Town of Queen Creek

Standard Construction Specifications for Vertical Construction 2024/25

The purpose of these Standard Construction Specifications is to provide minimum standards of materials and construction methods used for new construction of buildings and repair, maintenance or any other alteration to a building's equipment or systems. The standards outlined within this document are primarily intended to be used by designers, Architects and Engineers when developing designs and incorporating them into the project specifications for any project that includes vertical construction and is owned and maintained by the Town of Queen Creek (TOQC); however, these standards are also intended to be used as supplemental instructions for Contractors when performing work and shall be included in the construction contract language. Any item(s) specified for a particular project that are not included in these standards, shall be presented to and approved by the appropriate department, through the Town of Queen Creek Public Works Department, prior to specifying or approval of submittals. In the event a conflict arises between these Standard Construction Specifications and any other specifications, these Standard Construction Specifications shall govern. Unless otherwise excluded, these Standard Construction Specifications shall apply to all materials and methods of construction for work performed for the Town of Queen Creek.

Nothing in this standard is intended to allow or approve any material, equipment, installation, or method in violation of the building codes adopted and enforced by the Town under "the Town Building Code". All materials and equipment must be installed in accordance with the applicable manufacturer's installation instructions and limitations and any applicable third-party listing and labelling approvals recognized by the Town Building Code. Existing equipment and material installations that conformed to the Town's building code standards at the time of construction shall be permitted to continue without change, except as otherwise specifically provided in the Town Building Code and will not require change retroactively.

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Division 01: General Requirements and Miscellaneous Installation Practices

A. General Requirements

1. All work shall include a minimum 2-year warranty period from the agreed upon, substantial completion date.
2. Multivista construction documentation services shall be used from start through the duration of each building construction project in order to document progress of construction and locations of systems within walls/ceilings/ground. Contractor shall include the cost of using this software in their bid proposals.
3. Computer Aided Design (CAD) files shall be provided to the Town of Queen Creek for all projects to maintain proper and accurate record drawings and for upload to Queen Creek GIS (QCGIS).
4. For facilities utilizing evaporative cooling and standard DX or chilled water air conditioning, design shall include properly sealed and insulated barriers to separate the spaces and protect against climate mixing.
5. Buildings deemed as "critical" facilities shall be designed with back-up or standby generator power systems. Examples of "critical" facilities are Fire Stations, Police Stations or any other Public Safety support facility or facilities housing cl network infrastructure. Some facilities may not be deemed as "critical" facilities; however, design considerations may be necessary to include provisions for quick, non-energized connections for temporary generators if needed. These needs would be decided during early programming phases of a project.

B. Closeout Documentation – As-Built/Record Drawings

1. As-built drawings, digital and/or hard copy, shall be maintained and updated on site for the duration of construction. Drawings will be reviewed regularly by TOQC Inspectors throughout construction.
2. Provide marked up as-built drawings only where deviations from original design had occurred.
3. Where changes to design have been approved, drawings shall be labeled with the RFI, Construction Change Directive, Architects Supplemental Instruction (ASI), Change Order, etc.
4. Concealed elements that have been installed for future connections or as spare, such as underground or above hard ceiling conduit shall be clearly identified on the as-built drawings and dimensioned both vertically and horizontally. Descriptions such as "below grade" or "above ceiling" shall be used.
5. Identify all locations where sleeves under roadways, sidewalks, equipment pads, etc. have been provided.
6. Where underground utilities are damaged and repaired during construction, notes shall be indicated on the as-built drawings indicating the type of utility encountered, size of utility, depth of utility, type of repair made and date the repair was made.
7. All final as-built drawings provided to TOQC shall be in digital, PDF format with all redlines prepared using a digital PDF editing program such as Bluebeam, Adobe Acrobat or similar. Handwritten redline drawings are not acceptable.

(a) Each sheet of the as-built drawings shall be named according to the sheet designation assigned by the Architect/Engineer, i.e. “A-201”, “M2.1”, etc. and properly grouped by disciplines as provided by the designers.
(b) Drawings shall be bookmarked and properly hyperlinked to the general sheet index for the plan set.
(c) RFI and ASI Sheets shall be included in the as-built drawing package at the end of the plan set and each sheet shall be labeled by the corresponding RFI or ASI number. Where multiple pages are involved for an RFI or ASI, subsequent pages shall be labeled with the referenced number first and then numerically in page succession, i.e. “RFI-1-001, RFI-1-002, etc.”. RFIs and ASIs referenced on individual plan sheets shall be hyperlinked to the first sheet of that RFI or ASI.
(d) As-built drawings shall include all utility provided drawings such as SRP, Cox, Lumen, etc.
(e) The cover sheet of the as-built set shall have the designation of “As-Built Drawing” in large, red font, in a prominent location on the title block of the sheet.
(f) The Architect’s or Engineer’s seal and signature shall be removed or permanently obscured on all as-built drawings that have been altered.

