizing: ASTM A123 for steel plates, bars and strips.
P. Metal Primer: VOC compliant.
    a. Interior Steel: Zinc oxide, alkyd primer, high-solids content, conforming to SSPC Paint 25.1.
    b. Exterior Steel (exposed): 2-component, moisture-cured zinc-rich primer conforming to SSPC-PS 12.01.

50.07 ACCESSORIES

A. Inserts and Anchorages: Furnish inserts and anchoring devices to be set in concrete or built into masonry for installation of Miscellaneous Metal Work. Provide setting Drawings, templates, instructions and directions for installation of anchorage devices.
B. Concrete Fill (for concrete filled pipe bollards): Comply with requirements of Section 03 30 00 for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi.

50.08 FABRICATION

A. General: For fabrication of Miscellaneous Metal Work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes, including zinc coatings.
B. Shop Assembly: Preassemble items in shop, when possible, to minimize field splicing and assembly of units at the site. Disassemble units only to extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
C. Workmanship:
    a. Use materials of the size and thickness shown, or if not shown, of the required size and thickness to produce adequate strength and durability of the finished product for the intended use. Work to the dimensions of fabrication and support. Use type of materials shown or specified for various components of Work.
    b. Form exposed Work true to line and level with accurate angles, surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32 inch unless otherwise shown. Form bent-metal corners to the smallest radius possible without causing grain separation or otherwise impairing the Work.
    c. Weld corners and seam continuously and in accordance with the recommendations of AWS. Grind exposed welds smooth and flush to match and blend with adjoining surfaces.
    d. Form exposed connections with hairline joints which are flush and smooth, using concealed fasteners wherever possible. Use exposed fasteners of the type shown, or if not shown, use Phillips flat-head (countersunk) screws or bolts.
    e. Provide for anchorage of type shown, coordinated with supporting structure and the progress schedule. Fabricate as required to provide adequate support for the intended use of the Work.
    f. Cut, reinforce, drill and tap Miscellaneous Metal Work as may be required to receive finish hardware and similar items of Work.
    g. Use hot-rolled steel bars for Work fabricated from bar stock, unless Work is indicated to be fabricated from cold-rolled, or cold-finished stock.
D. Carpenter's Iron Work:
    a. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware are specified in Division 6 Sections.
    b. Manufacture or fabricate items of sizes, shapes and dimensions required. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

E. Ladders:
    a. Fabricate ladders for the locations shown, with dimensions, spacings, details and anchorages as required. Comply with requirements of ANSI A14.3, except as otherwise shown.
    b. Fit rungs into punched holes in centerline of side rails, plug weld and grind smooth on outer rail faces.
    c. Support each ladder at top and bottom and at intermediate points spaced not more than 5 feet o.c. Use welded or bolted steel brackets, designed for adequate support and anchorage, and to hold the ladder 6 inches clear of the wall surface and other obstructing construction. Extend rails 42 inches above top rung, and return rails to wall or structure unless other secure handholds are provided If the adjacent structure does not extend above the top rung, gooseneck the extended rails back to the structure to provide secure ladder access.
    d. Provide non-slip surfaces on the top of each rung, either by coating the rung with aluminum oxide granules set in epoxy resin adhesive, or by using a type of manufactured rung which is filled with aluminum oxide grout.
    e. Exterior ladders shall have hot-dipped galvanized finish.

F. Loose Bearing Plates: Provide loose bearing plates for steel items bearing on masonry or concrete construction, made flat, free from warps or twists, and of required thickness and bearing area. Drill plates to receive anchor bolts and for grouting as required.

G. Loose Steel Lintels: provide loose structural steel shape lintels for openings and recesses in masonry walls and partitions, as shown. Weld adjoining members together to form a single unit. Provide not less than 4 inch bearing at each side of openings, unless otherwise shown.

H. Miscellaneous Framing and Supports:
    a. Provide miscellaneous steel framing and supports which are not a part of the structural steel framework, as required to complete Work.
    b. Fabricate miscellaneous units to sizes, shapes and profiles shown, or if not shown, of the dimensions required to receive adjacent grating, plates, doors or other Work to be retained by the framing. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars of all welded construction using mitered corners, welded brackets and splice plates, and a minimum number of joints for field connection. Cut, drill and tap units to receive hardware and similar items to be anchored to the Work.
    c. Equip units with integrally welded anchor straps for casting into concrete or building into masonry wherever possible. Furnish inserts if units must be installed after concrete is poured. Except as otherwise shown, space anchors 24 inches o.c., and provide minimum anchor units of 1-1/4 inch x 1/3 inch x 8 inch steel straps.

I. Enclosure Gates: Fabricate to sizes and shapes indicated using galvanized steel tubing and shapes with minimum 20 gauge galvanized steel plate skin as detailed. Fabricate with continuously welded joints, and smooth exposed edges. Miter corners and use concealed field splices wherever possible.
    a. Hinges: Provide heavy duty galvanized steel butt hinges sized as required for weight of gate. Weld hinges to frame.
    b. Latching Mechanism: Provide plunger style cane-bolts with pipe receiver set into paving, size as indicated.

J. Exterior Canopies, Awnings, Accents and Ornamentation: Fabricate to sizes, configurations and shapes indicated using steel tubing, shapes, plate, and rod as detailed. Continuously weld all joints and grind smooth. Provide exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness, except where these features are a design feature of the ornamental item.

a. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.
b. Galvanize exterior units.

K. Fabricate pipe bollards from steel pipe of diameter indicated on Drawings.
L. Miscellaneous Steel Trim: Provide shapes and sizes as required for the profiles shown. Except as otherwise noted, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges. Use concealed field splices wherever possible. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation with other Work.

50.09 FINISHING

A. Galvanizing: Comply with ASTM A123 and A153 for the hot-dip process after fabrication.
B. Shop Painting:
a. Shop paint Miscellaneous Metal Work, except those members or portions of members to be embedded in concrete or masonry, surfaces and edges to be field welded, and galvanized surfaces, unless otherwise indicated.
b. Remove scale, rust and other deleterious materials before shop coat of paint is applied. Clean in accordance with SSPC SP-2, SP-3, SP-6, or SP-7, as required. Remove oil, grease and similar contaminants in accordance with SSPC SP-1.
c. Apply one shop coat of metal primer paint to fabricated metal items, except apply 2 coats of paint to surfaces which are inaccessible after assembly or erection.
d. Immediately after surface preparation, brush or spray on metal primer paint in accordance with Manufacturer's instructions, and to provide a uniform dry film thickness of 2 mils for each coat.

Division 6 – Wood and Plastics

FINISH CARPENTRY

62.01 SUBMITTALS

A. Samples: When requested by Architect, submit two samples of each species of exposed wood to receive transparent finish at the site. Samples shall be 12 inches by 12 inches in size.
B. Shop Drawings: Indicate materials, components profiles, fastening methods, jointing details and accessories to a minimum scale of 1-1/2 inch to 1'-0".
C. Product Data: Provide data on fire retardant treatment materials and application instructions

62.02 REFERENCES

A. Reference Standards: Following standards apply to Work of this Section except where more stringent requirements are specified:
    a. Architectural Woodwork Institute (AWI)/ Woodwork Institute (WI) "Architectural Woodwork Standards" latest Edition.
    b. American Wood Preservers Association (AWPA).
    c. Hardwood Plywood & Veneer Association (HPVA)
    d. National Hardwood Lumber Association (NHLA)
    e. National Particleboard Association (NPA)

62.03 QUALITY ASSURANCE

A. Applicable Standard: Perform work in accordance with AWI "Architectural Woodwork Standards".
    a. Provide Custom when not otherwise indicated.
    b. Affix Quality Grade Stamp to each unit of product (e.g. each case; each panel; each bundle of trim, etc.).
B. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum of 5 year documented experience.

62.04 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact. Protect finished surfaces with removable wrapping or coating which will not bond when exposed to sunlight.
B. Storage: Adequately protect against damage while stored at the site.

62.05 PROJECT CONDITIONS

A. Environmental Requirements: Provide humidity conditions which will not damage woodwork.
B. Measurements: Verify dimensions shown on Drawings by taking field measurement; proper fit and attachment of parts is required.

62.06 MATERIALS

A. Softwood Lumber: Graded in accordance with applicable standard specified herein under "Quality Assurance," for grade of work specified, Douglas Fir species, plain sawn, moisture content of 6-8 percent, with flat grain, of quality suitable for transparent finish. Thicknesses as indicated on Drawings.
B. Softwood Plywood: Graded in accordance with applicable standard specified herein under "Quality Assurance," for grade of work specified, Douglas Fir face species, rotary cut, exterior glue (APA Marine Grade where subject to moisture), sanded finish. Thicknesses as indicated on Drawings.
C. Hardwood Plywood: HPVA HP Graded in accordance with applicable standard specified herein under "Quality Assurance," for grade of work specified, veneer core, type of glue recommended for application, face species plain sliced. Thicknesses as indicated on Drawings.
D. Wood Particleboard: ANSI A208.1, Type 1; NPA standard, composed of wood chips, medium density, made with water resistant adhesive of grade to suit application; sanded faces. Thicknesses as indicated on Drawings.
E. Hardboard: ANSI A135.4, pressed wood fiber with resin binder, tempered grade, 1/4 inch thick, smooth one sides.
F. Base, Moldings and Trim:
    a. Stain Finish: AWI Grade I .
G. Grounds, Blocking and Furring Strips: #2 White Pine, construction grade Douglas Fir or other sound softwood. Fire treated lumber as required by codes or construction type.
H. Plastic Laminate: As specified in Division 6
I. Fasteners:
    a. Size and type: To suit application, galvanized finish in concealed locations and stainless steel finish in exposed locations. Concealed joint fasteners: Threaded steel.
J. Wood Treatment Processes:
    a. Fire Retardant: Chemically treated and pressure impregnated; capable of providing flame spread/smoke developed ratings required by Building Code in accordance with ASTM E84.
    b. Wood preservative treatment: Provide the following as applicable.
        i. Pressure treatment type: AWPA Treatment C2 using waterborne preservative with 0.25 percent retainage.
        ii. Repellent treatment by dipping: 0.25 percent retainage.
        iii. Surface application: Clear.

62.07 FABRICATION

A. Fabrication shall be in accordance with applicable standard specified herein under "Quality Assurance," for grade of work specified.
B. Shop assemble finish carpentry, when possible, for delivery to site in units easily handled and to permit passage through building openings.
C. Shop prepare and identify components for matching during site erection.
D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
E. Plastic Laminate:
    a. Apply plastic laminate finish in full, uninterrupted sheets consistent with manufactured sizes.
    b. Fabricate components so that corners and joints hairline will have hairline fit; for attachment with concealed fasteners.

c. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

62.08 EXAMINATION

A. Verify adequacy of backing and support framing.
B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

62.09 PREPARATION

A. Priming: Back-prime wood surfaces inaccessible and unexposed after installation before delivery with an approved linseed oil and aluminum primer. Prime coat unfinished metal

ARCHITECTURAL WOODWORK

64.01 SUBMITTALS

A. Shop Drawings: Submit Drawings showing layout, elevations, dimensions, hardware, construction details, and schedule of finishes.
    a. Samples:
        i. Submit two samples of each wood species to receive transparent finish at job site and at mill.
        ii. Submit two samples of type or color of plastic laminate.

64.02 REFERENCE

A. Reference Standards: Comply with the following:
    a. Architectural Woodwork Institute (AWI) "Architectural Woodwork Standards" latest Edition.
    b. ANSI/NEMA LD3 for laminates.

64.03 QUALITY ASSURANCES

A. Applicable Standard: Perform work in accordance with the reference standards specified, and as follows:
    a. Provide Custom when not otherwise indicated.
    b. Affix Quality Grade Stamp to each unit of product (e.g. each case; each panel; each bundle of trim, etc.).
B. Qualifications: Manufacturer shall be company specializing in manufacturing the products specified in this Section with minimum 3 years documented experience.

64.04 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping: Deliver materials to site in Manufacturer's original unopened packaging with labels intact.
B. Storage: Adequately protect against damage and moisture while stored at the site.
C. Handling: Comply with Manufacturer's instructions.

64.05 PROJECT CONDITIONS

A. Environmental Requirements: Provide humidity conditions which will prevent damage to woodwork.
B. Verify that field measurements are as indicated on Shop Drawings.

64.06 MANUFACTURERS - PLASTIC LAMINATE

A. Furnish plastic products of one of the following Manufacturers, except as approved by the Architect, subject to compliance with Specification requirements:
    a. Formica www.formica.com
    b. Wilsonart www.wilsonart.com
    c. Nevamar www.nevamar.com
    d. Laminart www.laminart.com
    e. Pionite www.pionite.com

64.07 WOOD MATERIALS

A. Hardwood Lumber: Custom Grade in accordance with applicable standard specified herein under "Quality Assurance," average moisture content of 6 percent; as follows:
    a. Species: as determined by project.
    b. Cut: Plain Sliced

64.08 SHEET MATERIALS

A. Hardwood Plywood: Core materials of particleboard, type of glue recommended for application; face veneer and cuts as follows:
    a. Species: as determined by project.
    b. Cut: Plain Sliced
B. Softwood Plywood: DOC PS 1, MDO (Medium Density Overlay), or other overlay plywood product suitable for application of plastic laminate as approved by the Architect.
C. Thermofused Decorative Overlay (Melamine): Roseburg Thermally Fused Melamine Panels as manufactured by Roseburg Forest Products (800) 245-1115 www.rfpco.com.
    a. Substrate: Roseburg Ultrablend, Roseburg Pine Particleboard or Medium Density Fiberboard (MDF).
D. Wood Particleboard: Standard in accordance with applicable standard specified herein under "Quality Assurance," for grade of work specified, composed of wood chips, 45 lb. density, made with water resistant adhesive; of grade to suit application; sanded faces for drawer construction and shelving.
E. Hardboard: Pressed wood fiber with resin binder, tempered grade, 1/4 inch thick, smooth one side, for drawer bottoms, gables and backs.
F. Medium Density Fiberboard (MDF): Medite II (or Medite FR as applicable) as manufactured by SierraPine, Roseville, CA, 800-676-3339 www.sierrapine.com, or equal as manufactured by Roseburg Forest Products www.rfpco.com, complying with the following:
    a. Fabricate from 90% pre-consumer wood residuals
    b. Fabricate without formaldehyde.
    c. Provide Medex in lieu of Medite II at all wet areas or within 2 feet of any sink or source of water.

64.09 LAMINATE MATERIALS

A. Plastic Laminate: High pressure decorative type.
   a. Horizontal Grade: NEMA LD-3, Grade GP50, .050 inch thickness.
   b. Horizontal Grade (Color-Thru): NEMA LD-3, Grade GP50 with color extending through material thickness.
   c. Horizontal Grade (High Wear): Exceeding NEMA LD-3, Grade GP50, 0.048 inch thickness. Wear resistance: 3.1 at 3500 cycles in accordance with NEMA LD-3 test method.
   d. Vertical Grade: NEMA LD-3, Grade GP28, (.028 inch thickness). This grade of laminate shall be counterbalanced.
   e. Fire-Rated Horizontal Grade: NEMA LD-3, Grade FR50; 0.050 inch thickness.
   f. Fire Rated Vertical Grade: NEMA LD-3, Grade FR32, 0.032 inch thickness.
   g. Post Forming Grade: NEMA LD-3, Grade PF 42.
   h. Cabinet Liner Grade: NEMA LD-3, Grade CL-20, (.020 inch thickness). This grade of laminate shall be counterbalanced.
   i. Backer: NEMA LD-3, Grade BK-20 (.020 inch thickness).
   j. Finishes, Colors and Patterns: As selected from manufacturer's standard colors.

64.10 SOLID POLYMER COUNTERTOPS

A. As specified in Section 06 61 16

64.11 ACCESSORIES

A. Adhesive: Type recommended by Laminate Manufacturer to suit application.
B. Wall Adhesive: Cartridge type compatible with paneling and wall substrate.
C. Edge Trim for Plastic Laminate Faced Casework: Moisture-curing reactive polyurethane hot melt adhesive (PUR) applied 3mm PVC banding with eased corner. Color shall be as selected by Architect.
D. Edge Trim for Wood Veneer Faced Casework: Matching solid hardwood edge of same species as face veneer. Thickness and profile as indicated on Drawings or as selected, 1/8 inch minimum.
E. Glass: As specified in Division 8
F. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application. Threaded steel for concealed joints.

64.12 HARDWARE

A. Adjustable Shelf Standards and Supports:
   a. KV255 shelf pilasters with KV256ZC shelf supports.
   b. Injection molded polycarbonate, clear color to blend with selected interior finish, friction fit into cabinet end panels and vertical dividers, readily adjustable on 32mm (approximately 1-1/4") centers. Each shelf support shall have two (2) integral support pins, 5mm diameter, to interface pre-drilled holes, and to prevent accidental rotation of support. The supports shall be automatically adaptable to ¾" or 1" thick shelving and shall provide non-tip feature for shelving.
B. Drawer and Door Pulls: Colors as selected by Architect:
   a. Plastiglide Model 142-3740 flush mount plastic.
   b. Amerock Model 5560-ID recessed plastic.
   c. HCI Model HC2867 recessed plastic.
   d. Ferum FE1484CH or FE1484DCH 4" CTC metal wire.

e. Amerock PB76312-26 or BP76312D 4” CTC metal wire.
f. Stanley STH4484-26D 4” CTC metal wire.

C. Catches: EPCO EP1018N or IVES IV2AM.
D. Drawer Slides: Full extension design, 100 lb. capacity, side mount: ACCURIDE 3832 or K&V KV8400.
E. Hinges: Stanley STHHT 1592-4 five knuckle, 2 ¾ inch, overlay type, .088 inch thick steel,
   a. Face Framed cabinets: Stanley STHHT-1592 five knuckle, 2 ¾ inch overlay type, .088 inch thick with a dull chrome finish. Doors 48 inches and over I height shall have three (3) hinges per door. Install spacer block behind frame at each hinge location.
   b. Frameless cabinets: Five knuckle hinges with hospital tips, 2 ¾ inch temper-controlled cold rolled .095 inch steel with adjustable screw holes, dull chrome finish.
   c. RPC’s RP454-26 D overlay hinge for ¾ inch doors & styles.
   d. RPC’s RP456-26D overlay hinge for 13/16 inch doors & styles.
F. Locks: Olympus 100DR for doors. Olympus 200DW for drawers. Furnish each with 2 keys. Each room to be keyed differently.
G. Pendaflex File Suspension Rails: For all file drawers shall be 14 gauge steel Pendaflex file suspension rails epoxy coated to match wither light beige or dove grey drawer boxes.
H. Finish: Dull Chrome

64.13 FINISHING MATERIALS

A. Finishing Materials: As specified in Division 9

64.14 FABRICATION

A. Fabricate architectural woodwork and cabinets in conformance with Custom Grade Standards in accordance with applicable standard specified herein under "Quality Assurance."
B. Exposed fasteners are not allowed in the finish Work on exposed and semi-exposed surfaces.
C. Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.
D. Cap shelves, doors, and other exposed edges with 3mm PVC edging. Use one piece for full length only.
E. Door and Drawer Fronts: 3/4 inch thick overlay style.
F. Plastic Laminate Faced Countertops: Fabricated plastic laminate faced countertops with separate back splash and separate side splashes with integral scribe for fitting to wall.
   a. Countertop Edge Treatment: Square self edge.
G. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
H. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
I. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
J. Provide cutouts for appliances, outlet boxes, fixtures and fittings. Verify locations of cutouts from on-site dimensions. Seal contact surfaces of cut edges.
K. Allow adequate scribe material to back and side walls at base, countertops and upper and tall storage units. Scribe shall be an integral part of cabinet.
L. Use exterior grade plywood at all countertops with sinks and at all cabinet bases.

64.15 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
B. Coordination: Coordinate with other Work which affects, connects with, or will be concealed by this Work.

64.16 INSTALLATION

A. Set and secure cabinetry and other woodwork in place; rigid, plumb and level, and in accordance with applicable standard specified herein under "Quality Assurance" for grade of work specified.
B. Use fixture attachments in concealed locations for wall mounted components.
C. Secure and align adjoining cabinet units and counter tops with concealed joint fasteners.
D. Scribe casework abutting walls and other components, including walls with variable decorative finishes, with maximum gaps of 1/32 inch (0.80 inch). Do not use trim or additional overlay trim for this purpose.
E. Secure cabinet and bases to floor using appropriate angles and anchorages.
F. Where exposed anchors or fasteners are unavoidable in the finish Work, countersink anchorage devices at exposed locations and conceal with plastic or laminate faced plugs to match surrounding plastic laminate; finish flush with surrounding surfaces.
G. Install trim in single lengths without splices where possible. Miter external corners and cope internal corners.
H. Provide top closure panels at ends and corners of all cabinets.

64.17 FIELD FINISHING

A. Sand Work smooth and set exposed fasteners.
B. Prime, fill, and finish Work of this Section in accordance with Division 9

64.18 CLEANING

A. During the course of the Work and on completion, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

SOLID SURFACING FABRICATIONS

65.01 INTRODUCTION

A. Section Includes: Solid polymer fabrications, as indicated on Drawings and as specified, including, but not limited to:
    a. Molded vanity tops and bowls.
    b. Custom vanity tops.
    c. Backsplashes.
    d. Wall cladding/wainscoting.
    e. Countertops.

65.02 SUBMITTALS

A. Product Data: Indicate product description, fabrication information and compliance with specified performance requirements.
B. Shop Drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
C. Samples: Submit minimum 6 inches x 6 inches samples. Indicate full range of color and pattern variation. Approved samples will be retained as a standard for work.
D. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions.

65.03 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications:
    a. Certified or approved by the Manufacturer.
    b. Subject to approval by Architect.
    c. Have adequate physical facilities and sufficient production capacity to produce, transport, deliver, and install the required units without causing delay in the work.
    d. Have a minimum of 2 years of fabrication experience.

65.04 DELIVERY, STORAGE AND HANDLING

A. Deliver no components to project site until areas are ready for installation. Store indoors in a dry area and away from extreme temperatures.
B. Deliver materials and accessory products in manufacturer's unopened containers.
C. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

65.05 WARRANTY

A. Provide manufacturer's ten year limited warranty against visible defects and failure due to manufacturing defects. Damage caused by physical or chemical abuse or damage from excessive heat is excluded from warranty. Warranty shall provide material and labor to repair or replace defective materials.

65.06 MANUFACTURERS

A. Furnish plastic products of one of the following manufacturers, except as approved by the Architect, subject to compliance with Specification requirements.
    a. Solid Acrylics:
    b. Corian as manufactured by Du Pont, Inc., Wilmington, DE (800) 551-2121. www.dupont.com/corian/
    c. Gibraltar as manufactured by Ralph Wilson Plastics Co., Temple, TX (800) 433-3222.
    d. LG HI-MACS as manufactured by LG Chem, Peoria, AZ 623-776-7373 www.lghimacs.com or approved equal.

65.07 MATERIALS

A. Solid polymer fabrications:
    a. Conform to ANSI Z124-1980, Type 6 and Fed. Specification WW-P-541E/GEN (August 1, 1980).
    b. USDA approved for food preparation use.
    c. Cast, filled acrylic or polyester/acrylic blend, not coated, laminated or of composite construction.
B. Provide edge details as shown on the Drawings.
C. Exposed joints shall be in locations shown on the Drawings. Seams not indicated on the Drawings shall be unexposed and adhesively joined.
D. Provide backsplashes, where shown on the Drawings, to dimensions shown on the Drawings.
E. Provide solid polymer bowls and/or lavatories, sinks in locations shown on the drawings.
F. Finish: Matte
G. Colors shall be as selected by Architect.

65.08 ACCESSORY PRODUCTS

A. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints. Color to match fabrication material.
B. Panel Adhesive: Manufacturer's standard neoprene-based panel adhesive meeting ANSI A136.1-1967 and UL(R) listed.
C. Sealant:
    a. For conditions exposed to moisture; Manufacturer's standard mildew-resistant, FDA/UL(R) recognized silicone sealant in colors matching components.
    b. For conditions not exposed to moisture; Manufacturer's standard silicone sealant in colors matching polymer material.
D. Sink/Bowl Mounting Hardware: Manufacturer's approved bowl clips, panel inserts and fasteners for attachment of undermount sinks/bowls.