C. Closeout Documentation – Operation and Maintenance (O&M) Manuals

1. Provide operating and maintenance manuals for all systems, subsystems, and equipment that requires operation and regular maintenance, or has replaceable parts. For each system, subsystem, and piece of equipment not part of a system, include source information, product data, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and warranty information.
2. Provide Operation and Maintenance Manuals in electronic, PDF format consisting of a single master directory with sub- directories for the individual PDF files for each system and piece of equipment. Provide a table of contents file with hyperlinks to each of the individual PDF files within the sub- directories.
   (a) O&M manuals shall include separate sections for testing, start-up, commissioning, etc. for each discipline, as needed. For example, Division 23 may have separate tabs for start-up and testing, commissioning, Test and Balance (TAB) and Division 26 may have a separate tab for Electrical Testing to include meg-ohm reports, torque reports and Hi-Pot Testing.
   (b) Separate tabs shall be included for systems and equipment controls to include as-built control schematics/wiring diagrams and record sequence of operations and control procedures.
   (c) All HVAC equipment shall have corresponding start-up sheets for each piece of equipment indicating at minimum: model number, serial number, electrical operating data (voltage, amperage, etc.) for both nameplate and as measured, start-up (warranty start) date, belt size(s) if applicable, filter size(s) if applicable and technician performing start-up.
   (d) An accurate spare parts list with a signed copy of TOQC receipt of items shall be included in a separate tab.
   (e) Fire alarm O&M submittals shall include copies of the NFPA 72 pre-test documentation and AHJ acceptance of the system.

(f) QA/QC and testing documentation for each jurisdiction shall have separate tabs labeled as Testing, QA/QC and placed under each corresponding discipline.
(g) Clear and concise maintenance and service schedules shall be provided for all major equipment and included as separate tabs under each corresponding system.
(h) Maintenance service contracts, if applicable, shall be included under separate tabs and grouped with the appropriate corresponding systems.
(i) Warranty letters for each discipline shall be included at the front of each discipline's section and have clear start and termination dates for warranties.

3. Training information including videos shall be included in the O&M manual.
4. Contractor shall video record all waste piping mains to document as-built conditions and provide separate video files with the O&M manuals.

Division 07: Thermal and Moisture Protection (Roof Systems, Insulation, Caulking, etc.)

A. Roofing

1. Crickets shall be installed on the uphill side of any equipment base, ductwork, etc. wider than 12".
2. Piping/conduits shall be sleeved through the roof structure with a pipe sized to allow 1" of clearance around all piping/conduits/insulation, etc., and shall extend a minimum of 12" above the finished roof.
3. The interior of parapet walls 30" and less in height (not viewable by the general public) shall have the roofing material run up the wall and under the parapet cap. Parapet walls over 30" high shall have the roofing material run up the wall 18" minimum.

B. Roofing Products

1. Standard roof hatches (unless specified otherwise) shall be Model Type S, manufactured by Bilco.
2. LadderUP safety posts, model LU-1, manufactured by Bilco shall be a standard accessory with all roof hatches.

C. Elastomeric Roof Coating Systems

1. (RESERVED FOR FUTURE USE)

Division 08: Openings (Doors, Door Hardware, Storefront Systems, Automatic Doors and Operators, Glazing, etc.)

A. Door Hardware

1. Install factory-made latch guards over door latches on park buildings and remotely located building doors subject to vandalism.
2. Access doors in restrooms, wet locations, or outdoors shall be stainless steel with slot-head, screw latches.
3. Access doors in all other interior locations shall be paintable steel, painted to match the wall color.

B. Door Hardware Products

1. 9K Varsity Series cylindrical locks and levers manufactured by BEST for interior, exterior, light-duty and heavy-duty use areas with Lost Motion feature and 15D trim standard.
2. 9K Series lockset functions per room type shall be as follows:

(a) 9K-AB – Office Faculty, Administration
(b) 9K-IN – Classroom Security, Conference Rooms
(c) 9K-D – Storeroom, Storage, Mechanical and Electrical Rooms
(d) 9K-N – Coat Closets, Non-Secure Rooms
(e) 9K-L – Privacy Rooms such as Bathrooms