65.09 FABRICATION

A. Factory fabricate components to greatest extent practicable to sizes and shapes indicated, in accordance with approved shop drawings.
B. Form joints between components using manufacturer's standard joint adhesive; without conspicuous joints.
C. Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings.
D. Cut and finish component edges with clean, sharp returns. Route radii and contours to template. Repair or reject defective and inaccurate work.

65.10 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report detrimental conditions in writing to Architect. Commencement of Work will be construed as acceptance of subsurfaces.
B. Coordination: Coordinate with other work which affects, connects with, or will be concealed by this Work.

65.11 INSTALLATION

A. Install components plumb and level, scribed to adjacent finishes, in accordance with approved shop drawings and manufacturer's installation instructions.
B. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.
C. Provide backsplashes and sidesplashes as indicated on the drawings. Adhere to countertops using manufacturer's standard color-matched silicone sealant and panel adhesive.
D. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Keep clean until Date of Substantial Completion. Replace stained components.
E. Lavatories/Sinks:
    a. Make plumbing connections to sinks in accordance with applicable Division 22 Sections
    b. Adhere undermount sinks/bowls to countertops using manufacturer's recommended adhesive and mounting hardware.

65.12 PROTECTION

A. Protect surfaces from damage until Date of Substantial Completion. Repair work or replace damaged work that cannot be repaired to Architect's satisfaction.

65.13 CLEANING

A. During the course of the Work and on completion of the Work, remove and dispose of excess materials, equipment and debris away from premises. Leave Work in clean condition.

Division 7 – Thermal and Moisture Protection

75.00 BUILT-UP ROOFING AND MEMBRANE PROTECTION

A. The City has developed a built-up roofing performance specification that will be made available for reference purposes. This standard specification outlines the City's preferred system. Contact PRCF PM for the most recent copy of the specification.
B. All roofing systems must have a manufacturer's 10-year, no dollar limit (NDL) warranty. This warranty shall cover all items from the roof deck up. The roofing manufacturer is required to inspect the system's installation and certify in writing that the installation was done in accordance with its installation directions and recommendations. The roofing contractor must provide a two-year workmanship and installation warranty. In addition, the roofing manufacturer must provide the following maintenance inspections:
C. One inspection one year after substantial completion.
D. One inspection two years after substantial completion and prior to expiration of the warranty.

77.00 ROOFING SPECIALTIES

A. Particular attention shall be paid to roof edges as they intersect parapets and/or vertical surfaces. All transitions from horizontal to vertical surfaces shall be reinforced by backing with solid roofing materials to prevent tearing or damage at these intersections.
B. All roofing surfaces (not pitched roofs) shall be provided with deck pads from roof access areas to all serviceable rooftop mechanical equipment. Roof plans for 75% and 95-100% construction document submittals must clearly show these traffic pad locations. Show dimensions of walkway pads. Deck pads shall not hamper roof drainage.
C. Provide building roof hatch access from building interior. Provide access to different height roofs and over any demising wall parapets. Hatches and access ladders shall meet all OSHA standards.
D. Any exposed drainage downspouts shall be steel pipes up to 10 feet above finish grade. No light-gauge sheet metal shall be used.
E. All roof drain covers shall be heavy-gauge metal.
    a. Initial solar reflectance value for roofing shall be greater than or equal to 0.65.
F. On walkways, do not run walkways from roof access to all the equipment. Instead just install walkways around all the mechanical units and the roof hatch.
G. On coating and foam roofs, install minimum three feet wide around all the mechanical units and roof hatch. Add an extra layer of coating, install white granules into coating, next day install one more layer of coating to lock the granules into place.
H. All plastic drain baskets shall be replaced with cast iron baskets.
I. On single-ply roofs, Contractors shall leave the City of Mesa at least 5 square feet of material and all the solvents that we will need to do basic roof repairs.
J. All trees that are within 50 feet of a building should be trimmed to not grow towards the building. This is to help keep roofs clean and drain debris free.

78.00 SKYLIGHTS

A. The use of skylights shall be carefully evaluated with the PRCF PM prior to use on projects. If and when used, they must include guardrails per OSHA requirements. Depending on size and shape, use of burglar bars may be required. Skylight glazing shall comply with Mesa City Code.
B. Skylights should be a standard size of 2'x2' or 2'x4'. Custom skylights can cost up to 5 times more than standard sizes.
C. Flashing should be used and type and application must be approved my PRCF staff prior to installation.

Division 8 – Doors, Windows, and Glass

81.00 Steel Doors and Frames

A. All exterior doors shall have thresholds and weather-stripping. Brush type seals are preferred.
B. All hollow metal doors shall be a minimum of 16-gauge, closer hardware reinforced, and raceways for electric access controls. Interior doors shall be 18-gauge minimum.
C. All frames are to be fully welded; knockdown frames are not permitted unless approved by PRCF PM. Provide floor anchors always; ramset fastening is not permitted.
D. No doors shall have bottom vision lites. Provide minimum 6-inch stiles where vision lites are specified.
E. All typical and special frame conditions shall be illustrated on the drawings.
F. All exterior hollow metal frames will be 16 gauge, filled solid with grout.
G. All exterior door frames shall have drip caps at the frame head.
H. Aluminum storefront systems shall be heavy-duty systems. No sliding doors are allowed by the City.
I. Thresholds shall be no more than 1/2 inch in height.

82.00 Wood Doors

A. Wood door frames are not permitted unless approved by the PRCF PM.
B. The design consultant shall require shop drawings of all solid-core wood doors to be submitted for approval by the City. A cross-section sample of typical solid-core doors shall also be submitted for approval. This cross-section sample will be constructed to be the sample for all doors on the project.
C. Wood doors shall be flush, 1.75-inch-thick, solid core, with double side stiles and single top rails. Hardwood veneer wood doors shall have minimum 6-inch-wide side stiles where glass panels or vision lites are installed. Maximum vision lite size shall be 4-inch x 24-inch tempered or laminate glass.

83.00 Glass, Overhead, and Folding Doors

A. Avoid pivot hinges and floor closers on all glass/storefront doors unless approved by PRCF PM.

83.05 Access Doors

A. All access doors shall be metal and rated as required. Provide access doors to attics, roofs, crawl spaces, tunnels, and similar areas where the City's personnel must have access for maintenance or repair activities. Provide keyed locks on all access doors accessible to the public or in general office areas.

83.60 Overhead Doors

A. The use of manual chain operated doors is preferred unless the size is such that a power operated door would be required. Sectional doors shall be specified; no one-piece overhead doors will be used. Roll up doors to be lockable in the open and closed positions. All products shall be reviewed and approved by PRCF PM prior to fabrication and delivery to the site.
B. Four-fold and Bifold doors are acceptable in certain situations, however written approval must be obtained by the PRCF PM.

85.00 Windows

A. Typical exterior window profiles for City projects shall have a profile of flush glass to the outside. Windowsill or ledges are not recommended.
B. Insulated glazing is required on all City projects. Whenever possible interior-side removable glazing is preferred for ease of glass replacement and security.
C. No wood windows are allowed unless specifically approved by the PRCF PM.
D. Operable windows have to be approved by the PRCF PM.
E. All prefinished windows shall have protective coverings during construction.
F. Cut sheets for all proposed window types shall be submitted with the 60% submittal for approval prior to commencing with the construction document phase. Shop drawings shall require test results for water and air infiltration and certification that the windows meet the requirements of the steel or aluminum window institute.

87.00 Hardware

General Information

A. Finish hardware shall include all materials required for a fully functioning and secure installation for all swing, sliding, and folding doors. Exterior applications shall provide for a weatherproof installation. Standardize the system between buildings to minimize the number of keys required by the Facilities Maintenance Division.
B. If the existing hardware system does not conform to the approved manufacturers and models outlined in this section, install hardware types specified herein.
C. A complete hardware schedule shall be provided to the City of Mesa Facilities Maintenance Department with the 90% construction document submittal. The hardware schedule shall provide the following information: Door schedule including door type(s); door locking hardware, including finishes, make, model number, duty level (Grade 1), and function/use designation (office, storage, etc.) of each hardware item.
D. The construction documents shall include a complete set of maintenance instructions as needed for the City's continued maintenance of the hardware system.
E. The hardware specification shall include a statement to the effect that the supplier of finish hardware systems shall provide all items necessary for a complete and functioning system, which includes construction keyed cylinders. All installation shall be completed by the contractor.
F. No lock cylinders will be allowed at the base or head of any door. Overhead doors with base locks by manufacturer are allowed.
G. The City has first right of refusal to all existing hardware removed from a project. Plans and submittals shall be submitted to and reviewed by Facilities Locksmiths.
H. Products
I. The contractor shall install all locksets and test doors for proper latching. If door warpage, silencers, gaskets or smoke/sound insulators mounted on the door prevent the door from latching properly, the contractor will take proper measures to correct the problem prior to acceptance by the City. The City requires that the following door and hardware products be used. Any substitutions must be approved by the PRCF PM in writing.
    a. Key systems: Schlage LFIC-D145 keyway for C-cure doors. Use LFIC SC9 or SC4 for other standard doors. All permanent cores will be provided by the City. The architect shall coordinate with the PRCF PM on the key system for every building. The PRCF PM will establish the key hierarchy. Schlage LFIC: Keyway to be determined by FM Locksmiths, per City key master plan.

b. Locksets: Schlage ND series with Rhodes style levers and full-size interchangeable cores. Proper functions per opening. All exterior doors to have the 90 series Vandlgard feature. ND80JD-EU with RX on access control.
c. Cylinders: Schlage Rim 20-079 cylinders with brass temporary construction cores. Provide full-size interchangeable permanent cores 20-030 in 626 finish. Mortise Cylinders: L&N Escutcheons 30-008; For Outside 30-030. Typical unless otherwise stated.
d. Sectional Trim 30-138; For Outside 30-030+36-083+35-082-030. Typical unless otherwise stated.
e. Deadbolts: Schlage B660 series with full-size removable core in 626 finish. Proper functions per opening.
f. Anti-vandal pull trim: Von Duprin 996 Lever trim with night latch. E996 on doors with access control.
g. Panic/exit device: Von Duprin 99EO series rim panic exit devices in US26D finish. Von Duprin 99L-F-2 series rim exit devices in US26D finish on fire-rated openings. XP99 devices to be used on high abuse and high traffic areas. Von Duprin 99EL with RX switch on all doors with access control.
h. Mullions: Von Duprin KR 4954 key removable steel mullion with 299 strikes. For fire-rated doors use KR 9954 with 268 strikes. On aluminum systems use KR 5654 aluminum mullions with 299 strikes.
i. Surface closers: LCN-4041 EDA series (extra heavy duty) surface-mounted door closers in powder coated aluminum finish (689). Provide hold open arms (H) or stop arms (spring cushion) as required. Use LCN 4041 XP on all high abuse areas. The City requires the use of thru-bolts (TB) when mounting all surface applied door closers.
j. Automatic operators: LCN-4642 regular clear aluminum on all pull sides. Use LCN RF wireless wall plate actuator kit 8310-3856WS and RF wireless receiver 8310-865. No sliding doors allowed.
k. Continuous hinges for glass doors: Ives 702 full-surface or 704 half-surface stainless steel hinges on all exterior entry and high abuse areas (all other doors over 4 feet tall). Full-surface hinges should be cut high enough to allow door sweeps to cover the full width of the doors.
l. Hinges: Ives 5BB1HW 4.5 X 4.5 NRP heavyweight ball bearing hinges in 652 finish on all interior doors.
m. Overhead stops: Glynn-Johnson 900 series surface-mounted overhead stops or holders in 626 finish when required. Ives FB18S series heavy-duty floor-mounted stops at all exterior doors.
n. Wall stops: Ives WS401 series, concave wall stops in 626 finish as required.
o. Kick plates and Latch Guards: Ives 8400 series 12-inch-high heavy-duty steel kick plates required on all doors. Latch guards on all exterior doors with cylindrical locksets.
p. Hold open magnets: LCN 7850 die-cast housing, standard profile recessed wall mount. Tri-voltage design with 35 pound holding force.
q. Access control: City is currently using house software. Exceed ID readers, HID ISO prox credentials, AD and CO locks. Von Duprin 6300 electric strikes.

88.00 Glazing

A. Standard glazing colors shall be used in City projects. Approved standard colors are: clear, gray, bronze or Solar Ban 60 low E produced by PPG Industries or approved equal. Any substitutions shall be approved by the PRCF PM.
B. Where single glazing is specified, it shall be a minimum of 1/4 inch and be safety, laminated, or tempered glass.

C. Use 1/4-inch laminated or safety glass at all door side lites. The use of plastics in lieu of glass is discouraged. Exceptions may be approved by the PRCF PM. In those cases, use a polycarbonate compound with scratch-resistant UV coating.
D. For glass mirror installations, use mastic products that facilitate reglazing.
E. Window films will be considered on existing buildings where the replacement of windows may be cost prohibitive.
F. On new projects the minimum efficiency standard will be specified for East, West and South facing glazing (min U-value and SHGC).

89.60 Sloped Glazing Systems

A. Sloped glazing systems should be avoided on City projects unless approved by the PRCF PM.

89.70 Suspended Glazing Systems

A. Suspended glazing systems should be avoided on City projects unless approved by the PRCF PM.

Division 9 – Finishes

92.00 Drywall, Lath, and Plaster

A. All interior walls shall have 5/8-inch Type X drywall. All wet areas shall have 5/8-inch drywall blue board designed for wet areas.
B. Sheetrock to be tape jointed and primed before texture is applied with manufacturer's recommended primer.
C. Drywall texture shall be a smooth finish level 5. No other texture will be allowed unless approved by the PRCF PM.
D. No plaster finishes will be allowed unless approved by the PRCF PM.

93.00 Tile

A. Use standard tile sizes and colors. Complex patterns should be avoided. Samples of tiles shall be provided with 75% submittal. Any deviation from this requirement shall be approved by the PRCF PM. No mosaic tile will be used on restroom floors in City buildings. Provide cove bases in restrooms.
B. All epoxy tile grout must be sealed to prevent discoloration.
C. Provide an integral color epoxy grout in toilet rooms. Avoid the use of white or light-colored grouts.
D. Surplus tiles and grout colors shall be provided as required by the PRCF PM. 5% surplus should be provided to PRCF.
E. Seal grout and VCT tile per Manufacturer's specifications. Minimum number of coats shall be (4) four with minimum of (3) three coats of wax. Use standard drying time allotments between coatings in accordance with manufacturer's specifications.
F. In IT rooms, use anti-static VCT tile.
G. Samples must be provided to PRCF PM for approval prior to installation.

94.10 Terrazzo

A. Thin-set epoxy or cement terrazzo may be considered for use on City projects. If a thin-set product is used, the minimum thickness will be 3/8 inch. Non-slip topcoat to be used in wet environments. Product information needs to be reviewed by the PRCF PM.

95.11 Suspended Acoustical Ceilings

A. Whenever possible, use standard 2-foot x 4-foot x 5/8-inch drop-in, fissured acoustical tiles with white suspension "T" grid. Provide a screw attachment (two) at opposite corners of each lay-in light fixture.
B. All fire-rated suspended ceiling systems shall be able to be identified and differentiated from a nonrated system.
C. Troffer style light fixtures in a suspended acoustical ceiling shall be suspended separately from the suspended grid.
D. Surplus and/or extra stock: Provide extra stock from the same manufactured lot as all materials installed. Surplus material shall be enclosed in protective packaging with appropriate identifying labels. Verify quantity with the PRCF PM.

96.80 Carpeting

General

A. Provide 5% attic stock for all flooring installations.

Minimum Product Requirements

A. Carpet Material and Construction
    a. The following information is intended to provide the minimum quality desired by the City. Any substitution or deviation from these standards must meet or exceed, without exception, all performance requirements.
B. Materials
    a. Specify a minimum of 26-ounce or greater polyurethane primary carpet, backing, secondary backing, UPS block, Lifespan, and Teklok or better. Seam sealer must be used on all products. Dyed-Solution manufactured by Mohawk, Milikan, Shaw or equal must be submitted to the PRCF PM for approval.
C. Carpet Color
    a. Color may be selected by the design consultant from the manufacturer's standard mid-tone colors for simple patterns. The pile yarn shall be looped and composed of three different shades: a light shade, a medium shade, and a dark shade. These three shades may be in the same color tones, such as beige, brown and cocoa, or they can be in contrasting colors as long as they are light, medium, or dark.
D. Carpet Tiles
    a. If carpet tiles are used, they may be in 24-inch x 24-inch and attached to the slab or subfloor material to be easily removed and replaced. Approved manufacturers: Mohawk, Importance or approved equal.
    b. Mohawk First One Up II Tile, Color: 988 Importance

97.00 Resilient and Vinyl Flooring

General Requirements

A. Only first-quality resilient flooring, applied in strict accordance with the manufacturer's latest installation instructions. Verify surplus quantities with the PRCF PM.
B. Vinyl tile shall be minimum 1/8-inch-thick with thru-chip integral coloring. Approved manufacturers are Armstrong and Mannington Essentials or equal approved by the PRCF PM.
C. Luxury Vinyl Plank and Tile Flooring shall be from one of the listed manufacturers, Mohawk, Shaw, Mannington, and Armstrong.
D. Installation and Execution
    a. Subflooring leveling and/or patching: Do not use gypsum-based products for filling cracks and/or subfloor depressions. Use only epoxy or Portland Cement products.

99.72 Fiberglass Reinforced Plastic Wall Panels

A. Finish wall surfaces in all janitor closets and restrooms shall be Marlite FRP board, stainless steel (at sinks) or ceramic tile.
B. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.

a. Coating: Multi-layer print, primer, and finish coats or applied over-layer. Color selected by design professional.
b. Dimensions: Thickness – 0.090-inch (2.29 mm) nominal.

99.00 PAINTING

SUMMARY

Section Includes: Painting as specified and as noted on Drawings. Surfaces requiring finishing and left unfinished by the requirements of other Sections shall be painted or finished as part of the Work of this Section.

99.01 DEFINITIONS

A. Touch-Up: Painting of items missed by painter at no additional cost to Owner.
B. Re-Paint: Repairs to paint work for damages caused by other trades.

99.02 SUBMITTALS

A. Product Data: Submit schedule of manufacturers of products required for the Work, together with specifications recommended by each manufacturer.
B. Samples: Submit samples of each type of finish specified.
    a. Architect will furnish Contractor a color schedule of colors selected either from manufacturer's stock colors or specially requested color mixes before Work is begun.
    b. Submit six (4 to be retained) samples of each color, including the correct sheen and texture, on heavy cardboard. Submit sealer and stain finishes on material of the same quality and species of wood on which that particular finish shall be used. Rejected samples shall be resubmitted until approved.
    c. Samples shall be submitted at least 30 days prior to the start of painting work. Label and identify each sample as to location and application. Upon submittal of color samples, minor variations or changes in color selection may be requested by the Architect and new samples ordered, until final color approval.

99.03 QUALITY ASSURANCE

A. Standards: Preparation, application and workmanship shall be in accordance with manufacturer's recommendations and applicable provisions of the following:
    a. Painting and Decorating Contractors of America (PDCA) "Painting Specification Manual" and "Standards".
    b. PDCA P1-92, "Touch-Up Painting and Damage Repair - Financial Responsibility:" A properly painted surface shall be as defined in this Standard.
    c. PDCA P2-92, "Third Party Inspection Qualifications and Responsibilities."
    d. PDCA P3-93, "Designation of Paint Colors."
    e. PDCA P4-94, "Responsibilities for Inspection and Acceptance of Surfaces Prior to Painting and Decorating."
    f. PDCA P5-94, "Benchmark Sample Procedures for Paint and Other Decorative Coating Systems."
    g. Gypsum Association - GA210, "Gypsum Board for Walls and Ceilings."

99.04 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping: Deliver materials to site in manufacturer's sealed containers, legends and labels, intact.
B. Storage:
    a. Adequately protect against damage while stored at site.
    b. In no case shall the amount or method of materials stored exceed the amount permitted or the manner allowed by local ordinances, state laws, or fire underwriter regulations.

99.05 PROJECT/SITE CONDITIONS

A. Environmental Requirements: Do not apply exterior paint in damp or rainy weather or until after the surface has dried thoroughly from the effects of such weather.
    a. Do not apply varnish or paint when temperature is below 50 degrees F.. Avoid painting surfaces exposed to hot sunlight.
    b. During interior application, maintain minimum temperature of 65 degrees F. unless otherwise directed by Architect or manufacturer's printed instructions. Hold temperature as constant as possible.
    c. Provide adequate ventilation at all times so the humidity cannot rise above the dew point of the coldest surface to be painted.
    d. Moisture-containing surfaces, such as concrete, stucco and cement plaster shall have a moisture content of less than 8 percent as measured by moisture meter. Remove surface salt deposits prior to painting. Verify that pH is neutral, or within acceptable limits of Paint Manufacturer. Paint after thoroughly cured.

99.06 MAINTENANCE

A. Extra Materials: Upon completion of the Work, furnish Owner with one fresh gallon of each type and color of paint and finish used on this Project. Label containers with manufacturer's name, batch, color, shelf life, instructions, and cautions.

PRODUCTS

99.07 MANUFACTURERS

A. Furnish products of one of the following manufacturers, except as otherwise approved by Architect, subject to compliance with specification requirements.
    a. Dunn-Edwards Corporation

99.08 MATERIALS

A. Provide materials in accordance with the Schedule of Paint Products at the end of this Section as applicable to project. Contractor shall provide either waterborne or solvent borne products at contractor's option and as follows:
    a. Waterborne:
    b. Provide where low odor and fast dry are desired.
    c. Non-blocking materials shall be used for doors, door jambs, railings and other locations subject to handling, or where surfaces will come into contact with other painted surfaces or belongings.

d. Solventborne:
e. Provide where harder finish is required (such as "wet" areas) and odor will not create problems with occupants.
f. These products shall not be used where color retention is a concern. Verify with Architect.
g. Materials used shall comply with applicable Federal and local air pollution regulations, lead content laws, and current VOC requirements. If products listed in Schedule of Paint Products located at the end of this Section are not in compliance with regulations, laws, or requirements, Contractor shall notify Architect and shall provide information regarding substitute products.

B. Basic painting materials such as linseed oil, shellac, turpentine, thinners, driers, and other similar products, shall be of highest quality, made by reputable, recognized manufacturers, and have identifying labels on containers. Paint materials shall be factory fresh.
C. Alternate materials submitted for prior approval shall have qualities and materials equal to the other listed manufacturer's scheduled, top of the line, first quality products. Materials selected for coating systems for each type of surface shall be the products of a single manufacturer.
D. Standard Gloss Range: Provide paints in accordance with the following MPI standard ranges as measured in accordance with ASTM D523, and as indicated on the drawings:
    a. MPI Gloss and Sheen Standards Gloss @ 60º
    b. Gloss Level 5 – traditional semi-gloss 35-70 units
    c. (typical interior & exterior)
    d. Paints shall be ready mixed except for field catalyzed coatings.

Standard Paint Specifications

A. Primer for exterior will be Dunn-Edwards “UltraGrip,” Interior “Vinylastic.” Interior finish coating shall be “Suprema” by Dunn-Edwards.
B. Standard traffic paint color applications are as follows:
    a. Parking spaces: White, minimum 4-inch width
    b. Traffic/speed bumps: White
    c. Fire lanes: Red
    d. Handicapped spaces: Blue and White
C. Approved paint colors are all Dunn-Edwards:
    a. North Pond DE5870
    b. Ash Grey DEC751
    c. Antique Coin DE6270
    d. Almond Latté DE6143
    e. Pearl Necklace DEW343
D. Any other colors selected must be approved by PRCF representatives.
E. Use DE “Vinylastic” on all naked walls.
F. DE “UltraGrip” primer on walls with existing paint.
G. DE “Suprema” interior eggshell.

99.09 EXAMINATION

A. Verification of Conditions: Examine subsurfaces to receive Work and report in writing with a copy to Architect, conditions detrimental to Work. Commencement of Work will be construed as acceptance of subsurfaces.

99.10 PROTECTION

A. Before painting, remove hardware, accessories, electrical plates, lighting fixtures and similar items and protect.
    a. Provide “Wet-Paint” signs and other barricades and protections as required to protect adjacent surfaces and work of other trades, whether being painted or not.
    b. Mask permanent labels.
    c. Provide, distribute, and maintain a sufficient supply of clean drop cloths and other protective coverings.
    d. Protect foliage and other exterior finished surfaces from contact with cleaning materials and thoroughly flush with water after contact.
    e. On completion of each space, replace above items.

99.11 SURFACE PREPARATION

A. General:
    a. Surfaces requiring painting or finishing shall be thoroughly dry and cured, free of dirt, dust, rust, stains, scale, mildew, wax, grease, oil, deteriorated substrates, bond-breakers, efflorescence and other foreign matter detrimental to the coating’s adhesion and performance. Repair voids, cracks, nicks and other surface defects with appropriate patching material. Finish flush with surrounding surfaces and match adjacent finish texture.
    b. Spot prime marred or damaged shop coats on metal surfaces with appropriate metal primer.
    c. Determine moisture content of plaster, stucco, cementitious materials, wood and other moisture-holding materials by use of a reliable electronic moisture meter.
    d. Determine alkalinity of plaster, stucco and other cementitious materials by performing appropriate tests.
    e. Do not paint surfaces where moisture content or alkalinity exceeds that which is allowed by paint manufacturer.
B. Existing Surfaces:
    a. Clean, sand, patch, repair and prepare existing surfaces to be painted so that such existing finished surfaces are indistinguishable from new surfaces.
    b. Surfaces which cannot be prepared or painted as specified shall be immediately brought to the attention of the Architect in writing.
    c. Remove loose peeling and checked paint.
    d. Remove mildew by washing the surface with a commercially available mildew killer/remover.
    e. Remove efflorescence by wire brushing, power brushing or washing. Thoroughly rinse surfaces wire brushed. After removal of efflorescence, wash the surface with a commercially available cleaner acceptable to the manufacturer of the substrate.
    f. Remove existing wallcovering and wash the surface to remove paste residue. Seal surface before making any surface repairs.

g. Dull and roughen glossy surfaces to obtain proper adhesion by either sanding, washing with a tri-sodium phosphate solution, or treating with a liquid deglossing compound.
h. Overlap and feather edge spot-primed areas.

C. Wood:
   a. Sandpaper to smooth and even surface and then dust off. After primer or stain coat has been applied, thoroughly fill nail holes and other surface imperfections with putty tinted with primer or stain to match wood color. Sand woodwork between coats to a smooth surface. Cover knots and sap streaks with a thin coat of shellac, or seal with a suitable stain blocking sealer.
   b. Finish door and window edges after final fitting. Finish interior of cabinets in the same manner as the exterior unless otherwise specified. Seal interior of drawers unless otherwise specified.
   c. Backpriming:
      i. Back prime exterior woodwork, which is to receive paint finish, with exterior primer paint.
      ii. Back prime interior woodwork, which is to receive paint or enamel finish, with enamel undercoater paint.
      iii. Backprime interior and exterior woodwork, which is to receive stain and/or varnish finish with VOC compliant varnish acceptable to the Architect.
      iv. Back-prime wood trim before installation.
   d. Where existing stained surfaces are indicated to be coated with a transparent stain, test apply stain to small area where directed by Architect and obtain Architects approval of color.

D. Steel and Iron:
   a. Remove grease, oil, mill scale, rust and rust scale and touch-up chipped or abraded places on items that have been shop coated. Remove and reprime incompatible or damaged shop applied primers. Comply with the Steel Structures Painting Council's (SSPC) recommendations for cleaning of uncoated steel and iron surfaces.
   b. When area will be exposed to view, sandpaper the entire primed area smooth, feather the edge of surrounding undamaged prime coat and spot prime in a manner to eliminate evidence of repair.
   c. Where steel or iron at existing Work have a heavy coating of scale, remove by sand blasting, sanding, descaling, grinding or wire brushing, as necessary, to produce a satisfactory surface for painting.

E. Galvanized Metal and Aluminum:
   a. Thoroughly clean by wiping surfaces with a non-hydrocarbon solvent that will not leave an oily residue. Apply surface conditioner or vinyl-wash pretreatment as required for proper adhesion if required by paint manufacturer. Prime galvanized metal with galvanized iron primer as recommended by paint manufacturer. A test sample of the complete painting system should be applied and checked for adhesion before final painting begins.
   b. Clean visible portions of throats of galvanized steel ductwork with solvent; wipe dry with clean rags and paint flat black.

F. Concrete:
   a. The method of surface preparation shall be at Contractor's discretion, provided the results are satisfactory to the Architect, and the method is in compliance with applicable codes and requirements.
   b. Clean and prepare surfaces of tilt-up precast concrete wall panels to be painted by power washing surface to remove all efflorescence, chalk, dust, dirt, grease, oils and release agents.

c. Repair surfaces to be painted prior to application of prime and finish coat(s). Apply a tinted primer to the substrate to help identify surface imperfections. After the primer has thoroughly dried, patch, fill and repair surface imperfections to match and flush-out with adjacent finish texture and profile.
d. Before first paint coat is applied, spot prime nails and other exposed metal occurring in the surfaces with a rust inhibitive primer as recommended by paint manufacturer.

G. Plaster and Gypsum Board Surfaces:
   a. Fill cracks, holes or imperfections with compatible patching material and smooth off to match adjoining surfaces. Before painting, surfaces shall be first tested for dryness with a moisture testing device.
   b. Apply no paint or sealer on gypsum board or plaster when the moisture content exceeds 8 percent. Test sufficient areas in each space and as often as necessary to determine if the surface has the proper moisture content for painting. If the moisture content is between 8 percent and 12 percent, prime with alkali resistant primer.
   c. If 8 percent or less, prime with specified primer. Remove the dry salt deposits from plaster surfaces by brushing with a stiff brush before painting.

H. Acoustical Surfaces (Lay-in acoustical ceiling panels, acoustical wall panels, etc.):
   a. Thoroughly vacuum clean surfaces to remove dust and debris from acoustical surface pores. Use a soft brush attachment that will not damage or loosen acoustical surface.
   b. Seal surface stains with a suitable stain blocking sealer that will not fill pores of acoustical surface.

99.12 WORKMANSHIP

A. Apply products to achieve paint manufacturer's printed specifications for dry mil thickness
B. Apply each coat of paint evenly and comply with manufacturer's drying time before applying subsequent coats.
C. Finished work shall be uniform, match approved color, texture and coverage, and free from runs, sags, clogging or excessive flooding. Make edges of paint adjoining other materials or colors sharp and clean, without overlapping. Where varnishes or enamel is used, lightly sand, dust and clean undercoats to obtain a smooth finish coat. Sand carefully between each coat of finish on smooth surfaces for good adhesion of subsequent coats.
D. Where clear finishes are required, ensure tinted fillers match wood. Work fillers well into the grain before set. Wipe excess from the surface.
E. Where specific mil thicknesses are required, check thickness by the following methods:
   a. Over ferrous metal - Elecometer Film Gauge
   b. Other surfaces - Tooke Dry Mil Inspection Gauge

99.13 APPLICATION

A. The number of coats scheduled is the minimum number of coats required. Additional coat(s) shall be applied, at no additional cost to the Owner, to completely hide base material, provide uniform color and to produce satisfactory finish results.
B. Apply coatings without thinning except as specifically required by label directions, or required by these specifications. In such cases, thinning shall be the minimum reduction permitted.
C. Priming will not be required on items delivered with prime or shop coats, unless otherwise specified. Touch up prime coats applied by others as required to ensure an even primed surface before applying finish coat.
D. Block Fillers: Provide level of block fill as scheduled to conform with the following:
    a. Level 1 – Regular Fill: Minimum block fill, reduces irregularity in masonry profile. One coat, spray applied.
    b. Level 2 – Medium Full Fill: Masonry profile slightly reduced. One coat, spray applied and back-rolled.
    c. Level 3 – Full Fill: Minimum block fill required for semi-gloss and gloss finishes. Use where conformance with health regulations is required. Number of coats as required to conceal most of masonry texture, spray applied and back-rolled.
E. Plumbing, Mechanical and Electrical:
    a. Exterior and interior exposed water, gas, waste piping, sprinkler piping, conduit, lighting and electrical panels, telephone terminal boxes, galvanized ducts and insulated ducts, shall be painted in areas other than mechanical rooms, unless otherwise scheduled.
    b. Paint exposed unfinished fixtures, metal ducts, switch boxes, control panels, devices, starters, junction boxes, vents, drains, and other similar items, as directed by Architect.
F. Spray paint prime coated (not pre-finished) grilles and registers with enamel or lacquer to match walls and ceilings. Paint materials shall not sag, run or bind movable parts of grilles, registers, louvers, baffles and other similar items.
    a. Throats of ducts shall be given one coat of flat black paint, wherever visibility of the interior of the duct is allowed through registers or other similar items. At fiber lined duct, use black latex paint.
    b. Examine the Mechanical and Electrical Drawings and Specifications to determine the amount of exposed work to be painted.
G. Paint exposed surfaces of every member, paint items inaccessible after installation before installation, if required to be painted. Paint all exposed surfaces of overhead roof or floor structures, including deck, except where specifically indicated not to be painted.
H. Edges, tops, and bottoms of wood doors shall be sealed and finished with the same finish as the door faces, to meet door manufacturer's warranty requirements. Verify edge color with Architect as different colors may be selected for each face.
I. Paint items fitted with finish hardware after hardware has been temporarily removed.
J. Heating and other equipment on or adjacent to walls or surfaces scheduled for painting, shall be disconnected, using workmen skilled in appropriate trades and moved temporarily to permit painting of surface. Following completion of painting, replace and reconnect items.
K. Each succeeding pigmented coat shall be distinguishably lighter than the previous coat. Tint prime and undercoats to a color similar to finish coat. Each coat of material applied must be inspected and approved by the Architect before the application of the succeeding specified coat; otherwise no credit for the

concealed coat will be given, and the Contractor shall assume the responsibility to recoat work in question. Contractor shall notify the Architect when each coat is completed.

L. Brush, wipe or roll stain in 2 coat application. Avoid lap marks by maintaining "wet-edge" continually being merged with existing liquid coverage and stop only at natural edges, turns and breaking places.
M. Do not paint over Underwriters' Laboratory labels, fusible links, exposed sprinkler heads and other similar items.
N. Paint piping, electrical or other equipment, conduit, vents and other similar items, on roof or other exterior locations as directed by Architect.
O. Finish closets and the interior of cabinets with same color as adjoining rooms, unless otherwise specified. Finish other surfaces same as nearest or adjoining surfaces, unless otherwise shown or scheduled.
P. Paint surface of walls which will be concealed by cabinets and other items mounted on or attached to walls.

99.14 ADJUSTING

A. At completion, do touch-up and re-paint work and leave finish surfaces in good condition.

99.15 CLEANING

A. During the course of the Work, remove misplaced paint and stain spots or spills. Leave Work in clean condition acceptable to Architect.
B. Remove oily rags and waste daily, taking precaution to prevent fire.

99.16 SCHEDULES

A. Color Schedule:
    a. Architect will provide a complete schedule of colors. Interior colors shall be selected from list of Owner’s standard interior colors. Exterior colors may be selected from various manufacturer's color palettes. Manufacturer supplying paint shall match these colors. Contractor shall prepare duplicate set of samples of treatments for major surfaces. If a specific surface or item receiving a paint finish does not have a specific color indicated or selected by the Architect, obtain clarification from the Architect. Do not assume the confirmation of the same color on the adjacent surfaces.
    b. Final coat of paint shall be not be applied until colors have been approved by the Architect.
B. Schedule of Finishes: Refer to the "Finish Schedule" on the Drawing for designated finishes of areas.
C. Finishing of the following listed items and materials will not be required and shall be protected:
    a. Stainless Steel, brass, bronze, copper, monel, chromium, anodized aluminum; specially finished articles such as porcelain enamel, plastic coated fabrics, and baked enamel, unless otherwise indicated.
    b. Finished products such as ceramic tile, glass, brick, resilient flooring and acoustical tiles, board and metal tees.
    c. Pre-finished products such as wood folding partitions and doors, wood classroom and laboratory casework, bleachers and elevator cabs.

99.17 EXTERIOR PAINT FINISHES

A. This schedule uses the generic names listed in the Schedule of Paint Products.

B. System 101 (Ferrous Metals): Apply to exposed steel such as beams and column connectors, metal doors and frames, grilles, light fixture standards in parking areas, metal handrails, sectional and coiling doors, canopy overhangs and other exposed miscellaneous ferrous metals that are not pre-finished.
    a. 1st Coat: Ferrous Metal Primer (ULTRA-GRIP Premium).
    b. 2nd Coat: Same material as 3rd coat in accordance with manufacturer's recommendations.
    c. 3rd Coat: Semi-Gloss unless noted otherwise ARISTOSHIELD.
C. System 102 (Galvanized Metals): Apply to exposed galvanized metal such as copings, louvers and metal flashings.
    a. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment (if required by paint manufacturer).
    b. 1st Coat: Galvanized Metal Primer.
    c. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.
    d. 3rd Coat: Semi-Gloss unless noted otherwise ARISTOSHIELD.
D. System 103 (Aluminum): Apply to exterior louvers and other miscellaneous exposed exterior unfinished aluminum surfaces.
    a. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment.
    b. 1st Coat: Aluminum Primer.
    c. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.
    d. 3rd Coat: Semi-Gloss unless noted otherwise ARISTOSHIELD.
E. System 104 (Concrete Masonry Units): Apply to exterior concrete masonry unit construction indicated to be painted. (Refer to Section 07 19 00 “Water Repellents” for water repellents to be applied prior to painting.) Roller apply 2nd or 3rd coat.
    a. 1st Coat: Concrete Masonry Block Filler. Provide Level 2 or 3 Fill as required by gloss.
    b. 2nd Coat: Same material as 3rd Coat as recommended by manufacturer.
    c. 3rd Coat: Semi-Gloss unless noted otherwise EVERSHIELD.
F. System 105 (Concrete and Stucco): Apply to exterior cementitious surfaces as indicated or noted, including tilt-up precast concrete. Precast concrete lintels, beams, caps, sills, etc. at exterior of buildings shall not be painted, unless specifically noted. (Refer to Section 07 19 00 “Water Repellents” for water repellents to be applied prior to painting.) Roller apply 2nd or 3rd coat.
    a. 1st Coat: Concrete and Masonry Primer.
    b. 2nd Coat: Same material as 3rd coat as recommended by manufacturer.
    c. 3rd Coat: Semi-Gloss unless noted otherwise EVERSHIELD.
G. System 106 (Exterior Wood): Apply to wood fascias, soffits, trim, wood posts, columns, beams and exposed trim and framing where indicated to be painted.
    a. 1st Coat: Exterior Wood Primer - Waterborne (100% Acrylic) unless noted otherwise.
    b. 2nd and 3rd Coats:
    c. Flat - Rough-Sawn Wood: Paint, Flat - Waterborne (100% Acrylic) unless noted otherwise. Sheen shall be 4 to 6% per a 60 degree gloss meter.
    d. Semi-Gloss - Smooth Surface Wood unless noted otherwise: Enamel, Semi-Gloss - Waterborne (100% Acrylic - Non-Blocking).
H. System 107 (Exterior Gypsum Board): Apply to exterior grade gypsum board soffits.
    a. 1st Coat: Exterior Gypsum Board Primer/Undercoater – Waterborne unless noted otherwise.
    b. 2nd and 3rd Coats: Semi-Gloss unless noted otherwise EVERSHIELD. One of the coats shall be roller applied.

99.18 INTERIOR PAINT FINISHES

A. This schedule uses the generic names listed in the Schedule of Paint Products.
B. System 201 (Ferrous Metals): Apply to exposed metals such as steel doors, hollow metal frames, metal beam saddles, columns, grilles and registers, stair and hand railings, ladders, and other exposed miscellaneous metals.
    a. 1st Coat: Ferrous Metal Primer ULTRA-GRIP Premium.
    b. 2nd Coat: Same material as 3rd Coat as recommended by manufacturer.
    c. 3rd Coat: Semi-Gloss unless noted otherwise EVERSHIELD.
C. System 202 (Interior Wood Finishes - Enamel): Apply to wood door frames, columns, exposed and concealed casework and millwork, wood-window wall construction, medium density plywood surfaces, shelving, roll-up wood doors, perforated and plain type hardboard, particleboard and other exposed miscellaneous wood and trim, except wood specified for a transparent or stain finish.
    a. 1st Coat: Enamel Undercoater.
    b. 2nd and 3rd Coat: Semi-Gloss unless noted otherwise EVERSHIELD.
D. System 203 (Interior Wood Finish - Flat): Apply to plywood telephone backing boards and other miscellaneous softwood as noted, specified or scheduled.
    a. 1st Coat: Enamel Undercoater/Primer.
    b. 2nd and 3rd Coat: Flat Paint, SPECTROSHIELD.
E. System 204 (Galvanized Metals): Apply to exposed galvanized metal.
    a. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment (if required by paint manufacturer)
    b. 1st Coat: Galvanized Metal Primer
    c. 2nd and 3rd Coats: Semi-Gloss unless noted otherwise ARISTOSHIELD.
F. System 205 (Aluminum): Apply to interior louvers and other miscellaneous exposed unfinished aluminum surfaces.
    a. Clean metal to remove foreign matter or any coating applied by the metal manufacturer. Apply Surface Conditioner or Vinyl Wash Pretreatment.
    b. 1st Coat: Aluminum Primer
    c. 2nd and 3rd Coats: Semi-Gloss unless noted otherwise ARISTOSHIELD.
G. System 206 (Gypsum Board, Plaster and Concrete - Wet Areas): Apply to gypsum board, plaster and concrete surfaces in toilet rooms, janitor rooms, kitchens, and other areas as scheduled.
    a. 1st Coat: Enamel Undercoater – ULTRA-GRIP Premium.
    b. 2nd and 3rd Coats: Semi-Gloss: Semi-Gloss unless noted otherwise EVERSHIELD.
H. System 207 (Gypsum Board, Plaster and Concrete - Non-Wet Areas): Apply to gypsum board, plaster and concrete except for wet areas.
    a. 1st Coat: Waterborne Primer/Sealer. ULTRA-GRIP Premium.
    b. 2nd and 3rd Coat: Semi-Gloss unless noted otherwise EVERSHIELD.
I. System 208 (Ferrous Metal - Chemical Resistant Finish): NOT USED
J. System 209 (Interior Concrete Masonry - Wet Areas): Apply to concrete masonry block units in kitchen, toilet rooms, bathrooms, janitor rooms, vestibules and other walls noted for enamel finish.
    a. 1st Coat: Block Filler, w/o Aggregate. Provide Level 3 Full Fill.
    b. 2nd Coat: Primer/Sealer or same material as 3rd Coat as recommended by manufacturer.
    c. 3rd and 4th Coats: Enamel, Semi-Gloss EVERSHIELD.
K. System 210 (Interior Concrete Masonry or Plaster - Extremely Wet Areas): Apply to surfaces such as showers.

a. 1st Coat: Block Filler, w/o Aggregate - Solventborne (Polyamide-Epoxy) Provide Level 3 Full Fill.
b. 2nd and 3rd Coats: Enamel, Gloss - Solventborne (Polyamide-Epoxy).

L. System 211 (Interior Concrete Masonry - Non-Wet Areas): Apply to exposed interior concrete masonry block units except areas specified above for enamel finish.
   a. 1st Coat: Block Filler, w/o Aggregate. Provide Level 1, 2 or 3 Fill as required by gloss.
   b. 2nd Coat: Same material as 3rd Coat as recommended by manufacturer.
   c. 3rd Coat: Enamel, Semi-Gloss EVERSHIELD.

M. System 212 (Acoustic Ceilings): Apply to existing acoustic panel or tile ceilings.
   a. 1st and 2nd Coat: Acoustic Paint.

99.19 CLEAR WOOD FINISHES

A. This schedule uses the generic names listed in the Schedule of Paint Products.

B. System 301 (Stained and Clear Finish): Apply to wood doors, handrails and chair rails. Fill open grain hardwood such as Oak.
   a. Stained and Finished with Clear Satin or Gloss Varnish - Solventborne:
   b. 1st Coat: Semi-Transparent Stain - Solventborne (Oil)
   c. 2nd Coat: Varnish, Gloss – Polyurethane (Solventborne)
   d. 3rd Coat:
      i. Satin: Varnish, Satin – Polyurethane (Solventborne)
      ii. Gloss: Varnish, Gloss – Polyurethane (Solventborne)
   e. Stained and Finished with Clear Satin or Gloss Varnish– Waterborne:
   f. 1st Coat: Semi-Transparent Stain - Solventborne (Oil)
   g. 2nd Coat: Varnish, Gloss – Polyurethane (Waterborne)
   h. 3rd Coat:
      i. Satin: Varnish, Satin – Polyurethane (Waterborne)
      ii. Gloss: Varnish, Gloss – Polyurethane (Waterborne)

99.90 Adhesives

A. All adhesives used in carpeting, tile, resilient flooring, and base shall be approved by the flooring product manufacturer and applied per the manufacturer's recommendations. Low or no VOC.

B. Specified adhesives shall have minimum Volatile Organic Chemical (VOC) releasing characteristics. Verify with information available from the flooring product manufacturer and provide a copy to the PRCF PM.

C. Adhesives shall not contain asbestos properties.

Division 10 – Specialties

101.60 Toilet Compartments and Urinal Screens

A. Toilet stalls shall be solid plastic/polymer and ceiling mounted or floor mounted with approval by PRCF PM. Parks Facilities will use metal partitions. Provide structural support as necessary and approved by manufacturer. Stall doors shall have accessible operating hardware including U-pulls on both sides and flip-over or sliding locks that do not require grasping, pinching, or twisting motions. Colors as approved by the PRCF PM. Stalls may be floor mounted with PRCFPM approval.
B. Urinal screens shall be solid plastic/polymer and wall mounted. Secure the screens to the wall and provide structural backing at each screen. Colors as approved by the PRCF PM.
C. Public park restrooms shall have brushed stainless steel partitions and piano hinges.

103.50 Flagpoles

A. Flagpoles may be considered at all new facilities. Verify specific requirements and locations with the PRCF PM.
B. Flagpoles shall be anodized aluminum. Maximum height: 30 feet. Design for local wind loading requirements.
C. Provide lighting of the flag as required by national codes. Use all LED fixtures. Ground lighting is NOT APPROVED. Top mounted downward facing, lighting shall be used on all new flagpoles.

104.00 Signage and Graphics

A. All building signage must comply with Americans with Disabilities Act requirements.
B. All exterior address numbers must comply with City of Mesa Fire Department requirements.
C. All room signage shall be zinc, PVC or equal and attached with mechanical means that allow for removal and relocation if necessary.
D. All room and/or other signage shall be of uniform color and lettering.
E. In renovation and/or addition projects, signage must match the existing signs colors, material, style, and lettering.
F. All exterior signage must be approved by the PRCF PM and using agency.
G. Room numbers and titles shall be coordinated with the PRCF PM and using agency.
H. All interior room signage shall include maximum occupancy, room number, contrast color, no smaller than 7” x 5”, and be mounted by main entrance and exit to assembly areas.

105.22 Fire Extinguishers

A. All fire extinguishers in new construction shall be placed in fully or semi-recessed lockable steel cabinets. Provide acoustical and fire separation as required.
B. Fire extinguishers in renovated areas shall be lockable, fully or semi-recessed steel cabinets. No surface-mounted cabinets are permitted, which protrude more than 4” per ADA.
C. Include addition of at least one AED defibrillator in each building.