3. Where existing sites have mortise locksets, BEST 45H Series shall be used only to match existing.
4. Keying system shall have BEST, 7 pin, interchangeable core, Standard "L" keyway with Cormax Keying System.
5. Standard door closers shall be heavy duty, Grade 1, model QDC100 manufactured by Stanley.
6. Exterior door hinges shall be five knuckle, full mortise, heavy weight, concealed bearing with non-removable pins, model CB199 NRP 4.5" x 4.5" manufactured by Best(Stanley).
7. Interior door hinges shall be five knuckle, full mortise, heavy weight, concealed bearing with non-removable pins, model CB168 NRP 4.5" x 4.5" manufactured by Best (Stanley).
8. Where continuous hinges are specified, Best (Stanley) model 661HD, heavy duty, full mortise, flush mount hinges shall be used for all heavy-duty exterior doors utilizing a continuous hinge application.
9. For doors with access control utilizing electric hinges, exterior hinges shall be Stanley model CECB199 and interior hinges Best (Stanley) model CECB168.
10. Lock/latch guards shall be Ives brand, model LG1 with security pin with typical 630 finish (satin stainless) or finish to match other hardware as needed.
11. Exit Devices shall be manufactured by Precision, model 2103CD x 4903A for standard rim devices or FL2108 x 4908A for fire rated rim devices.
12. All padlocks shall be solid steel body, 1.75" wide, interchangeable core, manufactured by Best, model 21B722L or American Padlocks Model #A3201WO.
13. Auxiliary Locks (dead bolts) shall be Best, model 83T-S.
14. Knox Boxes shall be provided as follows:
    (a) Model 3271NC w/ tamper alert switch, recessed mount, hardwired to and communicating with Fire Alarm Panel (TOQC preferred option)
    (b) Model 3262NC w/ tamper alert switch to Fire Alarm Panel for surface mount
    (c) Model 3502 w/ single lock-on plate and 2-position toggle switch for gate and key switches

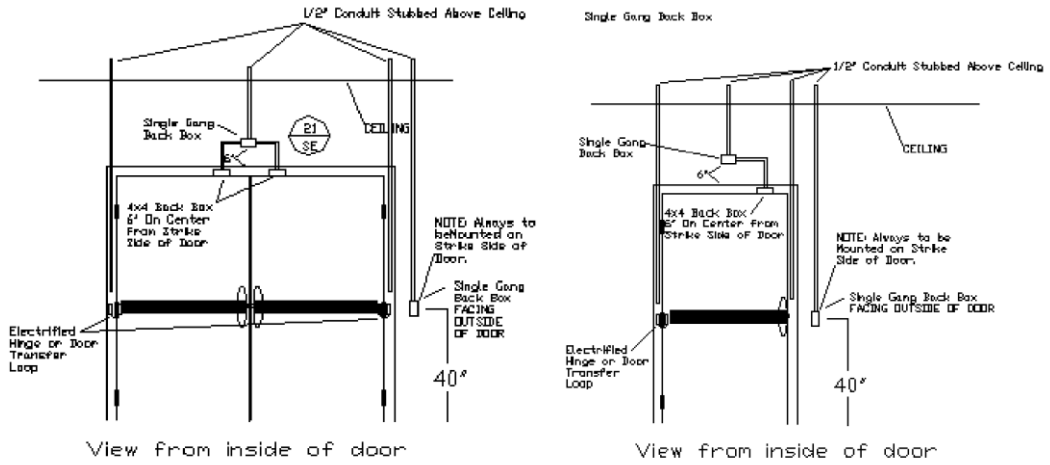
Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments
Lock Set	Best	9K Varsity Series, 15D Trim x LM	None	626 AM finish
Aux. Locks	Best	83T-S Bathroom	None	626 AM finish
Padlocks	Best	21B722L	American - A3201WO	
Key System	Best	Cormax 7-pin	None	Removable/Interchangeable core, 626 finish
Electrified Exit Devices	Precision	C MLR TDS 2103 x 4903A	None	630 AM finish
	Precision Power Transfer	EPT-12C	None	

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments
	Precision Best Power Supply	Dormakaba compatible with specified hardware	None	With battery backup
Electric Switch	Best	1W7D2	None	630 finish
Door Pull	Trimco	Trim 1097TL	Need approval	
Exit Devices	Best (Precision)	2103CD x 4903A	None	Rim device
	Best (Precision)	FL2108 x 4908A	None	Fire rated rim device
	Best (Precision)	2101CD & 2103CD	None	Pairs of exterior doors use keyed, removable mullion with one of each listed, no trim
	Best (Precision)	FL2101 & FL2108 x 4908A	None	Pairs of fire rated doors use removable mullion with one of each listed, no trim
Coordinator	Trimco	3094 x brackets (as needed)	None	Use coordinator where required by fire code for pairs of rated doors where locks are used (i.e. mechanical rooms)
Flush Bolts	Trimco	3810	None	Automatic for metal doors, 626 finish
	Trimco	3815	None	Automatic for wood doors, 626 finish
	Trimco	3915	None	Manual for metal doors, 626 finish
	Trimco	3917	None	Manual for wood doors, 626 finish
Magnetic Holders	ABH	2300 Series	None	689 finish
Closer	Stanley	QDC100 Series	None	All door frames reinforced
Overhead Door Holders	ABH	1000 Series	None	36” + Overhead concealed, 630 finish
	ABH	4000 Series	None	36” + Overhead concealed, 630 finish
	ABH	4400 Series	None	36” + Overhead surface mount, 630 finish
Door Stop	Trimco	1270WX or WV	Hager/Don-Jo	Interior wall stop, 630 finish
	Trimco	1209	Hager/Don-Jo	Exterior floor
	Trimco	1212	Hager/Don-Jo	Interior floor, 626 finish
Push/Pull Plate	Trimco	1001-9 x 1017-3B	Hager/Don-Jo	630 AM finish
Kick Plate	Trimco	KO050 10” x 2” LDW x .050 x B4E x CSK	Hager/Don-Jo	Single doors, 630 finish
	Trimco	KO050 10” x 1” LDW x .050 x B4E x CSK	Hager/Don-Jo	Double doors, 630 finish

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments
Mop Plate	Trimco	KO050 4" x 2" LDW x .050 x B4E x CSK	Hager/Don-Jo	Single doors, 630 finish
	Trimco	KO050 4" x 1" LDW x .050 x B4E x CSK	Hager/Don-Jo	Double doors, 630 finish
Lock Protector	Trimco	5002	N/A	630 finish
Threshold	National Guard	513A	Hager/Pemko	½" x 5" saddle threshold
Smoke Seal	National Guard	5050B	Hager/Pemko	Head and jambs
Weather Seal	National Guard	160SA	Hager/Pemko	Heads and jambs, Aluminum
	National Guard	200NA	Hager/Pemko	Sill on door (surface mount), Aluminum
Door Silencer	Trimco	1229A	Need approval	Metal frames, gray
	Trimco	1229B	Need approval	Wood frames, gray
Drip Guard	National Guard	16A x 4" ODW	Hager/Pemko	Exterior doors exposed to rain, aluminum

C. Door Hardware Coordination

1. Contractor shall provide construction cores and keys during the period of construction. Construction control, operating keys and cores shall not be part of the TOQC permanent keying system or furnished one the same keyway (or key section) as the permanent keying system.
2. Permanent cores shall be purchased by the Contractor. The manufacturer shall email the TOQC Facilities Superintendent to determine proper core and keyway. TOQC will install permanent cores and return construction cores to the Contractor.
3. Permanent keys and cores shall be stamped with the applicable key mark for identification, not including codes for the actual key cut and stamped "Do Not Duplicate".
4. Grand Masterkeys, Masterkeys and other Security keys shall be transferred to TOQC by registered mail.
5. Supplier shall provide TOQC key and pinning information in Keystone software format.
6. Coordination of conduit/raceways in door frames and walls for entries with access control shall be as per the details below:



7. Arlington bushings or similar shall be installed on all open ended raceways to prevent damage and chaffing of cabling routed in the raceway.

D. Automatic Interior/Exterior, Non-Vehicular Door Hardware Products

1. Automatic/ADA door operators shall be Dormakaba model ED900 x WS/RFT 1 433 SQ x RFR 433. Finish to be selected by Architect. Contractor shall provide Owner Training for all automatic door operator installations.
2. Automatic door operators shall carry a minimum 2-year manufacturer's warranty.
3. All door actuators shall be hardwired, 4 ¾" x 4 ¾" and flush mount. Dormakaba activators shall be used for push button type or for touchless, wave sensors.

E. Automatic Overhead and Exterior Folding Doors and Door Operator Systems Requirements and Installation Standards

1. Exit doors at Fire Stations shall utilize quick acting, four-fold doors manufactured by Door Engineering and Manufacturing with specific models selected by the Architect and equipped with the following safety features at minimum:
   (a) Monitored, Electric Safety Edges (Qualifies as UL 325 Primary Type A Sensor)
      (1) Optional Interior Swing Path Safety Edges
   (b) Exterior Light Curtain Photo Eyes (Qualifies as UL 325 Primary Type B1 Sensor)
   (c) Hinge Guards
   (d) Clutch/Pressure Release (Qualifies as UL 325 Primary Type C Device)
   (e) Door Activation Warning Horn/Strobe (Qualifies as UL 325 Secondary Type E Device)
2. All overhead doors at fire stations shall be interconnected to the apparatus bay ventilation systems and four fold door sequence of operations shall be coordinated with Owner to match all existing stations.
3. Swing path areas for four-fold doors shall have safety stripes painted on the floors.
4. Remote safety shut off switches shall be installed at ground level no higher than 46" to center of device A.F.F. and in a location that can be accessed easily in the event of an emergency.
5. Manual door release cord systems shall utilize guides to prevent cables from catching on doors or related hardware during activation.