108.00 Toilet and Bath Accessories

General information

A. The construction documents shall show all toilet accessories and their placement in accordance with their actual sizes and proportions and meeting ADA requirements.
B. No recessed or semi-recessed toilet paper, sanitary napkins, or paper towel dispensers are acceptable. Only surface mounted units shall be used.
C. Specified Waxie Products:
    a. Foam Soap dispenser (1250ml refills):
        i. Black #386315
    b. Toilet Paper dispensers:
        i. Compact Side-by-Side 2-roll Coreless – Black #56784A
        ii. Compact Vertical Double Roll Coreless – Smoke #56790
        iii. Twin 9” Jumbo Roll – Smoke #851143/59210
    c. EnMotion Paper Towel dispenser:
        i. Black #59462A
        ii. Jr size #855120
    d. Seat Cover dispenser
        i. Black or Smoke #851585
    e. Feminine Product dispenser:
        i. Hospeco Feminine Hygiene Dual Vendor (10”w x 26.25”h x 7.75”d) White #820050
    f. Feminine Waste dispenser:
        i. Bobrick Rectangular partition mounted (7.5”w x 10”h x 3.81”d) Stainless Steel #820705
        ii. Metal Floor House Disposal Receptacle #820720
    g. Trash receptacles:
        i. Slim Jim 23-gallon waste dispenser, Grey 73004
        ii. Brute Round Vented 44-gallon container, Grey 730615
        iii. Rubbermaid Round 44-gallon trash can, Mfg. model #FG264356GRAY
    h. FM does not supply shower curtains or floor mats.

Products

A. All toilet and bath accessories shall match existing brand and model as is maintained by the City's current custodial contractor. Contact the PRCF PM for current availability and a listing of equipment.
B. If electric hand dryers are used, they shall be a blade type similar to Dyson airblade AB14 or equal. Verify with the PRCF PM.

Division 11 – Equipment

111.55 Gate Operator Equipment

A. The following manufacturer is the only unit approved. No substitutions will be allowed. Coordinate with the PRCF PM for full specification.
B. Hy-Security gate operator model Slide-Driver (222-SS ST) with Smart touch controller. The weight of the gate shall be considered, and if it exceeds 3,000 pounds, select a SlideDriver 80 operator.
C. Emergency vehicle optical detection system Tomar Model 2759-2. No substitutions.
D. Safety loops should be installed in concrete. Existing asphalt should be removed and replaced with an 8-inch-thick concrete pad with turned down edge poured in place. Three spare 1-inch conduits shall be installed for future use across the driveway. Where concrete cannot be installed use traffic rate loops.
E. Photo eye sensors should be of a transmitter/receiver style, not a reflector style.
F. Electrical enclosure: All wiring within the enclosure shall be wrapped with rodent-resistant spiral wrap to prevent damage. This includes safety loop wiring and photo-sensors.
G. Drive Rail: If the gate has to operate on any incline, the rail shall be drilled per the manufacturer's recommendations in order to allow the wheels to grip the track during wet conditions (slopes over 2% will not be accepted).
H. Pressure gauges for diagnostics shall be fluid-filled type.
I. All wiring shall be landed on terminal blocks; wire nuts are not allowed. All wiring shall be labeled to coincide with gate operation sequence. All wiring shall be clearly tagged and identified to match the control system.
J. Provide a voltage drop calculation to show the voltage drop shall not be more than 1% under full load current. If a site backup generator is present the gate shall be provided with power from the backup distribution system. Battery operated gates should only be used at sites without backup power.
K. Field Control: Final review of gate operation shall be viewed and approved by PRCF PM, who will witness the commissioning process and provide signoff for final approval.

111.60 Loading/Unloading Dock Equipment

A. All building projects must satisfy the need or verify the availability of off-street loading/unloading zone(s) and/or loading dock equipment as part of the construction contract. Specific requirements must be verified with the PRCF PM and using agency.

111.72 Dumpsters and Waste Compactors

A. All building projects must provide an area specifically designed for waste, trash, and recycling containers to meet the City of Mesa zoning requirements, if no existing waste disposal area can be used for this purpose. The area must be screened from public view yet easily accessible for City collection or disposal operations. Specific requirements must be verified and coordinated with the PRCF PM. Coordinate with the Environmental Management and Sustainability. Refer to City of Mesa standard detail M-62.

111.73 Waste Containers

A. All building projects must provide areas specifically designed for waste, trash, and recycling containers at interior and exterior locations of the building envelope. This consideration is to allow for common use whether by building visitors or building occupants. Special consideration shall be exercised when determining quantities, size and locations. Occupancy loads shall be referenced when determining quantities and locations.

B. All containers shall be located on an accessible path of travel per the ADA and Building Code. Care should be given to locate containers away from exit doors, elevators, or in areas that may impede movement in the event of an emergency. Containers shall not be placed in stairwells. Design of interior recess areas designated for wastebaskets should be considered and applied.

C. Common containers for interior spaces stay at or under 28 gallons. Containers for exterior spaces shall stay around or under 40 gallons.

D. Specific style of containers must be verified with the PRCF PM and using agency. This will be part of the submittal process.

Division 12 – Furnishings

Projects provides information.

Division 13 – Special Construction

Projects provides information.

Division 14 – Conveying Systems

14200 Elevators

A. Otis, Dover, Kone and Shindler equipment is recommended for passenger and freight elevators; Savaria equipment for Vertical Platform Lifts (VPL). All elevator specifications must be reviewed by the PRCF PM prior to completion of construction documents.

B. Cab dimensions shall be large enough to handle large equipment for maintenance and moving of furniture and medical gurneys. When two or more elevators are installed in a building, at least one of them shall be oversized. The other elevator can be standard height and width.

C. Elevator loading should be project specific. For multilevel treatment, plants, or high ceiling industrial operations, the cabs should have a load capacity well above normal with a width and height of 7 feet 0 inches and a depth able to carry a scissor lift weighing 5,000 pounds. All loads shall be approved by the PRCF PM.

D. Finishes in cabs shall be of durable materials that are easily maintained and replaced. Floors shall be of carpet tiles or high traffic rubber tiles. The City will consider alternative materials that are durable yet stylish. LED light fixtures are required for lighting.

E. When hydraulic elevators are used, the machine or equipment room should always be located next to the elevator shaft so that hydraulic lines have the shortest distance to connect. Sump pumps should be external if at all possible, for ease of maintenance, testing, and replacement by City staff.

Division 15 – Mechanical and Plumbing

150.00 General Requirements

A. Division 15 mechanical and plumbing systems shall be designed to minimize energy usage and maintenance requirements.
B. Division 15 designs and specifications shall comply with the International Energy Conservation Code edition adopted by the City of Mesa and all ADA standards at the time of permitting.
C. Maintenance requirements shall be considered by the designer at the schematic, design development, and construction document design phases as follows:
D. All equipment shall be drawn on mechanical and plumbing plans to correct scale. All equipment maintenance access requirements shall be shown on plans to scale as a hatched area and identified on the plans as areas to be maintained clear of all obstructions. Filter access areas shall be drawn and identified on the plans. These access areas will be clearly depicted in the plan and on elevation views of all Division 15 plans at schematic, design development, and construction document phases of the plan development.

150.60 Pipes and Pipe Fittings

HVAC Piping

A. HVAC chilled water piping shall be steel, shall be painted when outdoors, shall include flow arrows, and shall feature flanged, welded, or Victaulic grooved joint connections and fittings. Exterior chilled water piping shall be insulated with aluminum jacketed protected cover.

Open Circuit Cooling Tower/Chiller Condenser Water Piping

A. For condenser water piping applications in shared cooling towers, the City of Mesa Facilities Maintenance Department prefers solid walled Schedule 80 PVC or CPVC pressure-rated pipe to be specified and used for any segments of the piping that may go seasonally dry and/or periodically out of service and if the conditions of service allow PVC or CPVC use. PVC and CPVC joints shall be solvent cemented per the manufacturer.
B. In outdoor environments, protect the pipe from the sun’s rays with an approved metallic shield, adhesive-backed aluminum tape, or adhesive-backed aluminum sheet wrap. Alternately a coat of water-based latex paint may be used if applied consistently with the pipe manufacturer's recommendations. To ensure a leak-free system, specify that the installer completely follow the manufacturer’s joining and installation instructions.
C. In testing any PVC piping systems, test hydrostatically—DO NOT TEST WITH AIR.
D. Most condenser water systems contain bactericides or chemical treatment compounds. Make sure these additives are compatible with the PVC or CPVC piping system and add that specification to any water treatment specifications for the project. Engineer shall verify prior to specifying PCV or CPVC that the fluid velocity must not exceed 5 FPS. or blocked thrust can separate joint/fittings. PVC and CPVC expansion is substantially greater than steel and iron pipe so this must be considered in the PVC or CPVC design with adequate use of restrained expansion joints especially in long straight runs.

E. Increase frequency of pipe supports as needed. Require slip ends to be beveled [to not scrape off the glue during insertion], specify the correct glue, and require forced insertion tools on large diameters — all per the pipe manufacturer's instructions.
F. Employ an over temp limit control sequence on the condensing water pumps to alarm and then to shut them down in the event condensing water exceeds the engineer's determined safe maximum limit temperature to avoid melting and/or distorting and/or failing the PVC/CPVC piping.
G. Do not utilize strap-on temperature sensors. All sensors shall be installed in metal wells or put the strap-on sensor on metal pipe portions of the system. Do not exceed the engineered strength of the PVC or CPVC products or allow poor installation practices.
H. Specify that any flanges utilized shall be tightened carefully using torque wrenches per the manufacturer's recommended practice. Require PVC and CPVC installers to attend manufacturer's training for the product and to submit proof of training as part of the project submittals. Do not employ PVC or CPVC on any hot or heated water systems.

Condensate Piping

A. Condensate piping shall be Type L hard copper with brazed silver solder connections. Do not use compression or crimp fittings. Exception: Condensing furnaces and boilers shall include a PVC condensate drain installed upstream from condensate neutralization tanks. Type L copper shall be installed downstream from the neutralization tank.
B. All condensate piping shall be provided with readily accessible removable threaded cleanouts at the equipment trap, at all 90□ turns and at convenient and accessible locations along the runs to assist Facilities Maintenance activities. HVAC plans (or plumbing plans) shall depict the condensate piping and shall clearly depict cleanout locations. Access doors shall be shown when required to access the cleanouts.
C. All condensate drains shall be Type L copper piping. If equipment is condensing furnace or condensing boilers, units shall be provided with neutralization traps. Do not use compression or crimp fittings.
D. Condensate drain lines shall be insulated to 10 feet from cooling coils. All exterior condensate drain lines shall be insulated and provided with an aluminum jacket. Provide aluminum jacket with moisture barrier. Seal all seams with exterior rated clear silicone caulking. Installation shall be weathertight.
E. All copper piping outdoors shall be Type K hard and painted black.

Sanitary Waste and Vent

A. All underground sanitary waste piping shall be closed cell PVC piping. Cast Iron and ABS piping may not be allowed underground.
B. Sanitary waste and vent piping above ground shall be closed cell PVC piping. All piping, fittings, and couplings shall be of domestic origin only. All couplings shall be heavy-duty Husky brand or equal of heavy-duty grade only.
C. All single and ganged restrooms shall be provided with a main cleanout on the wall in an accessible location on the men's room side.
D. All sink and lavatories shall be provided with adjustable chrome-plated cast brass p-traps with cleanout plugs.
E. All ADA sinks shall be provided with cleanable white plastic pad covers on tailpieces and plumbing connections.
F. Solid core PVC preferred material for use above and below grade. Some areas may require PVC piping to be fire wrapped per International Fire Code.

Roof Drainage

A. The roof drainage piping and roof overflow drainage shall be solid-core schedule 40 PVC. If piping is routed through plenum areas, the piping shall be cast iron. No polyethylene or plastic fixtures or strainer baskets with be allowed.
B. Roof drains shall not be discharged to a sidewalk surface or similar locations where the water may run across a walkway and create a slip hazard. The roof drain designer shall coordinate with the architect and civil engineer to design systems to carry roof drainage a minimum of twenty feet (20') away from the side of the building underground and collect and connect the roof drains into underground storm drainage systems.
C. Where no such underground storm drainage systems are available, the roof drain and gutter leaders shall discharge to containment areas or landscaped areas and shall be provided with concrete splash blocks to prevent erosion.

Domestic Water Supply

A. Domestic water piping shall be Type L copper piping and fittings. Piping shall be brazed with silver lead-free solder. Press crimping fitting will not be allowed. No polyethylene piping or fittings are allowed for domestic water piping. Piping outdoors shall be Type K copper painted black. Underground service shall be type K. Fire lines and all domestic services before the meter shall be DIP.
B. All restrooms and isolated plumbing fixtures shall be provided with isolation valves. Locate valves above ceilings or in walls with access panels. Access panel shall be a minimum of 12 inches x 12 inches or larger to accommodate the valve size. All valves shall be located in accessible locations.
C. The isolation valves for the women's restrooms shall be located in the men's restroom or in the hallway above the ceiling. All valves shall be located in accessible locations.
D. All domestic water piping shall be labeled with flow directions and service.
E. All new domestic water lines will need to be bac T tested and test results submitted to PRCF PM
F. R.O. water systems are not allowed except for laboratories.
G. Domestic water supply shall be designed with two separate meters; one to supply the building and a second meter for the irrigation system to avoid higher sewer charges.

Compressed Air

A. Compressed air piping shall be Type L copper or steel. PVC, ABS, and plastic piping will not be allowed for compressed air.
B. Compressed air drops shall be provided with air regulator/filter/condensate trap unit.
C. All air-drops shall be provided with dirt leg with full port valve and plug.

151.00 Valves, Cleanouts, and Specialties

A. Domestic water isolation valves shall be rated Class 150 WOG or greater, brass with 316 stainless steel ball valves.
B. All valves shall be labeled with the area served. The tag shall be a 1-1/2 inch x 1-1/2 inch brass ID tag.
C. Approved domestic water isolation valve manufacturers are the following: Apollo, NIBCO, Watts, and Red & White.
D. Grease interceptors shall be provided with an upstream cleanout for maintenance to add enzymes as needed.
E. The exterior cleanout on the sanitary waste line shall be provided with 12-inch x 12-inch x 4-inch concrete base surrounds. All cleanouts shall be metal when exposed outdoors, with a brass screw-in plug.

151.70 Motors

A. All motors shall be IECC compliant, latest edition. All motors rated over 3 hp shall be NEMA premium efficiency. Motors used in VFD service shall be inverter duty rated and include shaft grounding brushes.

152.00 Insulation

A. Duct insulation shall meet the minimum IECC requirements. Exterior duct insulation shall be 1-1/2-inch-thick minimum; duct lining for acoustics shall be 1 inch minimum, installed 15 feet upstream and downstream from Supply/Return/Relief Fans.

B. Pipe insulation shall meet the minimum IECC requirements. All pipe insulation installed outdoors shall be wrapped with an aluminum jacket with stainless steel bands. Aluminum fitting covers shall be provided at elbows. All seams shall be sealed watertight with clear silicone caulking.

154.40 Plumbing Fixtures

Item	**Manufacturer/Types/Notes**
Fixtures, urinals, lavatories	Kohler, American Standard, TOTO, Eljer or Water Closets
Hot water circulating pumps	Grundfos (water-cooled/maintenance free) or equal (UP15-42SU) Bell and Gossett (water) SS fitted and brass body only
Flush valves for W/C and urinals Low GPF required for LEED No Green Bidirectional flush valves; manual lever only; no automatic	Sloan Royal only Urinals: 1.0 gpf WCs: 1.6 gpf 1.28 GPF or less not acceptable ADA compliant location as needed. Operating pressure of 5 lbs. or less
Shutoff valves on any/all water piping systems to be provided	Full-flow ball valves (Apollo or Nibco). No gate valves. Provide separate shutoff valves for the water supply piping to each restroom so that the men's and women's restrooms can be turned off independently. Locate SOVs in the men's restroom or hallway outside the RRs only.
Lavatory faucets*	Delta (2502), Delta (500 WF) Kohler – *Note: Also include Grid Strainer drain line. Toto Auto shutoff for public park restrooms. ADA compliance with operating pressure at or below 5 lbs.

Item	Manufacturer/Types/Notes
Urinals	Siphon jet-wash down, Kohler (PRCF) American S., Eljer.
Kitchen faucets	Delta (without spray) Kohler (without spray) Chicago faucet
Sumps and sewage pumps	Pumps controlled by float switches only (not sensors or mercury switches)
Cleanouts	When restrooms are back-to-back (and when possible) terminate all cleanouts (men's and women's) on the men's restroom side.
Trap primers	Facilities Maintenance prefers the use of Stink Stoppers in lieu of trap primers. Utilize 120V electrically actuated trap primers with timer only. Primers that rely upon pressure fluctuations to actuate shall not be utilized. When restrooms are back-to-back (and when possible) provide access to all trap primers (men's and women's) on the men's restroom side. Provide a trap primer with adjustable flow and pressure.
Water heaters	Provide a floor sink adjacent to all water heaters. Water heaters shall be provided with 16-inch stands or wall-mounted unit supports to allow pans to gravity drain as required. Provide water heaters with drain pans below them and dedicated 3/4-inch pan drains to floor sinks, mop sinks, or to landscaping outside the building. Provide a separate full-size T&P relief drain and drain separately to a similar approved location. Expansion tanks shall be mounted to structure. Provide primers on floor sinks. Re-circulating pumps shall be provided on all systems serving food handling areas and where required per code or good practice to provide hot water without unreasonable delay. Consider tankless instantaneous water heaters where applicable, such as the Rinnai tankless water heater. Instantaneous water heaters shall be gas-fired and not electric-powered. Remote small restrooms shall utilize small tank type water heaters with drains per above.

Item	Manufacturer/Types/Notes
Trench drains	Trench drains shall be provided with steel grates. Materials of grates allowed are stainless steel, cast iron, or galvanized steel. Grate shall be rated for each application. No plastic or polypropylene grates will be allowed.
Floor drains	Floor drains shall be provided with brass grates. Grate shall be rated for each application.
Mop sinks	Mop sink shall be constructed of heavy-duty materials. Acceptable construction of mop sink shall be stainless steel or terrazzo. Unit shall provide with the following: Chicago faucet with vacuum breaker, heavy-duty flexible rubber hose bracket, stainless steel wall guard on walls.
Access doors	Access doors shall be large enough to allow plumbing devices within the access doors to be serviced and completely removed and replaced without wall or ceiling demolition. Designers shall specify on plans a minimum size of 12 inches x 12 inches for all access doors and greater sizes when required to remove and replace devices within the access door. Doors shall be aligned properly with the device and device connections to which they will allow access. Final size and position of the door shall allow Facilities Maintenance personnel to use common hand tools to remove, replace, and service the devices behind the access door. The PRCF PM reserves the right to accept or reject all service access doors as part of the final inspection and require the contractor to replace the door with a larger door if needed. In lieu of providing a larger access door, the contractor shall have the option to demonstrate, in the presence of the PRCF PM, that the device within the access door can be serviced and completely removed and replaced using common hand tools, without damage to the walls or ceiling. Designers shall specify this on their plans or within their book specifications. Access Door Construction: Access doors in kitchen walls and tiled wall or ceiling areas of restrooms shall be constructed of stainless steel. Access doors in painted ceilings and walls shall be primed steel to be painted by the general contractor.

Item	Manufacturer/Types/Notes
Tempering valves	Tempering valves shall be utilized to serve gang restrooms using one valve to service multiple lavatory fixtures in both men's and women's restrooms when in close proximity. Do not design systems such that one tempering valve or device is required for each and every lavatory fixture. Provide thermostats on the HW inlet and TW outlet of each tempering valve. Acceptable brands: Leonard, Powers.

156.00 Heating, Ventilation, and Air Conditioning (HVAC)

Mechanical Unit Efficiency

A. SEER, EER, COP, IPLV, etc., shall meet current IECC standard with amendments by the City of Mesa.

Acceptable HVAC Equipment Manufacturers

A. Trane, ICP, Daiken or Ruud. Other manufactures may be accepted with approval of the PRCF PM.

Basis of Design

A. Mechanical plans shall utilize Trane equipment as the basis of design. Chillers, air handlers, water source heat pumps, packaged and split DX equipment, and similar key HVAC equipment shall be scheduled on plans using Trane part numbers, power requirements, weights, dimensions, performance, and schedule requirements. Mechanical plans shall depict Trane HVAC devices to scale and shall clearly show access areas including service access, filter, and tube pull areas as dashed and shaded areas to scale per Trane installation requirements. All mechanical plans shall state "or equal" to allow competition by suppliers offering competing brands with equal performance.

Controls

A. For Energy Management Systems (EMS) and Controls requirements, refer to the City of Mesa Energy Management System Specification sections. All controls equipment will be BACnet. (see Division 18)

Curbs

A. All rooftop equipment requires a curbs. Curbs shall be metal construction and 12 inches minimum in height above finish roof material.. Curbs shall have metal flashing at the top. Curb caps shall be made from a full metal sheet, seams in metal curb caps will not be allowed.

Cooling Towers

A. Cooling towers shall be fiberglass or stainless-steel construction. Dry vs. Wet shall be analyzed and designed for size and economy.
    a. Accepted manufacturers:
        i. Tower-Tech
        ii. Evapco
        iii. BAC
        iv. Reymsa

Evaporative Coolers

A. Evaporative coolers shall include stainless steel pans, heavy-duty sheaves, V-belts, and pillow block bearings. Basis of design shall be United Metal Products.

Lubrication Lines

A. Mechanical units with fans rated over 4,000 CFM shall include extended lube lines to readily accessible locations for servicing without equipment shutdown.

Restroom Exhaust Fans

A. All restroom exhaust fans shall be sized at 50% over code minimum exhaust airflow. Restroom exhaust fans shall include an internally mounted speed control for adjustment by the test and balance contractor. Acceptable manufacturers: Greenheck or Broan. All exhaust fans shall be attached to EMS or restroom lighting to avoid operation outside of occupied hours of operation.

Kitchens with Grease Traps

A. All kitchens that have a grease trap installed shall include an exhaust fan.

Dehumidification

A. Large central HVAC units utilizing chilled water shall include reheat capability or an alternate City of Mesa preapproved acceptable means of dehumidification. Space-mounted humidistats of adequate number, located as required to effectively control dehumidification, shall be provided. A dehumidification control sequence of operation shall be included in the control system design.

Air Filters

A. All unit return and fresh-air filters shall be sized for a 20-inch x 20-inch x 2-inch pleated air filter. Where 20-inch x 20-inch x 2-inch filter housings are installed above the ceiling, provide a marking ID tag on the ceiling grid located under the filter housing. Air filters shall be MERV 8 minimum rated per MERV-A standards. Filter pull areas shall be shown on plans to scale as dashed lines and shall be noted on plans not to be impeded by other trades. Acceptable standards: CamFil 30/30 or equal.

Air Handlers and HVAC Equipment Above Ceilings

A. Air handlers above lay-in or hard-lid ceilings shall be located in close proximity to the ceiling so that service access and filter change may be accomplished without ceiling demolition, without extending ladders above the ceiling level, and without Facilities Maintenance personnel physically climbing above the ceilings to service equipment. Equipment located in such a manner to be physically challenging or unsafe to perform service shall be relocated by the contractor when required by the PRCF PM.

Mechanical Balancing Dampers

A. Balancing dampers with a dimension greater than 12 inches shall have a continuous pivot rod. For dampers with the largest dimension less than 12 inches, a non-continuous pivot rod is acceptable. Damper blades shall be constructed of at least 2 gauges heavier than the duct in which they are installed and no lighter than 22 gauge. Dampers shall feature tight-fitting synthetic bushings and bearings at pivot rod to duct contact. Dampers shall be manual quadrant locking type unless otherwise specified on plans. Where ducts are wrapped with insulation, provide an insulation standoff. Do not use friction lock handle or “jiffy” dampers or similar, which are not acceptable. All installations shall be free of objectionable vibration and noise. Acceptable basis of design: Greenheck MBD/MBDR. Access to damper handles shall be clear and unobstructed. Damper handles shall feature an orange plastic ribbon tied to the damper

handle to make the location of the damper clear to Facilities Maintenance personnel searching for dampers.