6. All low voltage cabling associated with door systems shall be installed in raceways such as Flexible Metallic Conduit (FMC) or Liquid Tight Flexible Metallic Conduit (LFMC) to protect cabling where feasible.

F. Automatic Overhead and Exterior Folding Doors, Automatic Interior/Exterior, Non-Vehicular Doors and Door Operator Products

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments
Overhead Door Operators	Overhead Door	Model RHX	None	Heavy Duty
Exterior Folding Doors for F.S. Apparatus Bay Exit	Door Engineering	FF300, FF300/200/100-XT, FF30	None	With UL 325 safety features
ADA Automatic Door Operators	Dormakaba	ED900 x WS/RFT 1 433 SQ x RFR 433	None	Hardwired push buttons where possible installed at 46" A.F.F. to center of push button or touch free sensor

Division 09: Finishes (Painting, Flooring, Ceiling Systems, Elastomeric Coatings, etc.)

A. Painting Interior/Exterior

1. Proper preparation of substrate prior to application is required for all surfaces.
2. Priming shall be required for all paint applications. Coats of primer as specified by the Architect/Engineer.
3. Three coat systems shall consist of a white primer coat, 1st paint coat shall be 20% darker than final color, 2nd paint coat shall be 10% darker than final color, and the 3rd paint coat shall be the final color.
4. All devices cover plates, hardware, accessories, etc. shall be removed prior to application of priming and painting to ensure the entire surface will be properly covered.
5. All interior and exterior metal handrails, guardrails, stairs, gates, decorative fences, etc. shall be primed and painted using an electrostatic process with paint specifically formulated for an electrostatic application.
   (a) Primer shall be 2.8 VOC catalyzed epoxy.
   (b) Topcoat paint shall be 3.5 VOC Polyurethane enamel.
   (c) Ultraviolet Weathering Testing shall meet the following: Gloss retention per ASTM G53 100% at 150 hours, 90% at 300 hours, 70% at 450 hours and 55% at 600 hours.
   (d) Electrostatic paint shall be applied using a Ransburg #2 Process Handgun, model 19372 or equal.
   (e) Paint application shall have a 98% transfer efficiency rate.
6. Metal exterior doors can be painted using either the electrostatic process defined above or hand applied using one coat enamel primer and two finish coats of enamel paint, brush and/or roller applied to achieve mil thickness defined by the Architect.

B. Flooring

1. Where practical, common area flooring consistently available to the public, shall consist of ground, exposed aggregate, polished concrete.
2. Where carpet is specified such as individual offices, conference rooms, common staff areas, etc., carpet tiles shall be used. No broadloom carpet shall be installed.
3. IDF/MDF Room applications where raised flooring has not been provided, vinyl composite tile (VCT) shall be used.
4. Restrooms shall have ground, polished concrete or ceramic tile flooring.

C. Ceiling Grid and Tile Systems

1. Where suspended, acoustical ceiling systems are specified, 24" x 24", tegular or beveled tegular tiles shall be the standard, except in environments where these styles are not permitted such as kitchens.
2. Armstrong ceiling tiles such as Dune 1774 or 1775 are preferred as the standard. Alternates shall be approved by the Facilities Department prior to specifying.
3. Ceiling shall be framed for 2" x 4" tiles wherever HVAC, Plumbing or other serviceable equipment is installed and requires access.

Division 10: Specialties (Restroom accessories, modular furniture, partitions, signage, lockers, flagpoles, etc.)

A. Restroom Partitions/Accessories

1. World Hand Dryer, model DA5-974, push button, 115 volt, Quiet Hand Dryers shall be used for all applications where vandal resistant applications are not required.
2. Bobrick or ASI brands for restroom accessories shall be specified.

B. Modular Furniture

1. (RESERVED FOR FUTURE USE)

C. Signage

1. Fire extinguisher, AED, and eye wash station signage shall be provided and installed by the Contractor for any new build and/or tenant improvement project.
2. All signage shall be compliant with the 2010 American's with Disabilities Act (ADA) standards.

D. Flagpoles

1. All lighting associated with flagpoles shall be fed with dedicated circuits and raceways.
2. Flagpoles and lighting shall be installed in softscape locations where feasible.

E. Emergency Aid Specialties

1. All automated external defibrillators (AED) shall be manufactured by Zoll, model AED 3.

Division 14: Conveying Equipment (Elevators)

A. Elevators

1. It is preferred to have all elevators be Machine Room-Less (MRL) Traction style elevators for buildings up to 250' of rise.

B. Elevator Finishes

1. (RESERVED FOR FUTURE USE)

C. Special Conveying Equipment

1. For buildings 2-story and greater, emergency evacuation chairs shall be specified for each stairwell (one per stairwell).
2. EVAC+Chair 300H shall be the standard. The following features shall be the minimum requirements:
   (a) Shall have a weight capacity of 400 lbs. minimum
   (b) Chair itself shall be lightweight for ease of handling
   (c) Dual position seat
   (d) Heavy-duty, lockable wheels
   (e) Friction tracks used to control speed of descent
   (f) Adjustable head restraint
   (g) Quick release safety belts for head, chest and thighs
   (h) Reflective decals for better visibility in poor light conditions
   (i) Dust cover containment and wall mount brackets
   (j) Lifetime warranty

Division 21: Fire Suppression Systems

A. Wet Suppression

1. As required.

B. Pre-Action Suppression Systems

2. (RESERVED FOR FUTURE USE)

C. Dry (Clean Agent) Suppression

1. Clean agent, fire suppression fluid shall be specified for all locations containing sensitive electronic equipment such as IDF/MDF Rooms, SCADA systems, etc. or sensitive document/historical record storage. Wet suppression, including pre-action systems shall not be used in such areas.
2. Novec 1230 manufactured by 3M or equivalent shall be specified for clean agent suppression systems. Clean agent suppression shall have the following characteristics:
   (a) Stored as a fluid, discharged as a gas
   (b) Safe for use in occupied spaces per NFPA 2001 standard
   (c) Zero ozone depletion factor
   (d) Electrically non-conductive
   (e) Residue free

Division 22: Plumbing Systems

A. Plumbing General Requirements and Installation Standards

1. All potable water lines shall be hard drawn, Type L copper.
2. If required, buildings shall have a pressure-reducing valve at the main water line building entry point with bypass piping and isolation valves.
3. For pipe NPS 4 and smaller, isolation valves shall be Watts, Nibco, Conbraco or equal ball valves; two-piece, full port, lead free, bronze or brass body, with chrome-plated brass ball.
4. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping NPS 4 and smaller. Use gate valves for piping NPS 5 and larger.
5. Isolation valves shall be provided on incoming and outgoing lines at all equipment including pumps, water hammer arresters, water heaters, expansion tanks, etc. Valves must be installed as such to allow unrestricted access to the valve handle and the handle must be able to achieve 100% positive closure without having to manipulate pipe or adjacent systems.
6. Water hammer arresters shall be installed for all quick closing valve applications.
7. All equipment piping shall have a brass union between the equipment and its isolation valve.
8. Air admittance valves may only be used with prior written approval from TOQC.
9. Hose bibs shall be by Woodford Manufacturing, backflow protected faucets in recessed wall boxes (wall hydrants) models 26 and B26.
10. Woodford Manufacturing roof hydrants shall be required for all hose bib installations on rooftops. Model RHY2-MS shall be used for all roof hydrant applications unless specified otherwise.
11. Hose bibs shall be provided within 15’ of all rooftop and ground-mounted HVAC equipment requiring water for maintenance procedures.
12. Water zone valves shall be grouped in mechanical rooms or inside wall access panels located no more than 60” AFF.
13. All domestic hot water systems shall be designed with hot water return lines and properly sized automatic, balancing valves, with sizing and locations indicated on both the construction drawings and project specifications.
14. All custodial closets shall have backflow preventers for chemical dispensers used for cleaning solutions.
15. Temperature-actuated water mixing valves manufactured by Bradley, Watts or approved equal shall be provided for all eye wash stations.
16. All eye wash stations shall be properly commissioned by the contractor prior to acceptance by the Town.
17. All roof-mounted piping shall be supported by a Unistrut style frame/base and rubber DURA-BLOK style sleepers.
18. All copper piping penetrating concrete floors, pads, etc. shall be sleeved, preferably with PVC pipe. Sleeves shall be sized to allow 1” minimum clearance around the circumference of the pipe. Provide a waterproof seal in the cavity of the sleeve.
19. Pipe routed under building footers shall be sleeved. Sleeves for pipe up to 4” shall be 8”. Sleeves for pipes over 4” shall be 6” minimum larger than the pipe(s). Seal each side of the sleeve with a

flexible foam strip/sealant prior to backfill. The pipe shall be centered in the sleeve. Sleeves shall extend a minimum of 12" past the edge of the footer.