Motorized Control Dampers for Low- and Medium-Pressure Systems

A. Dampers shall be heavy-duty low-leakage and include blade and jamb seals for positive shutoff. Rectangular dampers shall include an airfoil style blade. Acceptable basis of design: Greenheck VCD for rectangular control dampers or VCDR for round control dampers.

Labels

A. All equipment shall have permanent labels (phenolic or plastic when installed indoors, aluminum or stainless steel when installed outdoors). Equipment ID tags shall match the mechanical plan IDs. All equipment above lay-in ceiling grids shall be identified on the grid support by the equipment ID tag using a clear plastic film label applied to the steel grid directly below the service access point for the equipment or air handler. All thermostats shall be labeled to match equipment IDs on the plans (not the room number) using a clear plastic film label. Hand-written ink or marker labeling shall not be acceptable and shall be removed and replaced with labeling per this specification.

Access Doors

A. Access doors shall be large enough to allow Facilities Maintenance personnel access to mechanical equipment and devices within the access doors to be serviced without wall or ceiling demolition. Designers shall specify on plans a minimum size of 24 inches x 24 inches for all mechanical equipment access doors and greater sizes, when required, to accommodate larger filters. Doors shall be aligned properly with the service side of the mechanical device and mechanical device connections to which they allow access. Filter pulls shall be unobstructed, and filters shall be able to be inserted into HVAC equipment without bending, crushing, or similar filter forcing into position. Final size and position of the access door shall allow maintenance Facilities Maintenance personnel to use common hand tools to remove, replace, and service the HVAC devices behind or above the access door and allow ease of filter replacement in HVAC units. The PRCF PM reserves the right to accept or reject all service access doors as part of the final inspection and require the contractor to replace the door with a larger door if needed. In lieu of providing a larger access door, the contractor shall have the right to demonstrate, in the presence of the PRCF PM, that the device within the access door can be serviced and filters completely removed and replaced using common hand tools without damage to the walls, ceilings, or filters. Designers shall specify this on their plans or within their book specifications. Access Door Construction: Access doors in kitchen walls and tiled wall or ceiling areas of restrooms shall be constructed of stainless steel. Access doors in painted ceilings and walls shall be primed steel and painted.

Mechanical Rooftop HVAC Equipment Replacement Projects

A. Consultant shall strive to specify new equipment of equal or lower weight than existing equipment. If new replacement equipment operating weight is greater than existing unit operating weight, an Arizona licensed structural engineer shall be required to approve the installation prior to the installation of the equipment. Contractors shall submit a letter from the structural engineer, along with the submittals, prior to purchase. If the new equipment is reported to be the same or lower operating weight as the old equipment, documentation supporting this must be provided by the contractor. If the existing equipment has been demolished, removed from the site, or if the original equipment operating weight is unobtainable for any reason, a structural engineer’s letter shall be required.

B. All rooftop equipment requires a curb. Curbs shall be metal construction and 12 inches minimum in height above finish roof material. Curbs shall have metal flashing at the top. Curb caps shall be made from a full metal sheet, seams in metal curb caps will not be allowed.

159.00 Ductwork

A. Ductwork shall be 22 gauge minimum, constructed per the latest SMACNA standards.
B. Ductwork shall be flanged construction: Ductmate, TDC, TDF for ducts over 22 inches. All joints shall be sealed with mastic. All exterior ducts shall be double wall with IECC compliant insulation (1-1/2 Inch minimum).
C. All ducts penetrating a foam roof shall be foamed in.
D. Ducts shall be internally lined with IECC compliant duct insulation liner (minimum 1 inch) for acoustics for the first 15 feet upstream and downstream from AC/AH unit fans.
E. Painting shall include surface prep, cleaning, priming, and painting. All-in-one DTM paint is not acceptable.

159.95 Operation and Maintenance Training, Warranty, PM Program, and Closeout Materials

A. Provide three complete sets and an electronic copy of all equipment submittals, equipment installation and operation manuals, warranty statements, final commissioning report, and test and balance final reports.
B. City of Mesa facilities are maintained using City Works software program to schedule regular monthly, quarterly, biannual, and annual PM activities. As part of the closeout materials, provide a COM Standard City Works maintenance schedule on the form provided by the COM Facilities Department for all equipment requiring maintenance including: All HVAC equipment, plumbing equipment, fans, pumps, and similar mechanical and plumbing equipment requiring maintenance, lubrication, cleaning, filter changes, periodic adjustment or inspection, etc. Base all maintenance activities on the equipment manufacturer's recommendations. If manufacturer's standard recommendations are unclear, obtain written clarifications from the manufacturer's representative on recommended maintenance.
C. A written statement of a one-year warranty shall be provided by the contractor, commencing on the date of the final acceptance letter.
D. Warranty five years minimum on all compressors and water heaters.
E. Provide one hardcopy and one electronic PDF copy of the project as-built drawings.
F. A list of all filters used, identified by each piece of equipment by equipment plan number, shall be posted in the mechanical room.
G. A list of all belt sizes, type, and model, by equipment plan number, shall be posted in the mechanical room and a copy provided to the PRCF PM.
H. Laminated mechanical piping plans/diagrams for chilled water, condenser water, boiler water, etc., shall be provided in an accessible and convenient location on the wall of the mechanical room. Laminated plans shall include valve location and operational notes, including Initial design flow rates and initial design supply and return temperatures.

Division 16 – Electrical

160.10 General Provisions

Systems Identification

A. Distribution panels, panelboards, motor control centers, transformers, transfer switches, and other electrical equipment shall have laminated plastic plates, white letters on black background. Letters shall be vertical 1/4 inch high. Nameplates shall have equipment identification. If required, use three lines each containing as many as 30 letters and/or spaces. The text of name plates shall be taken from the plans and shown on shop drawings.
    a. Standard Naming Convention
        i. 480-277V, Panel designation starts with an "H"
        ii. 120-208V, Panel designation starts with an "L"
        iii. 480-277V or 120-208V systems backed up by a generator start with "EMH" or "EML"
        iv. Floor levels are designated by either a letter or a number "HB or LB or EMB" for basement level or "H1 or L1 or EM1" for first floor
        v. I prefer to have the panel be lettered instead of numbered eg: "HB-A, LB-A, H1-A, L1-A, EMHB-A, EMLB-A, using A through Z
        vi. For UPS systems "UPHB-A, UPH1-A, UPLB-A, UPL1-A etc
        vii. In large electrical systems where distribution panels are used "HDSB-A, LDSB-A, HDS1-A, LDS1-A etc. When backed up by a generator the designation would be EMHDSB-A, EMLDSB-A, EMHDS1-A, EMLDS1-A
B. All panelboards shall be provided with a two-column, typewritten directory card under a plastic cover inside the door.
C. Name plates shall be attached to equipment with pop rivets or stainless steel self-tapping screws.
D. All junction boxes and pull boxes shall be clearly labeled with indelible, black ink to indicate the panel identification and circuit number or bus duct identification and switch number, etc. In addition, all conductors inside the pull or junction boxes and all conductors brought to device outlet boxes shall be wire tagged to indicate the circuit or switch number.
E. All auxiliary conduit and box systems, including communications or data, shall be clearly labeled to indicate function and use. Label all conduit systems as indicated above and label the covers of all junction or pull boxes using indelible black ink. The conduit and box labels should contain the following information.
    a. Description of where equipment is fed from
    b. Description of what equipment is served
    c. Description of the voltage, phase, and number of wires
F. All flexible conduit installed under raised floors shall be labeled with "Panduit" No. MP-200, 3/4-inch x 2-inch plastic marker plates. A black indelible felt-tip marker shall be used to neatly and clearly designate the panelboard and circuit number. Marker plates shall be fastened to each conduit using two Ty-Wraps at each panelboard or wireway exit point and at each outlet box. Provide adhesive labels in accordance with "Systems Identification" above for other portions of the conduit run.
G. All panelboards and switches shall be labeled with available fault current, related arc flash rating protective gears required to work on the equipment and/or a Panduit Verisafe absence of voltage system. Labeling shall be compliant with NFPA 70E requirements.

Separate Conduit Systems

A. Each system shall be contained in a separate conduit system. This includes each power system, each lighting system, each signaling system for any purpose, telephone/data, control system, fire alarm system, future EMS, security system, etc.

Accessibility

A. Provide a concrete pad under all major electrical equipment located outside. The concrete pad to be minimum of 4 inches thick and extends 6 inches around the back and sides and 3 feet in front of the equipment. Pad shall be at least 4" above finished floor. Major electrical equipment: Service switchgear and equipment, distribution boards, panelboards, transformers, transfer switches, motor control centers, engine/generators, etc.
B. Place no junction boxes, pull boxes, expansion joints, etc., for any system at a location that will not be easily accessible after construction is completed. Maintain easy access to all components for all electrical, signaling control systems.
C. Install all control devices or other specialties requiring reading, adjustment, inspection, repairs, removal or replacement in convenient and easily accessible locations.

Shop Drawings

A. Submit one set of shop drawings and equipment-related data for all electrical equipment, devices, and material in accordance with the electrical engineering design drawings for review and approval by the PRCF PM prior to ordering.

Equipment Lists and Maintenance Manuals

A. Prior to completion of the job, the contractor shall compile a complete equipment list and maintenance manual per project requirements. At a minimum, the equipment list shall include the following items for every piece of material and equipment supplied under this section of the specifications.
    a. Name, model, and manufacturer
    b. Complete parts drawings and list
    c. Local supply for parts and replacement and telephone number
    d. All tags, inspection slips, instruction packages, etc., removed from equipment as shipped from the factory, properly identified as to the piece of equipment from which it was taken
B. Maintenance manuals shall be furnished for each applicable section of the construction documents and specifications. At a minimum, the maintenance manual shall include all available manufacturer's operation and maintenance instructions, together with as-built drawings and lists hereinbefore specified and all other diagrams and instructions necessary to properly operate and maintain the equipment. The maintenance manuals shall also include the name, address, and phone number of the general contractor and all subcontractors involved in any of the work specified herein.

Project Closeout

A. Prior to completion of the project, compile a complete equipment maintenance manual for all equipment supplied under project contract documents, as described in equipment lists and maintenance manuals.
B. Warranty letters must be supplied as part of the project closeout as well.

Testing

A. Upon completion of the electrical work, the entire installation shall be tested and demonstrated to be operating satisfactorily in the presence of and in coordination with the City of Mesa Maintenance Division.

B. Wiring shall be tested for continuity, short circuits and/or accidental grounds. All systems shall be entirely free from grounds, short circuits, and any or all defects. All readings shall be documented and provided to PRCF PM.
C. Motors shall be operating in proper rotation and control devices functioning properly. Check all motor controllers to determine that properly sized overload devices are installed. Check all electrical equipment for proper operation.
D. Tests and adjustments shall be made prior to acceptance of the electrical installation by the architect/owner. A certificate of inspection and acceptance of the electrical installation by local inspection authorities shall be provided to the Facilities Maintenance Division.
E. All equipment or wiring provided, which tests prove to be defective or operating improperly, shall be corrected or replaced promptly, at no additional cost to the city, for a period of one year.

Cleanup

A. In addition to cleanup specified under other sections, thoroughly clean all parts of the electrical equipment, thoroughly clean off any spattered construction materials and remove all dirt, dust, oil, and grease spots. Wipe the surface carefully and scrape out all cracks and corners.

Final Observation

A. Prior to notifying the architect/engineer and owner, the project should be ready for the final electrical observation and acceptance, the contractor shall verify the following:
    a. All systems are complete and operational.
    b. All controls are complete and operational, and mechanical interfaces have been checked and are functioning properly.
    c. All light fixtures have been cleaned and all protective coverings have been removed.
    d. All equipment nameplates have been installed.
    e. All panel directories are typed and installed in corresponding panels.
    f. All equipment and devices have been cleaned, free of foreign objects and wiped.
B. Once notified, the architect/engineer will visit the job site and will prepare a final punch list of all items to be finished or corrected prior to project acceptance by the owner/Facilities Maintenance Division. The contractor will be responsible for finishing or correcting all items on the punch list prior to the subsequent verification visit by the architect/engineer and/or owner.

Guarantee

A. Guarantee in writing that all material, equipment, and workmanship for all sections under this Division are free of defects for one year from the date of final acceptance. A copy of the signed guarantee document shall be submitted to the City of Mesa Facilities Maintenance Division for their records.

General Notes

A. Locate electrical panels, time clocks, disconnect switches, and other electrical equipment in an electrical room. Provide/plan additional wall spaces for future panels and equipment.
B. Provide an exhaust fan controlled by a line-voltage thermostat and a door lever for electrical rooms. Set thermostat to 95F.
C. Electrical panelboards and equipment should be Nema-3R when located below restrooms, labs, shower rooms, and break rooms where water could leak and drip on electrical equipment.

161.10 Conduit and Fittings

A. Conduit sizes for various numbers and sizes of wire shall be as required by NEC and City of Mesa, but it shall not be smaller than 3/4 inch in size. All flexible conduit shall be steel.
B. Conduit shall be as manufactured by Allied, Triangle, Jones-McLaughlin, Republic, or approved equal.
C. Nonmetallic conduit shall be as manufactured by Carlon, Lpex Inc., PW Pipe, or a manufacturer that has received prior approval.
D. Liquid-tight flexible metal conduit shall be steel as manufactured by Anaconda Sealtite Type UA or approved equal.
E. Rigid metal or IMC conduit shall be used for all of the conditions or locations indicated below:
    a. In all areas or locations subject to physical damage, including but not necessarily limited to outdoor areas up to 8 feet above grade, areas subject to motorized vehicles or hand carts, etc.
    b. In outdoor areas subject to direct water runoff due to rain or other conditions.
    c. In hazardous and explosion-proof areas, as appropriate, and where required by NEC or City of Mesa electrical code.
F. EMT conduit shall be used in all other areas where Rigid, IMC, or PVC conduit is not required. EMT conduit may be used outdoors only where it is not subject to physical damage or direct water runoff.
G. Rigid PVC conduit minimum Schedule 40 shall be permitted only underground or as specifically noted on drawings. Provide rigid PVC elbows and risers and wrap conduit with 1/2-inch foam (where it passes through the slab, prior to concrete pour). Size and provide insulated equipment grounding conductor in all conduits per NEC requirements.
H. Liquid-tight flexible steel conduit, for other than cleanroom or raised floor applications shall be used outdoors and/or in damp or wet locations where flexibility is required above ground.
I. Flexible steel conduit shall be used indoors in dry locations where flexibility is required or as specified. Flexible steel conduit shall be a minimum of 3/4 inch trade size. Flexible conduit shall be used for all connections to motors, generators or other vibrating equipment. In addition, flexible conduit shall be used for connections to lighting fixtures. Flexible conduit lengths shall not exceed 4 feet and shall contain a separate grounding conductor (minimum code size or as indicated). All connectors shall be steel, compression type with insulated throats.
J. Provide minimum of two 4-inch PVC underground conduits from the electrical/ communication room of one building to the electrical room of another building when multi-buildings are constructed. Install pull wire and mark and identify for future use.
K. All conduits shall be concealed wherever possible. All conduit runs may be exposed in mechanical equipment rooms, electrical equipment rooms, and electrical closets. No conduit shall be run exposed in finished areas without the specific approval of the PRCF PM.
L. Conduits above lay-in grid type ceilings shall be installed in such a manner that they do not interfere with the "lift-out" feature of the ceiling system. All conduits, devices and cables shall not be less than 8 inches above the lay-In ceiling grid. The conduits, devices and cables shall not be fastened to the T-Bar ceiling system.

161.20 Wire and Conductors

A. Minimum size shall be #12 AWG except for control circuits, which may be #14 AWG, or signal circuits, which shall be as indicated. All conductors shall be copper with the 90□C insulation type as indicated on drawings and as specified below. **Stranded wire, solid conductors will not be accepted**.
B. THHN/THWN type conductors shall be used for all conductors smaller than #4 AWG and Type XHHW for all conductors sizes #4 AWG and larger. All conductors installed underground, under the floor, or where subject to moisture or water shall be copper Type XHHW.
C. All feeder conductors from and to SES, distribution boards, panelboards, transformers, and all other equipment shall be copper and sized as recommended by NEC and equipment manufacturer.

161.40 Wiring Devices

A. Acceptable manufacturers are Hubbell, Bryant, Leviton, Eagle and P&S.
B. Submit shop drawings for wiring devices. Submit manufacturer's data sheets giving all pertinent physical and engineering data.
C. Finish of all devices shall be nylon white except for areas where stainless steel plates or special plates are required. Verify finish with the PRCF PM prior to ordering.
D. Finishes of all switches, receptacles, and other devices and their cover plates shall be red and marked "Emergency", when connected to stand-by/emergency generator power system and shall be blue when connected to a UPS system.
E. Finish of all devices in areas where stainless steel plates are required shall be grey. Verify finish with the PRCF PM prior to ordering.
F. All wall switches shall be toggle type (no rocker type) of the quiet mechanical type, specification grade, 20 amperes, 120/277-volt AC.
G. All wall switches shall have the ON and the OFF position indicated on the handle as applicable.
H. All convenience receptacles and special outlets throughout shall be grounding type. The grounding pin (pole) of these devices shall be mounted down as you face the device.
I. Generally, convenience receptacles shall be specification grade, back or side wired, parallel slot, two pole, three wire, 20 amp.
J. Furnish and install wall plates for all wiring devices and outlet boxes, including special outlets, sound, signal, and telephone outlets, etc., as required. All cover plates shall be appropriate for the type of device and the finish.
K. All plates throughout shall be stainless steel, lexan, or nylon. Stainless steel plates shall be used throughout all public areas and in areas subject to frequent equipment or cart movement. The colors of all lexan or nylon shall be white, except where noted otherwise. Verify with the PRCF PM prior to ordering.
L. Weatherproof plates shall be UL listed for weatherproof when used, Tay-mac polycarbonate series, or approved equal.

161.60 Panelboards

A. Acceptable manufacturers are preferred Cutler-Hammer, and alternates are Square D, or Siemens. Load centers or residential grade panelboards are not permitted. All panelboards and related circuit breakers shall be bolt-on type.
B. Approved panelboard types for each of the above manufacturers shall be as follows:
    a. 120/240Vac:
        i. Square D Type NQOD using bolt-on branch circuit breakers
        ii. General Electric Type AQ using bolt-on branch circuit breakers
        iii. Siemens Type S1 using bolt-on branch circuit breakers
        iv. Cutler-Hammer Type PRL1 using bolt-on branch circuit breakers
    b. 277/480Vac:
        i. Square D Type NF using bolt-on branch circuit breakers
        ii. General Electric Type AE using bolt-on branch circuit breakers
        iii. Siemens Type S2 or S3, using bolt-on branch circuit breakers
        iv. Cutler-Hammer Type PRL3a using bolt-on branch circuit breakers
C. All bus bars shall be copper, located in the rear of the panelboard cabinet. Individual circuit breakers shall be removable from the cabinet without disturbing adjacent units or supporting members.
D. Locks shall be provided on all panelboards. All locks shall be keyed alike. Locking hasps shall also be provided with all panelboards. Hasps shall be installed using pop rivets.
E. Panelboards shall be equipped with full neutral and ground buses. Separate isolated ground buses shall be provided for isolated ground panelboards, as noted on schedules.
F. Each panelboard shall be identified. See labeling instructions under General Provisions.
G. All panelboards shall have door-in-door trim to allow access to wireways and line/load lugs without removing front covers. The hinges shall be continuous piano hinge type.
H. All panelboard enclosures shall have blank end-walls. The use of knock-out type end-walls is prohibited.
I. All panelboards shall have 42 circuit spaces and shall contain six 20/1P spare circuit-breakers and a minimum of three additional spaces for future circuit breakers. Flush-mounted panelboards shall be provided with three 3/4-inch spare empty conduits stubbed up into the accessible ceiling space and marked for future use.
J. Provide redundancy, including dual feeder for critical equipment, fed from Isolated ground panelboards.

161.70 Disconnect Switches

A. Acceptable manufacturers are Square-D, General Electric, Siemens/ITE, or Cutler-Hammer/Westinghouse.
B. Disconnect switches shall be heavy-duty type, quick-make, quick-break, externally operated with interlocking cover to break all ungrounded conductors. Provide with solid neutrals where required, number of poles, ampacity, and voltage as required by application. All switches for motors shall be horsepower rated. Fusible switches shall be complete with rejecting type fuse clips.
C. Disconnect switches for fractional horsepower motors larger than 1/2 horsepower for integral horsepower motors and for equipment of similar capacity shall be provided per paragraph above.
D. Disconnect switches for small 120V equipment 12 amps or less shall be specification grade single-pole, 20-amp toggle switch with pilot light.
E. Disconnect switch for a 1/2 horsepower and smaller motor loads shall be a single-pole or two-pole 120V or 240V motor-rated, specification grade 20-amp toggle switch with pilot light.

F. Install switches at locations indicated on the drawings, using approved fastening methods, and maintaining proper working clearances per NEC. Locate switches as close to the equipment as feasible and at a readily accessible and convenient location.
G. Where it is not possible to install switches on a wall, structure, or item of equipment, provide rigid freestanding supports of galvanized angle or channel.

161.80 Overcurrent Protection

Fuses

A. Acceptable catalog numbers and manufacturers: Bussmann Manufacturing or Gould/Shawmut or equal. The specified product shall set the standard relative to quality and performance requirements. Alternate fuses shall be submitted to the PRCF PM for approval during the construction process.
B. Fuses 600 amps and smaller shall be UL Class "RK5," current limiting, time-delay, 600V or 250V, with interrupting rating of 200,000 amperes RMS symmetrical. Where no indication is given, fuses shall be Bussmann FRN-R for applications less than 250V and FRS-R for applications greater than 250V but less than 600V.
C. Fuses shall be coordinated with each other, with the circuit breakers that they are protecting, and with motor overload relays. All applications of fuses shall be on a single fuse per phase leg basis.
D. Furnish and deliver to the owner a spare fuse cabinet, with spare fuses at the job site as follows:
    a. Three spares for each type and size, in excess of 60 amperes, used for initial fusing.
    b. Ten percent (10%) but no less than three spares for each type and size, up to and including 60 amperes, used for initial fusing.
    c. Cabinet shall be NEMA 4 for interior applications. Mount cabinet in electrical room or coordinate location with the PRCF PM. Size appropriate for quantity of fuses provided. Min. of 18 x 18 x 8 Piano hinge cover.

Molded Case Circuit Breakers

A. Circuit breaker protective devices rated from 15-amp through 1200-amp frame shall be molded case circuit breakers with inverse time and instantaneous tripping characteristics. Ground fault protection shall be provided where indicated on the drawings or as required by the City of Mesa. Provide neutral ground fault current sensor for four-wire loads.
B. Circuit breakers shall in all cases be full width type ("slims" are not permitted).
C. Where indicated on the drawings or noted herein, circuit breakers shall be UL listed for series application.
D. Where indicated on the drawings or required by NEC, circuit breakers shall be current limiting type.

162.00 Static Uninterruptable Power Supply (UPS) Systems

Unit Startup and Site Testing

A. Site testing shall be provided by the manufacturer’s field service personnel as requested by the PRCF PM. Site testing shall consist of a complete test of the UPS system and the associated accessories supplied by the manufacturer. A full-load power test, including a partial battery discharge test, shall be provided as part of the standard startup procedure. This shall be accomplished without disturbing user wiring and completed prior to operation of the site critical load from the UPS output. The test results shall be documented, signed, and dated for future reference and a copy provided to the PRCF PM.

Manufacturer's Field Service

Service Personnel

A. The UPS manufacturer shall directly employ a nationwide service organization, consisting of factory-trained field service personnel dedicated to the startup, maintenance, and repair of UPS and power equipment. The organization shall consist of regional and local offices.
B. The manufacturer shall provide a fully automated national dispatch center to coordinate field service personnel schedules. One toll-free number shall reach a qualified support person 24 hours a day, 7 days a week, 365 days a year. If emergency service is required, response time shall be 20 minutes or less.
C. An automated procedure shall be in place to ensure that the manufacturer is dedicating the appropriate technical support resources to match escalating customer needs.

Replacement Parts Stocking

A. Parts shall be available through an extensive network to ensure around-the-clock parts availability throughout the country.
B. Recommended spare parts shall be fully stocked by local field service personnel with backup available from national parts center and the manufacturing location. The national parts center Customer Support Parts Coordinators shall be on-call 24 hours a day, 7 days a week, 365 days a year for immediate parts availability. Parts from the national parts center shall be shipped within four hours on the next available flight out and delivered to the customer's site within 24 hours.

UPS Maintenance Training

A. Maintenance training courses for customer employees shall be available by the UPS manufacturer. This training is in addition to the basic operator training conducted as a part of the system startup.
B. The training course shall cover UPS theory, location of subassemblies, safety, battery considerations, and UPS operational procedures. The course shall include AC to DC conversion and DC to AC inversion techniques as well as control, metering, and feedback circuits to the Printed Circuit Board (PCB) level. Troubleshooting and fault isolation using alarm information and internal self-diagnostics should be stressed.

Maintenance Contracts

A. A complete offering of preventive and full-service maintenance contracts for both the UPS system and battery system shall be available. An extended warranty and preventive maintenance package shall be available. Warranty and preventive maintenance service shall be performed by factory-trained service personnel.

164.00 Services Entrance and Distribution Switchgear

A. Recommended manufacturer: Square-D, Siemens, and Cutler-Hammer.
B. Electrical service (SES) and the distribution switchgear to be freestanding and have front access only.
C. All electrical services of 600 amps and larger to be provided with one main disconnecting circuit breaker and downstream branch breakers as required.
D. All main and branch overcurrent protections in the electrical service and distribution switchgears shall be current limiting circuit breakers and not switches and fuses. However, switches and fuses should be used in motor control centers and disconnect switches designated and located at the equipment.
E. All indicator and instrument lights shall be LED type.
F. Provide labeling as noted under General Provisions.

G. Electrical service and distribution switchgear shall be scanned with IR-camera and physically inspected and torqued by a qualified testing company per manufacturer spec 90 days after obtaining a Certificate of Occupancy.
H. All current caring parts of the electrical distribution system including buses and conductors in the electrical service, distribution switchgears, and panelboards shall be copper. Use of aluminum buses and conductors are prohibited for the City of Mesa Facilities Maintenance Department.
I. The main and branch circuit breakers shall be set to the highest trip setting permitted and to be sequenced to achieve highest reliability and good protection.

164.30 Standby/Emergency Engine Generators

A. Acceptable manufacturers: Caterpillar, Onan, Kohler and Gillette.
B. Engine generators shall be self-contained with diesel fuel tank and enclosure suitable for Nema-3R location. New engine generators shall be located outside and provided appropriate fence for good security and architectural appearance.
C. For Locations where natural gas is available, a gas-operating type engine/generator should be considered.
D. Auto-transfer switch for standby power system shall be located inside the building in an electrical room. ASCO, Kohler or Russell Electric.
E. Provide an appropriately selected Transient Voltage Surge Suppressor (TVSS) for distribution boards and panelboards supplying power to critical systems and sensitive equipment.

164.50 Grounding

F. A separate insulated grounding conductor, sized per NEC, shall be installed in all conduit runs and metal roofs.
G. Provide separate, insulated, isolated grounding conductors for all isolated ground branch circuits or feeders as indicated on the drawings.
H. Provide all grounding materials, installation, etc., for system bonding as indicated on the drawings and to meet City of Mesa electrical requirements.
I. Ground wires provided for telephone system ground shall be connected to the service entrance ground conductor or bus or as otherwise specified by the telephone company and per NEC.

164.60 Dry Type Transformers

A. Acceptable manufacturers: GE Power, Square-D, Siemens.
B. Transformers shall be capable of operating at 100% of nameplate rating continuously while in an ambient temperature not exceeding 40C.
C. Step-down transformers shall be dry type with copper windings and suitable for the location used. Sound outputs of transformers shall not exceed the NEMA standard.
D. Transformers shall be mounted and anchored to concrete floor; otherwise, a 4-inch concrete pad shall be provided for the transformer. The exterior transformer pads shall extend 12 inches past transformer footprint at all four sides.
E. Dry type transformers smaller than 300 KVA rating shall have a minimum 9-inch clearance between transformer ventilation openings and adjacent structure. For ratings 300 KVA and larger, provide a minimum clearance of 15 inches between transformer and adjacent structure on all sides. All transformer connections shall be made with flexible metallic conduit.

F. Transformers rated 25 KVA and below shall have two 5% taps below normal. Transformers rated 30 KVA and larger shall have six 2-1/2% taps, four below, and two above normal.

165.00 Lighting, Accessories, and Controls

Submittals

A. Submit shop drawings for all lighting fixtures, lamps, ballasts, contactors, controllers, wall switches and wall box dimmers. Submittals shall include catalog cuts illustrating conformance with the specifications as well as drawings and information reflecting the materials, assembly, finish and dimensions.
B. All fixtures of the same type shall be of one manufacturer and of identical finish and appearance.
C. All fixtures and component parts shall bear the UL label.

Construction

A. Each fixture shall have a continuous light-seal gasket seated in such manner as to prevent any light leak through any portion or around any edge of the trim frame.
B. For recessed fixtures, provide a through-wiring junction box set to the side where it is accessible when the fixture is removed. Connect the box to the fixture housing with flexible conduit.
C. Unless shown otherwise on the drawings, all three- and four-lamp fluorescent lighting fixtures shall have the two outer lamps connected to one ballast and the inner one or two lamps connected to the other ballast.
D. Provide LED interior and exterior lighting system for all new buildings and renovated spaces where light fixtures are being replaced, such as the Hubbell Columbia Lighting LCAT dimmable LED series. Submittal shall include ratings for radio frequency interference. No incandescent lights.
E. Fixtures shall be DLC listed with radio frequency interference certification.
F. LED light fixtures shall be UL labeled and shall have 4,100 K light color output.
G. Fluorescent lamps: Fluorescent lamps shall be T-8, 32-watt, 2850 initial lumens (minimum), 4,100 K minimum CRI = 80.
H. Low-voltage incandescent: Unless noted otherwise on the fixture schedule, low-voltage lamps shall be MR-16, 75-watt Type EYC.
I. HID: Unless noted otherwise on the fixture schedule, provide coated lamps for clear lens fixtures and clear lamps for optical lens fixtures.
J. All light fixtures shall be corrosion resistant when located in moist or chemical-exposing location like water treatment plant and others.
    a. Provide fixtures approved by Energy Star, or Design lights consortium (DLC).

Ballasts/Transformers

A. Acceptable manufacturers: General Electric, Motorola, Quicktronic, Philips, Sylvania.
B. LED driver and controller shall be completely compatible for the LED light source for the purpose of energy savings and proper operation and performance. The contractor shall be responsible for verification of compatibility of the LED light source, switch/dimmer, and the driver.
C. Fluorescent ballasts shall be high power factor, rapid start, Class P with thermally actuated automatic reset protection and sound rating better than "A."
D. Fluorescent ballasts shall be rapid start, electronic energy-saving type for use with T-8 lamps. All ballasts and lamps shall be completely compatible for the purpose of energy savings and rated lumen output. The contractor shall be responsible for verification of the ballast and lamp compatibility. Power factor shall be greater than 95% and ballast factor greater than 85%. Ballast shall comply with ANSI Standards for

harmonic distortion with Total Harmonic Distortion (THD) less than 20% and 3rd harmonic content less than 15%. EMI and RFI not to exceed limits set by FCC (CFR 47 Part 18 subpart C) or NEMA. Ballasts shall be Magnetek "Triad High Performance (HP)," Motorola #M_-RN-T8-1LL-_, Valmont "UltraMiser," or as approved.

E. Fluorescent high-output ballasts shall be rapid start, energy-saving type for use with T-8 lamps. All ballasts and lamps shall be completely compatible for the purpose of energy savings and rated lumen output. The starting sequence shall be consistent with the lamp manufacturer's recommendations for full-rated lamp life. The contractor shall be responsible for verification of the ballast and lamp compatibility. Power factor shall be greater than 95% and ballast factor greater than 85%. Ballast shall comply with ANSI Standards for harmonic distortion with Total Harmonic Distortion (THD) less than 20% and third harmonic content less than 15%. EMI and RFI not to exceed limits set by FCC (CFR 47 Part 18 subpart C) or NEMA. Ballasts shall be Magnetek "Triad High Performance (HP)," Valmont "UltraMiser," or as approved.
F. No fluorescent dimming ballasts shall be used. If dimmable lighting is required it should be LED.
G. Ballasts shall be CBM certified and bear the UL label. Fluorescent and indoor HID ballasts shall have a sound rating of "A."
H. Low-voltage incandescent transformers shall be magnetic type and have a sound rating of "A."
I. HID Ballast – Metal high lite lamps: Lag-reactor (for 70, 100 and 150 watts) or the auto regulator CWA (for 200 through 1000 watt) with high power factor (90% min.) and starting current equal to or less than normal operating current; capable of maintaining ANSI lamp operation standards for a change in line voltage of 5% for 70 through 150 watt and 10% for 200 through 1000 watt. Insulation shall be 180□C, Class H. Minimum starting temperature shall be -20□F.
J. Contractor shall be responsible for the replacement of all ballasts due to excessive noise or failure for two years after final acceptance.

Additional replacement and Specific Fluorescent-Lamps Ballast information:

Type A-Fluorescent replacement ballasts:

K. Ballasts shall be UL listed Class P, type I electronic type
L. Where indicated, ballast shall provide 20% minimum lamp dimming
M. Ballasts shall be parallel wired, unless otherwise noted
N. Ballasts shall be a "matched" system with the fluorescent lamps and the same manufacturer to achieve the lamp life warranty as indicated below.
O. Ballasts shall be rated for >90,000 lamp starts and have a minimum 5-year warranty.
P. Ballasts shall have a Class A sound rating with no audible noise.
Q. University input voltage of 120V-277V at an input frequency of 60Hz. Light output shall remain constant for line voltage fluctuation of plus or minus 10 percent.
R. Ballasts shall contain no polychlorinated Biphenyl's (PCB'S) or potting compound.
S. Maximum ballast weight shall be 1.25 pounds.
T. Total harmonic distortion shall be less than 10% with a third harmonic distortion less than 8%.
U. Power factor shall be greater than 95%.
V. Lamp flicker shall be less than 2%.
W. Ballast factor (low, normal or high) shall as indicated.
    a. Low ballast factor units for U-shaped, 2, 3 & 4-foot lamps shall be instant start with a ballast factor between 0.70 – 0.75 and a crest factor of <1.7.
        i. GE lighting – UltraStart-MVPS-L T8 series.
        ii. Sylvania lighting – Quicktronic PROStart PSX series.
        iii. Phillips/Advance Transformer – Optanium S32L series.

b. Low ballast factor for 4- foot T5HO lamps shall be programmed or instant start with a ballast factor of 0.8 and a Crest factor of <1.7a.
    i. Sylvania lighting - Quicktronic Professional QTP54T5HO – P series.
c. Low ballast factor for 8 – foot lamps shall be programmed or instant start with a ballast factor between 0.71 – 0.78 and a Crest factor of <1.7.
    i. GE lighting – UltraMax – L T8 series.
d. Normal ballast factor for U – shaped, 2, 3, and 4 lamp fixtures shall be instant start with a ballast factor between 0.96 – 1.13 and a Crest factor of <1.7.
    i. GE lighting – UltraStart-MVPS-L T8 series.
    ii. Sylvania lighting – Quicktronic PROStart PSX series.
e. Normal ballast factor for a 4 – foot T5HO shall be programmed or instant start with a ballast factor between 0.87 – 0.89 and a Crest factor of <1.7.
    i. GE lighting – UltraStart-MVPS-L T8 series.
    ii. Sylvania lighting – Quicktronic PROStart PSX series.
    iii. Phillips/Advance Transformer – Optanium S32L series.
f. Normal ballast factor for a 8 – foot T5HO shall be programmed or instant start with a ballast factor between 0.96 – 1.13 and a Crest factor of <1.7.
    i. GE lighting – UltraStart-MVPS-L T8 series.
    ii. Sylvania lighting – Quicktronic 59 ISN series.
    iii. Phillips/Advance Transformer – Optanium P59 series.
g. High ballast factor for U – shaped, 2, 3, and 4 lamp fixtures shall be instant start with a ballast factor between 1.12 – 1.23 and a Crest factor of <1.7.
    i. GE lighting – UltraStart-MVPS-L T8 series.
    ii. Sylvania lighting – Quicktronic PROStart PSH series.
h. High ballast factor for a 8 – foot T5HO shall be programmed or instant start with a ballast factor between 1.15 – 1.35 and a Crest factor of <1.7.
    i. GE lighting – ProLine – HO T8 series.
    ii. Sylvania Lighting – Quicktronic 59 Plus series.

X. Type A8HEM emergency ballasts for fluorescent luminaries shall be Specification Grade, high lumen output (1800-3500), 2 – lamp operation. Manufacturer shall be Bodine Model B30ST.
Y. Ballasts for new luminaries and retrofit kits shall be as specified in the luminaries schedule
    a. Compact fluorescent SP4100 Kelvin
    b. Sylvania
    c. General Electric
    d. Phillips
Z. Ballast electronic for fluorescent lamps
    a. Sylvania
    b. General Electric
    c. Advance

Photoelectric and Occupancy Controllers

A. Acceptable manufacturers: Tork, Hubble, Intermatic, Wattstopper and Signify.
B. Photoelectric controller shall have automatic on/off switching with capacity of 1500 watts or 1800 volt amps at 120 volts and shall be socket type twist-lock. Operating level shall be field adjustable from 2 to 50 foot-candles with time delay to prevent false switching. Body shall be cast aluminum. Equal to Tork #2100 series.

C. Occupancy sensors shall be ceiling mounted, Dual Technology (PIR/Microphonic) and shall have required range appropriate for ceiling height and area to provide maximum coverage. Occupancy sensors shall be Sensor Switch, Type CM PDT (for surface mount) and Type RM PDT (for recess mount) or approved equal. Occupancy sensors for daylight harvesting use (photocell combined with dimming) shall be Sensor Switch, Type CMR-ADC, or approved equal.

Timeswitch

A. Acceptable manufacturers: Tork, Motorola Ace/M, Intermatic (FM).
B. Timeswitch shall be 24-hour, 7-day calendar or astronomic dial type. Switch capacity shall be 40 amps per pole at 277 volts. Timing motor shall be a heavy-duty synchronous, high-torque type, rated 120, 208 or 277 volts, 60 Hz as necessary. Contractor shall provide all on/off trippers necessary to perform desired control functions. Terminals shall accommodate up to AWG No. 8 wire. Timeswitch shall be housed in NEMA enclosure as indicated on drawings.

Lighting Contactor

A. Acceptable manufacturers: Square-D, Cutler Hammer or ASCO.
B. Mechanically held or magnetically operated lighting contactors shall have contacts rated 30 amperes minimum at required voltage with number of poles and coil voltage as indicated on drawings. Convertible contacts with normally closed indicators. Contactor shall be housed in NEMA enclosure as indicated on drawings and as required.

Diffusers

A. Diffusers shall be 100% virgin acrylic with a minimum thickness of 1/8 inch (0.125 inch).
B. No diffuser shall be manufactured with polystyrene, copolymer (mixture of polystyrene and acrylic), or reclaimed or recycled acrylic plastic.
C. All parabolic louvers shall be shipped with a protective plastic covering or coating. The protective covering shall not be removed until all construction is complete and final fixture assembly is complete. The contractor shall be responsible for cleaning all fixtures' lenses; in particular, removing all smudges, fingerprints, dust particles, etc.

Wall Box Dimmers

A. Acceptable manufacturers: Leviton, GE Lighting, Neutron, or approved equal.
B. Incandescent, quartz halogen, or magnetic low voltage: Device shall be UL listed for 120VAC, 60 Hz 600 – 2000 Watt (as required by load) to control incandescent, quartz halogen, or magnetic low-voltage lighting loads. Device operation shall include manual intensity control and a positive Off position. Provide with an air gap switch and "soft start" to preserve lamp life. Device shall mount in a single gang wall box and shall include a thin profile faceplate.
C. LED and fluorescent lighting with electronic dimming ballasts/drivers: Device shall be UL listed for 120/277 VAC, 60 Hz (as required by load) for LED or fluorescent lighting loads with dimming ballasts supplied for the project. Device operation shall include manual intensity control, instant on to preset, and a positive Off position. Provide with an air gap switch and "soft start" to preserve lamp life. Where device serves 277 VAC loads, provide the required interface equipment as directed by the dimmer manufacturer. Locate interface equipment above accessible ceiling space as near as possible to the dimmer. Device shall mount in a single gang wall box and shall include a thin profile faceplate.

Lighting Dimming System

A. Acceptable manufacturers: Lutron, Leviton, GE Lighting, Neutron, Trane or approved equal. Lighting controls solution from these manufacturers can be integrated into the Trane's Ensemble centralized buildings automation system to achieve dimming.
B. Provide new complete and operational dimming system if indicated and scheduled on the drawings.
C. The dimmer rack/cabinet shall be a welded steel cabinet with a baked enamel finish and a removable front panel.
D. Thoroughly clean all luminaries, lamps, and lenses for stage and special lighting system prior to final acceptance.
E. Contractor shall field-adjust aiming angles, focus points, etc., for all directional light fixtures, as directed by the architect, prior to final acceptance.

Fixture Support

A. Surface- or pendant-mounted fixtures shall be supported to meet national and local building code requirements and as noted below.
B. Support all fixtures weighing more than 50 pounds from the building structure, independent of the outlet box.
C. Support all T-bar grid mounted fluorescent fixtures at two opposite corners from building structure using steel wire. Screw 2-foot x 4-foot fluorescent fixtures to T-bar grid at two opposite points. Coordinate exact requirements with the PRCF PM.
D. Support all surface mounted fluorescent fixtures more than 18 inches wide at or near each corner, in addition to support from outlet box.

Lamps

A. Acceptable manufacturers: Sylvania, GE Lighting, Phillips, or approved equal. T-8 32 or 28 watt, 2850 lumens (min) 4, 100-degree K minimum.
B. Replace any lamps burning for construction purposes with new lamps at the time of and just prior to project closeout. Lamps to be in new operating condition for a period of 30 days after project closeout.
C. Provide separate neutrals for each dimmed circuit.
D. Do not remove any portion of the heat sink from the dimmer. Adjust installation to accommodate full-size heat sinks.
E. Contractor shall disconnect, remove, and dispose of all temporary (during construction) service equipment and related distribution systems, including any light fixtures, receptacles, outlets, and related wiring and controls prior to project closeout.

167.20 Fire Alarm System

A. Acceptable manufacturers: Silent Lite or Fire Lite by Gamewell. Non-proprietary.
    a. The fire alarm control panel shall have a remote dialer in lieu of telephone lines.
B. Fire alarm installer shall provide complete record drawings of the new and existing fire alarm system installation within the area shown on the plans and headend equipment. The record drawings shall reflect all device locations and wire/conduit runs as well as fire alarm panel and annunciator modifications. Fire alarm system shall be ADA compliant. Provide devices to match "class A" system and wire per fire alarm vendor's requirements. Contractor shall include in his bid price all fees required by the fire alarm vendor for programming the system and hardware for the systems shown and all other work required by the vendor. Contact and coordinate fees with an approved vendor prior to bid. Contractor to supply a flash

drive or electronic files with the fire alarm program to the PRCF Project Manager prior to closeout and the passcode to the panel will be changed per direction of the PRCF Project Manager.

C. All new fire alarm system modifications and installations shall be provided or supervised by the fire alarm vendor. The electrical contractor's bid price shall include all fees, devices, wire, conduit, labor, material, and equipment to provide the intended installation as indicated on the drawings and these notes.
D. It shall be the responsibility of the contractor and suppliers to submit the fire alarm system drawings, equipment cut sheets, and all other necessary information to the state fire marshal, engineer, local City and other authorities for review as may be requested or otherwise required to secure all approvals and to arrange pertinent field observations during construction as required. All submittals and approvals shall be provided in a timely manner and as required to meet all project schedules.
E. One set of shop drawings shall be submitted to the PRCF PM through the architect for review and approval prior to any work. Shop drawings shall clearly indicate the scope of work, necessary revisions, zone identifications, risers, manufacturer's catalog numbers, and any other information necessary to show the required scope of work.
F. The contractor shall provide all fire alarm system wiring as recommended and directed by the system supplier or manufacturer and in accordance with all codes and standards. All fire alarm system wiring shall be installed in **red** conduit.
G. Provide new combination strobes and alarm speakers and backboxes as indicated on the drawings and to meet ADA requirements.
H. The fire alarm installer shall test all strobe, speaker, and wiring that will be affected by this project prior to beginning any work. Any problems shall be made known to the PRCF PM. After this project is complete, the fire alarm installer shall test all strobes, speaker circuits, wiring, and all programming affected by this project. After all wiring and devices have been verified to be correct, the installer shall complete an "inspection and testing form" for all devices and programming verified as required or recommended by the authority having jurisdiction.
I. All new fire alarm devices and installations shall be in full compliance with ADA requirements.
J. All fire alarm device boxes, junction boxes, and conduits shall be red in color. Coordinate exact coloring requirements with the PRCF PM.
K. All valves controlling sprinkler system water supply and flow shall be electrically monitored, and the signal shall be automatically transmitted to a UL listed station.
L. The Fire inspectors test shall be located "back" to the fire riser room.

167.40 Telephone/Data and Conduit-Only Systems

A. This section describes requirements of the telephone/data and other conduit-only systems pertaining to conduit and equipment to be provided as shown on the drawings.
B. All conduit shall be installed in a neat, workmanlike manner and be separate from the electrical equipment.
C. Minimum conduit size shall be 3/4 inch.
D. Conduit runs shall not contain more than three 90□ bends or the equivalent. All bends or elbows shall be sweeps with no tighter than a 24-inch radius. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated on plans.
E. Terminal Cabinets (TTC) shall be sized as noted on plans. Provided with single door and "T" handle locking hasp equal to Hoffman.
F. Mounting Boards (TMB) shall be sized as noted on plans. Provided minimum 3/4-inch-thick fire-retardant plywood.

G. All telephone/data system and security system conduits from outlet boxes shall terminate above accessible ceiling space. Provide 90 conduit sweep at top and conduit bushings at each termination.
H. Provide a 2500-pound nylon pull string in all empty conduits and mark for communication use.
I. Cap all empty conduits.
J. Terminate ground conductor (see Grounding – 16450) on the plywood of TTC or TMB and leave 12 inches extra conductor length attached for telecom contractors use.

168.00 Electric Gate Operating Equipment (also see Gate Operator Equipment – 111.55)

A. Acceptable manufacturer: High Security or approved equal. Must be approved by the PRCF Project Manager.
B. All electric gate operator equipment specified shall include the latest technology available at the time of bidding.
C. Gates and associated fence connections shall have four (4') perforated metal panels that extent on either side of the gate closure areas. All safety items shall conform with current Building Code Requirements.
D. It is the responsibility of the contractor to ensure all safety items are approved by PRCF staff prior to submitting a proposal to complete the work. All safety items are part of the design, even if a specific notation is not referenced in the design plans.
E. Gate safety equipment shall be a minimum of vertical spread lasers, allowing for additional safety.
F. Gates shall be sliding type (no swing or raised gate). The gate track shall be level and recessed "V groove" embedded in reinforced concrete.
G. Gate power shall be connected to emergency circuit(s).
H. All electrically controlled exit gates shall have a free exit loop.
I. All gate wheels shall be 6-inch Elite power wheels with sealed bearings.
J. All entrance gates shall meet City of Mesa Fire Department requirements for emergency access, such as switches inside of Knox Boxes and optical sensing devices. In addition, and if applicable to the district of Salt River Project (SRP) utilities, a keyed SRP switch is required to be installed on the outside of the gate to allow SRP personnel access to read and service the electrical meters. Meter sections are to be placed behind the auto gates in secured areas.
K. Tomar brand devices for Fire Dept entry
L. For unmanned water sites no optical sensors, Knox key switches only.
M. Knox switches for keyed entry no switches inside of a Knox box.
N. All gates shall be finished with the highest standard paint/powder coat for long-lasting durability.
O. The Facilities Maintenance Department recommends that a pair of gates (with two operators) be used at each entrance rather than a long sliding type. Long sliding gates are typically very heavy, require more maintenance, and restrict traffic flow in the event of a breakdown. In addition, and if possible, the Facilities Maintenance Department highly recommends that a combination high-security gate operator be installed with 6-inch Elite wheels and sealed bearings. The combination of equipment mentioned will meet the demands of high traffic and increase reliability of service.
P. Final design of layout shall be approved by PRCF PM.