20. Pipe penetrations (sized per code) through below-ground foundation walls shall be sleeved in cored openings, using cast iron sleeves. The pipe shall be centered in the sleeves and sleeves shall be sized large enough to properly install sleeve seal systems such as Link-Seal by Garlock, MetraSeal by Metraflex or approved equal.
21. All sanitary, storm (roof drain) waste and vent piping shall be DWV-rated schedule 40 PVC except in plenum spaces. Where waste, vent and storm drain piping are located within a rated, HVAC plenum, hubless, service class, cast iron pipe and fittings shall be used. Cast iron connections shall be made using heavy-duty, Anaco-Husky, SD 4000 couplings, with the bands properly torqued per manufacturer's specifications.
22. All buildings shall have a double cleanout with a 12" W x 12" D concrete apron.
23. All cleanouts shall be located in walls.
24. End-of-line cleanouts shall be provided for the main drainage line and all main branch lines 2" and larger.
25. Cleanouts shall be provided for all urinals and sinks.
26. Urinal cleanouts shall be located directly above the flush valve. All other cleanouts shall be placed at a height so that the cover plate does not overlap the cove base. Multiple cleanouts in the same room shall be placed at one uniform height.
27. Cleanouts in plumbing chases shall point towards the chase entry.
28. All clean-out plugs shall be the raised square style and shall be set to be flush with the stud face. The access opening in the finished wall shall be a minimum of 2" larger in diameter than the clean-out plug.
29. When waterless urinals are specified, conceal a capped water line feed behind an access panel at the future valve location for a future water line connection. The water line header feeding the urinal(s) shall be controlled by a dedicated valve. The stub out shall be painted to match the wall.
30. Test ball access points shall be installed parallel with the wall so they are not confused with cleanouts.
31. Water closet offsets shall not be used.
32. All wall-hung water closets shall be set with a felt gasket.
33. All floor drains and floor sinks shall utilize trap guards/seals by Jay R. Smith Quad Close, Zurn Zshield, ProVent Systems Trap Guard, or approved equal.
34. All equipment requiring working clearances must have such clearances permanently marked on the floor with yellow/black floor tape (Mighty Line 2RYCHV or equal).
35. Utilize solar-powered auto flush valves and faucets in public areas if feasible, except in parks.
36. All park facilities shall utilize metered faucets manufactured by Chicago Faucets, model 857-E12V665PSHAB and Sloan Royal or Regal, manual flush valves.
37. Warehouse environments shall have manual, deck mounted, Chicago Faucet fixtures.
38. All other flush valves shall be Sloan Solis, solar powered flush valves with battery backup or Sloan Royal or Regal manual flush valves where indicated.
39. All other faucets shall be Sloan Optima, solar powered, faucets with battery backup.
40. Domestic hot water, recirculation pumps shall be manufactured by Grundfos.
41. Exterior drinking fountains shall be freeze-proof.
42. All drinking fountains shall have bottle fill.

43. Where garbage disposals are specified, InSinkErator brand, model Evolution Compact, ¾ HP shall be used and provided with a cord.
44. Kitchen Pot fill faucets shall be piped to filtration.
45. Drinking water filtration bases shall be manufactured by 3M, model: VH3 HF-40.
46. Ice machine filtration bases shall be manufactured by 3M, model: HF-25-S.
47. Ice machines shall be manufactured by Manitowoc. All ice machines shall be equipped with the Manitowoc Luminlce II Virus and Bacteria Inhibitor system
48. All water heaters shall be manufactured by A.O. Smith.
49. Water heaters shall not be installed higher than 36" AFF, shall have a containment pan piped to nearest floor or mop sink (if applicable) and installed on a suitable stand.
50. There shall be a minimum of 4" clearance between any plumbing component routed above removable ceiling tiles. There shall be sufficient space in the ceiling cavity to remove ceiling tiles without damage.
51. Contractor shall provide Owner training for all associated plumbing systems. Supplier training necessary for specific systems shall be provided by the installing Contractor and costs for the training included in the Contractor's bid.