Division 17 – Landscaping

170.00 General

A. Design standards for irrigation shall incorporate Uniform Standard Specifications and Details for Public Works Construction as dictated by the Maricopa Association of Governments, Mesa Amendments to MAG Standard Specifications, Mesa Standard Details, design considerations as mentioned in this section, and products list.

170.10 Products

Item	**Manufacturer/Types/Notes**
Master Valves and Flow Sensors	1. Master Valve – Bermad 410 Series (3” and larger) a. Flow Sensor – If the irrigation system is pump assisted, flows will be captured from the Mag Meter. b. Flow Sensor – Up to 4” without pump assistance will use Flomec QS200. 2. Master Valve – Rainbird Brass EFB-CP Series (2” and Smaller) a. Flow Sensor – Flomec QS200 for 1” to 4” b. Flow Sensor – Hunter HC-075-FLOW for ¾ Hunter HC-075-FLOW for ¾”” 1” and smaller. 3. Special Requirements a. 2” and below is to be threaded b. Above 2” is to be flanged
Gate Valve	1. American Flow Control 2500 Series AWWA C-509 Resilient Wedge
Ball Valve	1. Brass, Two-piece, Full port, NPT x NPT, Stainless steel handle and ball
Turf Remote Valves	1. Rainbird EFB-CP Series Brass Valve 1” – 2” 2. Rainbird 300 – BPE/300 BPES Brass Valve 3”
Drip Remote Valves	1. Rainbird EFB-CP Series Brass Valve 2. Rainbird Pressure Regulating Basket Filter – PRB-QKCHK-100
Quick Coupler Valve Assembly	1. Rainbird #44-NP Quick Coupling Valves with two-piece brass body

Item	Manufacturer/Types/Notes
Emitters	1. Bowsmith ML 200 Series
Turf Rotors	1. Hunter I-40 2. Hunter I-25 3. Rainbird 5000 Series 4. Rainbird 1800 Series
Tree Bubblers	1. Mature Trees – Rainbird Root Watering System - RWS-B-1402 2. Young Trees – Rainbird Model XBT ½" FPT inlet x barb outlet
Main Line Piping	1. Class 200 Ring Tite PVC = 3" and greater 2. Schedule 40 Solvent Weld PVC = 2" and smaller
Turf Lateral Piping	1. Schedule 40 Solvent Weld PVC
Shrub Lateral Piping	1. Schedule 40 Solvent Weld PVC
Pipe Sleeve	1. Schedule 40 PVC
Conventional Wiring Methods	1. Control Wiring a. 14 AWG Direct Burial 2. Common Wiring a. 12 AWG Direct Burial
Controllers	1. Motorola Irrinet Ace 2. Motorola Irrinet M
Backflow	1. FEBCO Series 825Y or 825YA = ¾" to 2" 2. Watts Series 957 = 2 ½" to 10"
Wire Splices	1. Spears Dri-Splice Wire Connector a. DS-100 2. Spears Sealant a. DS-300
PVC Glue and Solvent	1. PVC 711 Grey Glue 2. PVC Purple Primer

170.20 Tree and Shrub Maintenance During Construction

General

A. The Contractor shall be responsible for maintaining the health, condition, and watering of existing trees and plants during construction. Damage and loss that occurs during this time will be the sole responsibility of the Contractor, requiring replacement with like and kind at no cost to the City. Coordinate with the PRCF PM or Engineering Project Manager on the means and methods to either continue existing irrigation systems or provide a temporary alternate means to watering.

B. Contractor in coordination with City representatives and the Engineer will monitor the existing trees during construction and, in the event trees begin to show stress or the ground moisture content does not allow a soil probe to break the surface and penetrate to a minimum depth of one (1) foot from the base of the tree's trunk to its drip line, Contractor shall provide a temporary irrigation to existing trees at the direction of the City. Water supply to be used for temporary irrigation is to be approved by the City.

C. Contractor shall notify the Engineer when directed work will result in the expenditure of over one half of the authorized amount prior to performing actual work.

D. Contractor's watering frequency is to be no less than, but may be required to be increased beyond the following minimum watering occurrence:
    a. Once every seven (7) days in summer.
    b. Once every fifteen (15) days in fall.
    c. Once every twenty-eight (28) days in spring and winter.

Measurement and Payment

A. Materials, equipment and labor necessary to provide temporary watering to existing trees on the project during construction. Measurement and payment shall be made based on a per gallon basis and include equipment, water, materials, labor and necessary appurtenances to water up to 175 trees and 300 shrubs, to provide an average of 200 gallons of water per tree and 10 gallons of water per shrub total spread over multiple watering events as directed by the City.

Tree Protection During Construction

A. The contractor is responsible for establishing tree protection areas (TPA) that protect all existing trees, all well as soil and root zones around them. A TPA is, at a minimum but limited to, the area inside a perimeter established by the critical root zone (CRZ). The CRZ is equal to 3' outside the dripline or one foot radially from the tree for every one inch of trunk diameter at breast height, whichever is greater. Dripline = furthest extent of tree canopy. Diameter at breast height (DBH) = 4.5' above soil line.

B. The Contractor shall establish and maintain barriers to define tree protection areas throughout all construction activities.

C. Work involving trenching, vehicle movement, and any and all activity that may cause soil compaction inside the TPA shall not occur unless authorized by the PRCF PM or Engineering Project Manager and approved Project Arborist.

170.30 Turf Grass Variety

Products

Item	Manufacturer/Types/Notes
Sod	1. Cynodon dactylon 'hybrid' (Midiron Bermuda)
Sprig	1. Cynodon dactylon 'hybrid' (Midiron Bermuda)
Hydroseed	1. Post Card Bermudagrass Coated and unhulled high-quality Bermuda grass seed

Timing and Rates

A. The Contractor will comply with the following rates and timing of grass installation as described below. If the Contractor schedule for turf installation of the following categories does not comply or meet these dates, the contractor will be required to install sod at no additional compensation to the City. Special approval from the PRCF PM or Engineering Project Manager can be obtained if the contractor would like to return after the following March 1st to complete the installation. If the contractor elects to install over seeded sod, with approval from the PRCF PM or Engineering Project Manager, the contractor is responsible to guarantee that the sod will make a healthy transition from over seeded rye species to the Midiron Bermuda the following spring. If the turf fails to make an adequate transition between the species and seasons as determined by the PRCF PM or Engineering Project Manager, the Contractor shall be responsible for turf replacement.
    a. Sprigging from May 1st to July 15th will be spread uniformly at a minimum rate of 250 US bushels per acre.
    b. Sprigging from July 15th to August 15th will be spread uniformly at a minimum rate of 300 US bushels per acre.
    c. Sprigging from August 15th to August 31st will be spread uniformly at a minimum rate of 350 US bushels per acre.
    d. Hydroseeding shall only be completed between the months of March 1st and September 1st.

170.40 Pump Systems

General

A. The pump system shall be a variable frequency drive-controlled pump station. Design, manufacture, and testing are the sole responsibility of the pump station manufacturer. The pump station is to provide water to the irrigation system while simultaneously maintaining a constant discharge pressure by using a prefabricated pump station with variable frequency drive for pressure regulation, under varying flow conditions up to the maximum specified capacity and will be Underwriters Laboratory UL QCZJ – Packaged Pumping System approved. Pump system equipment, installation, start-up, training, close-out packages, clean-up, and guarantees are a part of this item.
B. Work and materials must be in accordance with the latest edition of the International Building Code, the International Electric Code, the International Plumbing Code, and applicable laws and regulations of local governing authorities.

C. All electrical control panels with controls must be built in accordance to N.E.C., U.L. and E.T.L. standards. The electrical components and enclosure must be labeled as complete U.L. listed assembly with manufacturer's U.L. label applied to the door. All equipment and wiring must be mounted within the enclosure and labeled for proper identification.
D. Pumping system must conform to the following specifications in all respects. This specification covers the minimum requirements; however, it should not be construed as all inclusive.

Guarantee/Warranty and Replacement

A. The manufacturer shall warrant the pumping system to be free of defects and product malfunctions for a period of two years from date of start-up at no extra cost to the City.

170.50 Maintenance

General

A. The Contractor will furnish all labor, materials, supplies and equipment required to establish, maintain, and protect the planted areas, for a 3-month plant establishment period from date of acceptance of the initial planting operations or date of acceptance of project completion. Essentially, whichever portion of the project comes last.
B. The maintenance period shall consist of the time from initial planting through acceptance after the three-month plant establishment period.
C. The Contractor shall supply a maintenance schedule to the PRCF PM or Engineering Project Manager thirty (30) days prior to landscape planting for approval. The Contractor shall be responsible for protection of his work during the maintenance period and shall repair and replace all materials and seeded areas damaged or destroyed within the scope of the Work, regardless of cause.
D. The maintenance schedule should include a month by month breakdown of trash pickup, watering/irrigation schedule, irrigation inspection/repairs, shrub trimming, mowing program, weed control, insect/pest control treatments, aeration, fertilization, top dressing efforts, replanting efforts if required, and re-sprigging, or re-sodding efforts if required.
E. The Contractor's staff shall include supervisory personnel experienced in landscape maintenance. The Work Force is to be experienced and familiar with maintaining plant materials.

Watering

A. A proposed watering schedule shall be submitted to the PRCF PM or Engineering Project Manager thirty (30) days prior to installation of plant materials. The Contractor shall deep water all planted areas, providing water penetration through the root zone. Water application shall be applied at a rate that will provide moisture penetration through the root zone with a minimum of water run-off.
B. In conditions where irrigation controllers are tied into the City's Central Control system, the Contractor shall email irrigation program requests and changes to the PRCF PM or Engineering Project Manager for implementation by the City. There will be cases where program changes will not occur within a 24 to 48-hour window. The Contractor should exercise pre-planning to assure plant materials receive the proper amount of water to promote health and vigor. The Contractor shall provide the names, numbers, and email addresses of those who will be placed in charge of the irrigation system and its components. The City will enter this information into the City's Central Control system to allow for alarms sent via text and email to the designated individuals. The Contractor will dispatch accordingly to rectify any alarms

received. The City will not be held responsible for any programming or equipment errors/failures while under the Contractor's control.

Turf Maintenance

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowing to maintain the following grass height.
    a. Mow bermudagrass variety Mid-Iron and Post Card to a height of 1 ½". Clippings to be mulched into soil. Clippings shall not be left on top of turf.
    b. Mow overseeded bermudagrass variety Mid-Iron with Rye to a height of 1 ½". Clipping to be bagged and removed from site. Wind rowing or mowing without collecting clippings while mowing shall not occur.

Plant Maintenance

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Spray or treat as required to keep trees and shrub areas free of weeds, insects, and disease.
B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace decomposed granite in areas damaged or lost in areas of subsidence.
C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.
D. Inspect landscape granite areas weekly. Remove man-made debris, weeds, and grass controlled with chemicals and/or hand removing. Any erosion that has occurred in granite areas, the Contractor shall remedy, repair and replace granite at the Contractor's expense.
E. Keep all landscape areas free of broadleaf or grassy weeds, with pre-emergent and/or selective contact herbicides. Cultivating or hoeing weeds is not an allowed practice. The Contractor shall eradicate all noxious weeds, or the Owner may not accept the project.
F. Unless otherwise authorized, the Contractor shall maintain all landscape areas, as he completes them during the course of work, on a continuous basis and until project acceptance. The Contractor shall provide adequate and experienced personnel to accomplish all maintenance. Maintenance shall include keeping the landscape areas free of debris on a weekly basis, chemical control and hand removal of weeks, fertilization as needed, cultivating the planting areas, repairing and restoring disturbed granite areas, and repairing tree stakes.
G. Pruning and re-staking shall be required as needed to remove any plant growth conflicting with vehicular or pedestrian movement. Prune, thin, and shape trees, shrubs, and vines according to ANSI A300 standards.

Plant Repair and Replacement

A. The Contractor shall repair/replace damaged plant materials, regardless of cause, upon notification from the PRCF PM or the Engineering Inspector.

Division 18 – City of Mesa Direct Digital Control System Standard

180.00 City of Mesa Direct Digital Control System Standard

	Direct Digital Control Systems Standard	**EFFECTIVE DATE:** 1/1/2022

I. ORGANIZATIONAL STANDARDS

1. Overview
2. Approved Control System Manufactures
3. Quality Assurance
4. Codes and Standards
5. System Performance
6. Submittals
7. Warranty
8. Ownership of Proprietary Material

1.1 OVERVIEW

Every City of Mesa facility that contains an HVAC system will include a Building Automation system that shall consist of a distributed network of BACnet-based interoperable Direct Digital Control (DDC) devices that are configured to perform energy management and monitoring functions for all specified heating, ventilating, air-conditioning (HVAC), and all other sub- systems required per these specifications. These controllers shall communicate via wireless BACnet over ZigBee mesh communication protocol with the Trane Open Protocol System Controllers (SC+) for integration with the COM WAN and to facilitate common global functions for scheduling, trending, alarming, and operator interface. Access to Trane Ensemble, either locally in each building, or remotely from a central site, shall be accomplished through standard Web browsers via the internet and/or local area network. The system shall consist of at least one System Controller (SC+) per building for integration with the Owners WAN and to facilitate common global functions for scheduling, trending, alarming and operator interfaces, and a network of BACnet Direct Digital Controllers (DDSs) for control and monitoring of the specified systems.

Although the primary DDC network shall utilize the BACnet open protocol, it is understood that a BACnet interface may not always be available when integrating directly with peripheral devices or sub-systems. In these cases, a Modbus or LonWorks open protocol may be considered. Device integration via any protocol other than BACnet must be explicitly approved by the City of Mesa.

The system is an enterprise-level multiple building control system as indicated on the drawings and described in the specifications. Control functions within a building site shall be performed by localized direct digital controls linked through a peer-to-peer network of building controllers. The system shall provide a web-based user interface and be designed to integrate multiple BACnet-based systems together, collect, store, and display historical data and provide enterprise-wide or multiple building facilities management capabilities from a central storage and operational location.

An operator shall be able to logon to the system using a standard web browser and be allowed access to all appropriate data and control functions, without requiring system vendor-proprietary software installed on the user's PC.

A. User Interface Requirements

1. Direct Digital Control (DDC) technology shall be used to provide the functions necessary for control of systems defined for control on this project.
2. The control system shall accommodate simultaneous multiple user operation. Access to the control system data should be limited by security permissions of the operator role. Multiple users shall have access to all valid data system data. An operator shall be able to log onto any workstation of the control system and have access to all appropriate data.
3. The control system shall be designed such that each mechanical system will operate under stand-alone control. As such, in the event of a network communication failure, or the loss of other controllers, the control system shall continue to independently operate the unaffected equipment.
4. Communication between the control panels and all workstations shall be over a high-speed network. All nodes on this network shall be peers. A network communications card shall be provided for each building control panel provided as part of the system installation.
5. The BAS shall meet open standard protocol communication standards to ensure the system maintains "interoperability" to avoid proprietary arrangements that will make it difficult for the Owner to consider other BAS manufacturers in future projects.

1.2 APPROVED CONTROL SYSTEM CONTRACTORS AND MANUFACTURERS

A. Manufacturer and Manufacturer Rep:

Manufacturer Name	Product Line	Contractor Name/Address	Contact
Trane	Ensemble – AirFi	Trane	Jerry Behnke (602)350-6322
Trane	Ensemble – AirFi	Trane	Dean Oakley (480) 333-2853

1. The BAS shall be provided by a single manufacturer and this manufacturer's equipment must consist of operator workstation software, Web-based hardware/software, Open Standard Protocol hardware/software, Custom application Programming Language, Graphical Programming Language, Building Controllers, Custom Application Controllers, and Application Specific Controllers. All other products specified herein (i.e., sensors, valves, dampers, actuators, etc.) need not be manufactured by the BAS manufacturer listed in this specification.
2. Independent representatives of BAS manufacturers are not acceptable. BAS vendor must be corporate owned entity of BAS manufacturer.

1.3 QUALITY ASSURANCE

A. System Installer Qualifications

1. The Installer shall have an established working relationship with the Control System Manufacturer of not less than three years.
2. The Installer shall have successfully completed Control System Manufacturer's classes. The BAS Manufacturer shall have factory trained and certified personnel providing all engineering, service, startup, and commissioning field labor for the project from their local office location. The Installer shall present for review the certification of completed training, including the hours of instruction and course outlines upon request.
3 The installer shall have an office within [25] miles of the project site and provide [24-hour] response in the event of a customer warranty or service call.

1.4 CODES AND STANDARDS

A. Work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of local, state, and federal authorities. At a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:

1. National Electric Code (NEC) – NFPA 70.
2. International Building Code (IBC)
3. International Mechanical Code (IMC)
4. Federal Communications Commission – Part J.

5. Underwriters Laboratories: Products shall be UL-916-PAZX listed.
6. ANSI/ASHRAE Standard 135-2001 (BACnet) - (System Level Devices) - Building Controllers shall conform to the listed version of the BACnet specification in order to improve interoperability with various building system manufacturers' control systems and device
7. ASHRAE/ANSI 135-2012 (BACnet) - (Unit Level Devices) - Unit Controllers shall conform to the listed version of the BACnet specification in order to improve interoperability with various building system manufacturers' control systems and devices.

1.5 SYSTEM PERFORMANCE

A. Data values displayed on web pages (that represent live data) shall automatically refresh at a minimum rate of every 10 seconds in the browser without refreshing the entire page.

B. Data on web pages must be returned and updated on a given web page within [5] seconds on average after the web page is initially delivered, subject to network loading.

C. Graphic Display. The system shall display a graphic with a minimum of [20] dynamic points with current data displayed within [10] seconds of the operator's request.

D. Graphic Refresh. The system shall update all dynamic points with current data within [10] seconds.

E. Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be [5] seconds. Analog objects shall start to adjust within [5] seconds.

F. Object Scan. All changes of state and change of analog values shall be transmitted over the high-speed network such that any data used or displayed at a controller or workstation will be current, within the prior [10] seconds.

G. Alarm Response Time. The maximum time from when an object goes into alarm to when it is viewable on an operator workstation web page shall not exceed [10] seconds.

H. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every [5] seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

I. Performance. Programmable Controllers shall be able to execute DDC PID control loops at a selectable frequency from at least once every [5] seconds. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

J. Multiple Alarm Annunciation. All workstations on the network shall receive alarms within 5

seconds of each other.

K. Reporting Accuracy. Table 1 lists minimum acceptable reporting accuracies for all values reported by the specified system.

Table 1 Reporting Accuracy

Measured Variable	Reported Accuracy
Space Temperature	±0.5°C [±1°F]
Ducted Air	±1.0°C [±2°F]
Outside Air	±1.0°C [±2°F]
Water Temperature	±0.5°C [±1°F]
Delta-T	±0.15°C[±0.25°F]
Relative Humidity	±5% RH
Water Flow	±5% of full scale
Air Flow (terminal)	±10% of reading *Note 1
Air Flow (measuring stations)	±5% of reading
Air Pressure (ducts)	±25 Pa [±0.1 "W.G.]
Air Pressure (space)	±3 Pa [±0.01 "W.G.]
Water Pressure	±2% of full scale *Note 2
Electrical Power	± 5% of reading *Note 3
Carbon Monoxide (CO)	± 5% of reading
Carbon Dioxide (CO2)	± 50 PPM

Note 1: (10%-100% of scale) (cannot read accurately below 10%)
Note 2: for both absolute and differential pressure
Note 3: not including utility supplied meters

1.6 SUBMITTALS

A. Contractor shall provide shop drawings and manufacturers' standard specification data sheets on all provided hardware and software for this project. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with plan and specifications. Three (3) copies are required. All shop drawings shall be provided to the Owner electronically DWG or DXF file formats.

B. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the contractor from furnishing quantities required for completion.

C. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with these specifications or which is deemed valuable in

documenting and understanding the system to be installed.

D. Submit the following within 90 days of contract award or otherwise agreed upon between owner, representative, and contractor:

1. A complete bill of materials of equipment to be used indicating quantity, manufacturer, and model number.
2. A schedule of all control valves including the valve size, pressure drop, model number (including pattern and connections), flow, CV, body pressure rating, and location.
3. A schedule of all control dampers. This shall include the damper size, pressure drop, manufacturer and model number.
4. Provide all manufacturer's technical cut sheets for major system components. When technical cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is being submitted to cover. Include:
   a) Building Controllers
   b) Custom Application Controllers
   c) Application Specific Controllers
   d) Operator Interface Computer(s) as specified (workstations)
   e) Portable Operator Workstation(s) or Service software PCs as specified
   f) Auxiliary Control Devices
   g) Proposed BAS architectural diagram showing system configuration, depicting various controller types, workstations, device locations, addresses, and communication cable requirements.
   h) Detailed termination drawings showing all required field and factory terminations, as well as terminal tie-ins to DDC controls provided by mechanical equipment manufacturers. Terminal numbers shall be clearly labeled.
   i) Points list showing all system objects, and the proposed English language object names
   j) Sequence of operations for each controlled mechanical system and terminal end devices. This sequence shall be specific for the use of the Control System being provided for this project
   k) Provide a BACnet Product Implementation Conformance Statement (PICS) for each BACnet system level device type (i.e. Building Controller & Operator Workstations) type. This defines the points list for proper coordination of interoperability with other building
   l) Systems if applicable for this project
   m) Color prints of proposed graphics with a list of points for display

E. Project Record Documents. Upon completion of installation submit three (3) copies of record (as-built) documents. The documents shall be submitted for approval prior to final

completion and include:

1. Project Record Drawings. These shall be as-built versions of the submittal shop drawings. One set of electronic media including PDF, CAD, or DWG drawing files shall also be provided.
2. Testing and Commissioning Reports and Checklists signed off by trained factory (equipment manufacturers) and field (BAS) commissioning personnel.
3. Operating and Maintenance (O & M) Manual. These shall be as-built versions of the submittal product data. In addition to that required for the submittals, the O & M manual shall include:
    a) Names, address, and 24-hour telephone numbers of Contractors installing equipment, and the control systems and service representative of each.
    b) Operators Manual with procedures of operating the control systems including logging on/off, alarm handling, producing point reports, trending data, overriding computer control, and changing set points and other variables.
    c) Programming Manual with a description of the programming language including syntax, statement descriptions including algorithms and calculations used, point database creation and modification, program creation and modification, and use of the editor.
    d) Engineering, Installation and Maintenance Manual(s) explaining how to design and install new points, panels, and other hardware; preventative maintenance and calibration procedures; how to debug hardware problems; and how to repair or replace hardware
    e) A listing and documentation of all custom software created using the programming language including the point database. One set of magnetic media containing files of the software and database shall also be provided.
    f) One set of electronic media containing files of all color-graphic screens created for the project.
    g) Complete original issue documentation, installation, and maintenance information for all third-party hardware provided including computer equipment and sensors.
    h) Complete original issue media for all software provided including operating systems, programming language, operator workstation software, and graphics software.
    i) Licenses, guarantee, and warranty documents for all equipment and systems.
    j) Recommended preventive maintenance procedures for all system components including a schedule of tasks, time between tasks, and task descriptions.

F. Training Materials: The Contractor shall provide a course outline and training materials for all training classes at least two weeks prior to the first class. The Owner reserves the right to modify any or all the training course outline and training materials. Review and approval by Owner and Engineer shall be completed at least 3 weeks prior to first class.

1.7 WARRANTY

A. Warrant all work as follows:

1. Labor & materials for control system specified shall be warranted free from defects for a period of twelve (12) months after final completion acceptance by the Owner. Control System failures during the warranty period shall be adjusted, repaired, or replaced at no charge or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during customary business hours.
2. At the end of the final start-up/testing, if equipment and systems are operating satisfactorily to the Owner and Engineer, the Owner shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of Owner's acceptance shall be the start of warranty.
3. Central server and configuration tool software, project specific software, graphics, database, firmware updates and any changes required that resulted in errors in programming not caught after installation and sign off shall be provided to the Owner at no charge during the warranty period. Written authorization by Owner must, however, be granted prior to the installation of such changes.
4. The system provider shall provide a web-accessible on-line resource that provides the Owner access to a question/answer forum, graphics library, user tips, upgrades, and manufacturer training schedules.

1.8 OWNERSHIP OF PROPRIETARY MATERIAL

A. All project-developed hardware and software shall become the property of the Owner. These items include but are not limited to:

1. Project graphic images
2. Record drawings
3. Project database
4. Project-specific application programming code
5. All documentation

II. PRODUCTS

1. Architecture/Communication
2. Operator Interface
3. Application and Control Software
4. System Controllers

2.1 ARCHITECTURE/COMMUNICATION

A. This project shall be comprised of a high-speed Ethernet network utilizing BACnet/IP

communications between System Controllers, Workstations and Unitary Intelligent Equipment coordinators. Communications between System Controllers and sub-networks of Custom Application Controllers and/or Application Specific Controllers shall utilize [BACnet/Zigbee] or [BACnet/MSTP (RS485)] communications. Communications of Unitary intelligent room equipment to the coordinators shall be EA certified 902mhz (ISO/IEC 14543-3-10/11).

B. BACnet/Zigbee

1. Each System Controller shall perform communications to a network of Custom Application and Application Specific Controllers using BACnet/Zigbee (802.15.4) as defined by the Zigbee Standard.
   a) Each communication interface shall be Zigbee Building Automation Certified product as defined by the BACnet Standard and the Zigbee Alliance.
   b) Each System Controller shall function as a BACnet Router to each unit controller providing a unique BACnet Device ID for all controllers within the system.
2. All values within the system – contained in both the system and unit controllers - (i.e. Schedules, Data Logs, Points, Application Variables, Custom Program Variables) shall be readable and controllable (where appropriate) by any System Controller or BACnet Workstation on the communications network via BACnet.

C. Wireless primary equipment controllers and auxiliary control devices shall conform to:

1. IEEE 802.15.4 radios to minimize risk of interference and maximize battery life, reliability, and range.
2. Communication between equipment controllers shall conform to ZigBee Building Automation (ZBA) standard as BACnet tunneling devices to ensure future integration of other ZBA certified devices.
3. Operating range shall be a minimum of 200 feet; open range shall be 2,500 ft. (762 m) with less than 2% packet error rate to ensure reliable operation.
4. To maintain robust communication, mesh networking and two-way communications shall be used to optimize the wireless network health.
5. Wireless communication shall be capable of many-to-one sensors per controller to support averaging, monitoring, and multiple zone applications.
6. Certifications shall include FCC CFR47 - RADIO FREQUENCY DEVICES - Section 15.247 & Subpart E.
7. Communication between equipment controllers shall conform to ZigBee Building Automation (ZBA) standard as BACnet tunneling devices to ensure future integration of other ZBA certified devices.
8. Operating range shall be a minimum of 200 feet; open range shall be 2,500 ft. (762 m) with less than 2% packet error rate to ensure reliable operation.

D. Wireless in room unitary and ancillary control devices shall conform to:

1. Radio certification of FCC (U.S. SZV-STM300U) & C (Canada 5713A-STM300U) at 902mhz.(ISO/IEC 14543-3-10/11)
2. Operating range shall be a minimum of 60 feet; open range shall be 300ft with less than 2% packet error rate to ensure reliable operation.
3. Wireless in room devices must be able to be fully configured with the intended application through a wireless connection direct to the device utilizing ISO/IEC 14543-3-10/11 compliant communications by user-friendly windows-based configuration tools.
4. In room unitary equipment coordinators must conform to both Bacnet IP BTL standards as well as EA 2.0/3.0 and must be capable of POE and 802.11.g/f wireless communications.
5. Coordinators must be able to automatically generate appropriate BACnet IP compliant messages from the in room unitary controls. Devices that require manual device input and output programming and BACnet message correlation table entries will not be accepted.
6. Wireless operating range shall be a minimum of 30 feet; open range shall be 200 ft. with less than 2% packet error rate to ensure reliable operation.
7. Unitary edge devices must be wireless, maintenance free and must not rely on batteries.

E. Wireless Space Sensors

1. Battery life shall be 15 years or greater to minimize the need for battery replacement in typical operating conditions.
2. To check for proper operation, wireless space temperature sensors shall include a signal strength on the space sensor display.
3. To allow local troubleshooting without specialized tools, error codes shall be displayed on the digital display. Error codes shall include not associated, address to 000, improper software configuration, input voltage too high, or general sensor failure. Codes shall be indicated on inside of sensor back cover.
4. To support use by the physically impaired, the wireless space sensor shall be a minimum font size of 12 points, and the LCD model shall be readable in low light conditions.
5. An optional 2% relative humidity sensors module shall be available for humidity control applications to minimize the need for wires sensors and shall not shorten typical battery life to less than 15 years.

F. SERVICE TOOLS

1. To support network setup and troubleshooting, service tools shall display link quality and hop quantities for each wireless device.
2. Wireless service tool access to comm link shall be provided to minimize installation and troubleshooting labor.

G. Wireless space sensors for use in Heating, Ventilating, and Air Conditioning (HVAC) systems

1. Temperature and Humidity Range
   a) The ambient operating temperature range for the wireless space sensor shall be 32 to 122°F (0 to 50°C).
   b) The ambient storage temperature range for the wireless space sensor shall be -40 to 185°F (-40 to 85°C).C.
   c) The ambient operating and storage humidity range for the wireless space sensor shall be 5 to 95%, non-condensing.
2. Components
   a) Wireless space sensors shall be available as: temperature only, field configurable model with digital display, and optional 2% humidity module for use in either model above. The field configurable model shall all allow field configuration without a field service tool. Configuration options include: setpoint, override pushbuttons, fan speed, and system mode switches. System mode, fan speed and setpoint shall include a lock option. The digital display shall also be field configurable to display in Fahrenheit or Celsius units of measure and configurable to display setpoint only.
   b) The wireless space sensor addresses shall be held in non-volatile memory to ensure operation through system voltage disturbances and to minimize the risk of incorrect association.
   c) The wireless space sensor shall be addressed using pushbuttons and display with numerical indication to simplify and reduce installation time and minimize risk of incorrect addressing. Two position DIP switches are not acceptable.
   d) Installation and replacement of failed sensors shall be accomplished automatically after power up.
   e) The wireless space sensor shall include security screws to protect against theft.
   f) Wireless space sensor component certifications shall include:
      1) TFP-13651127 - Canada Compliance
      2) UL 916 - Energy Management Equipment
      3) UL 94 - The Standard for Flammability of Plastic Materials for Parts in Devices and Appliances: 5 VA flammability rating
      4) UL 873 - Temperature regulating and indicating equipment
3. Accuracy
   a) To ensure proper system performance, the wireless space sensors shall automatically determine when the space temperature is rapidly changing. When the space temperature is readily changing, the space temperature shall be transmitted at least once each 30 seconds. The maximum time between transmissions shall be 15 minutes. Space temperature sensing accuracy shall be +/- 0.5F (+/- 0.28C).
4. Power Requirements
   a) The wireless space sensor battery life shall provide at least 15 years life under normal operating conditions and must be readily available size AA, 1.5V.

B. Wireless Communications Interface for use in Heating, Ventilating, and Air Conditioning (HVAC) systems

1. Temperature and Humidity Range
   a) The ambient storage temperature range for the wireless communications interface shall be -40 to 185°F (-40 to 85°C).
   b) The ambient operating and storage humidity range for the wireless communications interface shall be 5 to 95%, non-condensing.
2. Components
   a) The wireless communications interface shall be addressed using rotary switches with numerical indication to simplify and reduce installation time and minimize risk of incorrect addressing. Two position DIP switches are not acceptable.
   b) Wireless Comm Interface certifications shall include:
      1) TFP-13651127 - Canada Compliance
      2) UL 916 - Energy Management Equipment
      3) UL 94 - The Standard for Flammability of Plastic Materials for Parts in Devices and Appliances: 5 VA flammability rating
      4) UL 873 - Temperature regulating and indicating equipment
      5) ZigBee Building Automation, BACnet Tunnelling Device

2.4 OPERATOR INTERFACE

A. Each operator interface PC shall include the following:

1. Operating Systems
   a) Windows 10 or above (with up-to-date versioning)
2. Minimum Hardware
   a) Pentium Core 2 DUO or better
   b) 4 GB RAM
   c) 100 GB hard drive space
   d) Internet Browser compatible with operator interface requirements outlined in the operator interface section

B. Operator Interface

1. The operator interface shall be accessible via a web browser without requiring any “plug-ins” (i.e. JAVA Runtime Environment (JRE), Adobe Flash).
2. The operator interface shall support the following Internet web browsers (current version):
   a) Firefox
   b) Chrome

c) Edge
d) Safari

3. The operator interface shall support the following mobile web browsers:
   a) iOS (iPad/iPhone) V7.0+
   b) Android (Tablet) V4.3+
   c) Android (Phone) V2.3+

C. System Security

1. Each operator shall be required to login to the system with a username and password in order to view, edit, add, or delete data.
2. User Profiles shall restrict the user to only the objects, applications, and system functions as assigned by the system administrator.
3. Each operator shall be allowed to change their user password.
4. The System Administrator shall be able to manage the security for all other users.
5. The system shall include pre-defined “roles” that allow a system administrator to quickly assign permissions to a user.
6. User logon/logoff attempts shall be recorded.
7. The system shall protect itself from unauthorized use by automatically logging off following the last key stroke. The delay time shall be user definable.
8. All system security data shall be stored in an encrypted format.

D. Database

1. Database Save. A system operator with the proper password clearance shall be able to archive the database on the designated operator interface PC.
2. Database Restore. The system operator shall also be able to clear a panel database and manually initiate a download of a specified database to any panel in the system.

E. On-Line Help and Training

1. Provide a context sensitive, online help system to assist the operator in operation and configuration of the system.
2. On-line help shall be available for all system functions and shall provide the relevant data for each particular screen.

F. System Diagnostics

1. The system shall automatically monitor the operation of all network connections, building management panels, and controllers.
2. The failure of any device shall be annunciated to the operators.

G. Equipment & Application Pages

1. The operator interface shall include standard pages for all equipment and applications. These pages shall allow an operator to obtain information relevant to the operation of the equipment and/or application, including:
   a) Animated Equipment Graphics for each major piece of equipment and floor plan in the system. This includes:
      1) If applicable, each Chiller, Air Handler, VAV Terminal, Fan Coil, Boiler, and Cooling Tower. These graphics shall show all points dynamically as specified in the points list.
   b) b. Animation capabilities shall include the ability to show a sequence of images reflecting the position of analog outputs, such as valve or damper positions. Graphics shall be capable of launching other web pages.
   c) Alarms relevant to the equipment or application without requiring a user to navigate to an alarm page and perform a filter.
   d) Historical Data (As defined in Data Log section below) for the equipment or application without requiring a user to navigate to a Data Log page and perform a filter.

H. System Graphics. Operator interface shall be graphically based and shall include at least one graphic per piece of equipment or occupied zone, graphics for each chilled water and hot water system, and graphics that summarize conditions on each floor of each building included in this contract. Indicate thermal comfort on floor plan summary graphics using colors to represent zone temperature relative to zone set point.

1. Functionality. Graphics shall allow operator to monitor system status, to view a summary of the most important data for each controlled zone or piece of equipment, to use point and-click navigation between zones or equipment, and to edit set points and other specified parameters.
2. Graphic imagery. graphics shall use 3D images for all standard and custom graphics. The only allowable exceptions will be photo images, maps, schematic drawings, and selected floor plans.
3. Animation. Graphics shall be able to animate by displaying different images for changed object status.
4. Alarm Indication. Indicate areas or equipment in an alarm condition using color or other visual indicator.
5. Format. Graphics shall be saved in an industry-standard format such as BMP, JPEG, PNG, or GIF. Web-based system graphics shall be viewable on browsers compatible with World Wide Web Consortium browser standards. Web graphic format shall require no plug-in (such as HTML and JavaScript) or shall only require widely available no-cost plug-ins (such as Active-X and Macromedia Flash).

I. Custom Graphics. The operator interface shall be capable of displaying custom graphics in order

to convey the status of the facility to its operators.

1. Graphical Navigation. The operator interface shall provide dynamic color graphics of building areas, systems, and equipment.
2. Graphical Data Visualization. The operator interface shall support dynamic points including analog and binary values, dynamic text, static text, and animation files.
3. Custom background images. Custom background images shall be created with the use of commonly available graphics packages such as Adobe Photoshop. The graphics generation package shall create and modify graphics that are saved in industry standard formats such as GIF and JPEG.

J. Graphics Library. Furnish a library of standard HVAC equipment such as chillers, air handlers, terminals, fan coils, unit ventilators, rooftop units, and VAV boxes, in 3-dimensional graphic depictions. The library shall be furnished in a file format compatible with the graphics generation package program.

K. Manual Control and Override.

1. Point Control. Provide a method for a user to view, override, and edit if applicable, the status of any object and property in the system. The point status shall be available by menu, on graphics or through custom programs.
2. Temporary Overrides. The user shall be able to perform a temporary override wherever an override is allowed, automatically removing the override after a specified period.
3. Override Owners. The system shall convey to the user the owner of each override for all priorities that an override exists.
4. Provide a specific icon to show timed override or operator override, when a point, unit controller or application has been overridden manually.

L. Engineering Units

1. Allow for selection of the desired engineering units (i.e., Inch pound or SI) in the system.
2. Unit selection shall be able to be customized by locality to select the desired units for each measurement.
3. Engineering units on this project shall be IP or SI.

M. Scheduling. A user shall be able to perform the following tasks utilizing the operator interface:

1. Create a new schedule, defining the default values, events, and membership.
2. Create exceptions to a schedule for any given day.
3. Apply an exception that spans a single day or multiple days.
4. View a schedule by day, week, and month.
5. Exception schedules and holidays shall be shown clearly on the calendar.

6. Modify the schedule events, members, and exceptions.

N. Data Logs

1. Data Logs Definition.
   a) The operator interface shall allow a user with the appropriate security permissions to define a Data Log for any data in the system.
   b) The operator interface shall allow a user to define any Data Log options as described in the Application and Control Software section.
2. Data Log Viewer.
   a) The operator interface shall allow Data Log data to be viewed and printed.
   b) The operator interface shall allow a user to view Data Log data in a text-based format (time stamp/value).
   c) The operator shall be able to view the data collected by a Data Log in a graphical chart in the operator interface.
   d) Data Log viewing capabilities shall include the ability to show a minimum of 5 points on a chart.
   e) Each data point data line shall be displayed as a unique color.
   f) The operator shall be able to specify the duration of historical data to view by scrolling and zooming.
   g) The system shall provide a graphical trace display of the associated time stamp and value for any selected point along the x-axis.
3. Export Data Logs.
   a) The operator interface shall allow a user to export Data Log data in CSV or PDF format for use by other industry standard word processing and spreadsheet packages.

O. Alarm/Event Notification

1. An operator shall be notified of new alarms/events as they occur while navigating through any part of the system via an alarm icon.
2. Alarm/Event Log. The operator shall be able to view all logged system alarms/events from any operator interface.
   a) The operator shall be able to sort and filter alarms from events. Alarms shall be sorted in a minimum of 4 categories based on severity.
   b) Alarm/event messages shall use full language, easily recognized descriptors.
   c) An operator with the proper security level may acknowledge and clear alarms/events.
   d) All alarms/events that have not been cleared by the operator shall be stored by the building controller.
   e) The alarm/event log shall include a comment field for each alarm/event that allows a user to add specific comments associated with any alarm.
3. Alarm Processing.
   a) The operator shall be able to configure any object in the system to generate an alarm

when transitioning in and out of a normal state.

b) The operator shall be able to configure the alarm limits, warning limits, states, and reactions for each object in the system.

P. Reports and Logs.

1. The operator interface shall provide a reporting package that allows the operator to select reports.
2. The operator interface shall provide the ability to schedule reports to run at specified intervals of time.
3. The operator interface shall allow a user to export reports and logs from the building controller in a format that is readily accessible by other standard software applications including spreadsheets and word processing. Acceptable formats include:
   a) CSV, HTML, XML, PDF
4. Reports and logs shall be readily printed to the system printer.
5. Provide a means to list and access the last 10 reports viewed by the user.
6. The following standard reports shall be available without requiring a user to manually configure the report:
   a) All Points in Alarm Report: Provide an on-demand report showing all current alarms.
7. All Points in Override Report: Provide an on-demand report showing all overrides in effect.
   a) Commissioning Report: Provide a one-time report that lists all equipment with the unit configuration and present operation.
   b) Points report: Provide a report that lists the current value of all points.

Q. Air Handler Unit/RTU System. An operator shall be able to view and control (where applicable) the following parameters via the operator interface:

1. System Mode
2. System Occupancy
3. Ventilation (Outdoor air flow) setpoint
4. Ventilation (Outdoor air flow) status
5. Air Handler Static pressure setpoint
6. Air Handler Static pressure status
7. Air Handler occupancy status
8. Air Handler Supply air cooling and heating set points
9. Air Handler minimum, maximum and nominal static pressure setpoints
10. VAV box minimum and maximum flow
11. VAV box drive open and close overrides
12. VAV box occupancy status
13. VAV box Airflow to space
14. Average space temperature

15. Minimum space temperature
16. Maximum space temperature

2.3 APPLICATION AND CONTROL SOFTWARE

A. Furnish the following applications software for building and energy management. All software applications shall reside and run in the system controllers. Editing of applications shall occur at the operator interface.

1. Scheduling. Provide the capability to schedule each object or group of objects in the system. Each of these schedules shall include the capability for start, stop, optimal start, optimal stop, and night economizer actions. Each schedule may consist of up to [10] events. When a group of objects are scheduled together, provide the capability to define advances and delays for each member. Each schedule shall consist of the following:
   a) Weekly Schedule. Provide separate schedules for each day of the week.
   b) Exception Schedules. Provide the ability for the operator to designate any day of the year as an exception schedule. This exception schedule shall override the standard schedule for that day. Exception schedules may be defined up to a year in advance. Once an exception schedule is executed it will be discarded and replaced by the standard schedule for that day of the week.
   c) Holiday Schedules. Provide the capability for the operator to define up to 99 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.
   d) Optimal Start. The scheduling application outlined above shall support an optimal start algorithm. This shall calculate the thermal characteristics of a zone and start the equipment prior to occupancy to achieve the desired space temperature at the specified occupancy time. The algorithm shall calculate separate sets of heating and cooling rates for zones that have been unoccupied for less then and greater than 24 hours. Provide the ability to modify the start algorithm based on outdoor air temperature. Provide an early start limit in minutes to prevent the system from starting before an operator determined time limit.
2. Data Log Application
   a) Data Log data shall be sampled and stored on the System Controller panel and shall be capable of being archived to a BACnet Workstation for longer term storage.
      1. Data Log sample types shall include interval, start-time, and stop-time.
      2. Data Log intervals shall be configurable as frequently as 1 minute and as infrequently as 1 year.
   b) Data Logs
      1. The system controller shall contain Data Log information for defined key measurements for each controlled HVAC device and HVAC application.
      2. The Data Logs shall monitor these parameters for a minimum of 7 days at 15-

minute intervals. The Data Logs intervals shall be user adjustable.

3. The following is a list of key measurements required to be data logged:

a) Air Systems

Air Handling Unit/Rooftop (VAV)	Discharge Air Temperature
	Discharge Air Temperature Setpoint Active
	Space Temperature Active
	Cooling Capacity Status
	Discharge Air Flow

Air Handling Unit/Rooftop (CV)	Discharge Air Temperature
	Space Temperature Active
	Space Temperature Setpoint Active
	Cooling Capacity Status
	Heating Capacity Primary Status
	Outdoor Air Damper Position

b) Area

Area	Active Setpoint
	Heat/Cool Mode Status
	Space Temperature Average
	Space Maximum Temperature
	Space Minimum Temperature
	Space Temperature Sensor

3. Alarm/Event Log
   a) Any object in the system shall be configurable to generate an alarm when transitioning in and out of a normal or fault state.
   b) Any object in the system shall allow the alarm limits, warning limits, states, and reactions to be configured for each object in the system.
   c) An alarm/event shall be capable of triggering any of the following actions:
      1) Route the alarm/event to one or more alarm log.
         a) The alarm message shall include the name of the alarm location, the device that generated the alarm, and the alarm message itself.
      2) Route an e-mail message to an operator(s)

3) Log a data point(s) for a period of time.
4) Run a custom control program.

4. Air Handling Unit/RTU System Coordination. Provide applications software to properly coordinate and control the AHU system to ensure equipment safety and minimize energy use. This application shall perform the following functions:
   a) Startup and shutdown the air handler safely.
   b) Ventilation Optimization (ASHRAE 62) – properly ventilate all spaces while minimizing operating energy costs, using measured outdoor air flow. Dynamically calculate the system outdoor air requirement based on "real time" conditions in the spaces (i.e., number of occupants, CO2 levels, etc.) minimizing the amount of unconditioned outdoor air that must be brought into the building.
   c) Demand Controlled Ventilation – the active ventilation setpoint shall modulate between the occupied ventilation and occupied standby ventilation setpoint; reset the setpoint based on CO2 levels in the space.
5. Point Control. User shall have the option to set the update interval, minimum on/off time, event notification, custom programming on change of events.
6. Timed Override. A standard application shall be utilized to enable/disable temperature control when a user selects on/cancel at the zone sensor, operator interface, or the local operator display. The amount of time that the override takes precedence will be selectable from the operator interface.
7. Anti-Short Cycling. All binary output points shall be protected from short cycling

2.4 SYSTEM CONTROLLERS

A. There shall be one or more independent, standalone microprocessor-based System Controllers to manage the global strategies described in Application and Control Software section.

1. The System Controller shall have sufficient memory to support its operating system, database, and programming requirements.
2. The controller shall provide a USB communications port for connection to a PC.
3. The operating system of the Controller shall manage the input and output communications signals to allow distributed controllers to share real and virtual point information and allow central monitoring and alarms.
4. All System Controllers shall have a real time clock.
5. Data shall be shared between networked System Controllers.
6. The System Controller shall continually check the status of its processor and memory circuits. If an abnormal operation is detected, the controller shall:
   a) Assume a predetermined failure mode.
   b) Generate an alarm notification.
   c) Create a retrievable file of the state of all applicable memory locations at the time of the failure.
   d) Automatically reset the System Controller to return to a normal operating mode.

7. Environment. Controller hardware shall be suitable for the anticipated ambient conditions. Controller used in conditioned ambient shall be mounted in an enclosure and shall be rated for operation at -40 C to 50 C [-40 F to 122 F].
8. Clock Synchronization.
    a) All System Controllers shall be able to synchronize with a NTP server for automatic time synchronization.
    b) All System Controllers shall be able to accept a BACnet time synchronization command for automatic time synchronization.
    c) All System Controllers shall automatically adjust for daylight savings time if applicable.
9. Serviceability
    a) Provide diagnostic LEDs for power, communications, and processor.
    b) The System Controller shall have a display on the main board that indicates the current operating mode of the controller.
    c) All wiring connections shall be made to field removable, modular terminal connectors.
    d) The System controller shall utilize standard DIN mounting methods for installation and replacement.
10. Memory. The System Controller shall maintain all BIOS and programming information indefinitely without power to the System controller.
11. Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shut-down below 80% nominal voltage.
12. BACnet Test Labs (BTL) Listing. Each System Controller shall be listed as a Building Controller (B-BC) by the BACnet Test Labs with a minimum BACnet Protocol Revision of 14.