B. Plumbing Piping Insulation Materials and Installation Standards

1. All domestic hot water and hot water recirculation piping and domestic cold-water piping exposed on roofs shall be insulated using pre-formed, Type I, mineral fiber insulation covered in factory applied ASJ consisting of white, kraft paper, fiberglass reinforced scrim with aluminum foil backing manufactured by Johns Mansville, Knauf, Owens Corning or equal. Adhesives for insulation and ASJ shall comply with MIL-A-3316C, Class 2, Grade A. Domestic cold water installed on rooftops shall conform to this specification as well.
2. All bends in pipe shall be insulated using preformed PVC fitting covers with loose, mineral fiber insulation inserted into the fitting without voids. Mitering insulation to create fittings is not acceptable.
3. All exposed p-traps shall be properly insulated with ADA compliant covers such as TRUEBRO Lav Guard2.
4. Pipe insulation shall be continuous and full-sized when passing through walls, structural elements, etc. and shall run continuously through hangers as such to not compromise the vapor barrier. Where Unistrut trapeze hangers are used, Contractor shall use Hydra-Zorb, Klo-Shure, KS-8 Series insulation clamps to ensure proper pipe support and vapor barrier integrity.
5. Pipe insulation in exposed, indoor applications or subject to physical damage located in indoor and outdoor environments shall comply with the following standards:
   (a) Indoor insulation - Field-applied, high impact resistant, UV resistant, white PVC jacket with factory fabricated fitting covers. Jacketing installed with 1" overlap at longitudinal seams and end joints and sealed with manufacturer specified adhesive.
   (b) Outdoor insulation – Field-applied, embossed aluminum jacket with 3-mil thick moisture barrier and factory fabricated fitting covers. Jacketing installed with 2" overlap at longitudinal seams and end joints and sealed with manufacturer specified, weatherproof adhesive and the jacket secured using stainless steel bands at 12" spacing. All seams shall be sealed using aluminum colored, silicone caulking.
6. Pipe insulation shall be continuous and full-sized where passing through walls, structural elements, etc.

7. All piping larger than 2" shall utilize thermal hanger shield inserts such as Pro-Shield Thermal Hanger Shields manufactured by ASC Engineered Solutions or equal. All piping, under 2" may utilize rigid insulation through the hanger; however, must ensure steel shields are installed between the insulation and hanger.

C. Labeling for Plumbing Systems

1. Insulated and non-insulated piping shall have self-adhesive labels indicating the type of service and an arrow indicating the direction of flow. Piping to be labeled includes storm drain piping (roof drain), waste piping, domestic water, hot and cold, natural gas, compressed air, soft water or deionized water, etc.
2. Labels for overhead piping shall be placed at room entry and exit points. Exposed piping shall have labels every 50' and every 20' in accessible ceiling cavities.
3. Exterior piping shall have coil or strap type PVC, UV resistant labels or painted stencils.
4. Zone valves shall be sequentially numbered with a brass tag beginning with #1 at the main valve. A copy of the valve schedule shall be provided with all closeout documentation as well a hard copy installed in a frame and displayed in the mechanical room or plumbing closet.
5. Isolation or bypass valves on individual pieces of equipment do not need to be labeled.
6. All plumbing equipment shall be properly labeled with an engraved, plastic tag with black lettering on white background that is permanently affixed to the equipment using screws or rivets. Label shall indicate the equipment identification delineated in the construction drawings such as WH-1, B-1, etc.
7. All plumbing valves such as domestic water (hot and cold), compressed air and natural gas valves above accessible ceilings shall have a 12" section of non-flammable warning tape attached to each handle and colored blue for domestic water, pink for compressed air and yellow for natural gas.
8. Ceiling grid shall be labeled at all plumbing equipment located above accessible ceilings. Labels shall be ½" p-touch, adhesive labels, black font on clear background.

D. Plumbing Products

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments
Angle Stops	Chicago Faucets	STC-31-00-AB	??	¼ turn, loose key type
Backflow Preventers	Febco	825Y or 825YA		For piping 2" and smaller with upstream brass strainer
	Watts	909		For piping larger than 2" with upstream brass strainer
Disposals	InSinkErator	Evolution Compact	??	Quiet series ¾ HP with power cord
Drinking Fountains/Water Coolers	Haws	As specified	Elkay	ADA Interior with bottle fill
	Haws	As specified	Elkay	ADA Exterior and Parks with bottle fill
	Haws	3500D	MDF 370SM	Pet Fountains

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments
Faucets (Warehouse)	Chicago Faucets		??	Manual, deck mounted faucets
Faucets (Park Restroom)	Chicago Faucets	857-E12V665PSHAB	??	Metering type
Faucets (All Other)	Sloan	Optima	None	Solar powered, auto faucets
Flush Valves (Park Restrooms)	Sloan	Royal or Regal	None	Manual flush valves only
Flush Valves (All Other)	Sloan	Royal or Regal	None	Manual flush valves
	Sloan	Solis	None	Solar powered, auto flush valves
Hose Bibs	Woodford	26 & B26	None	Wall hydrants in recessed enclosures
Recirculation Pumps	Grundfos	UP, UPS Series 200	Taco	For domestic hot water return, controlled by aquastat
Roof Hydrants	Woodford	RHY2-MS	None	Backflow Protected, anti-freeze
Shower Valves	Chicago Faucets	As specified	Symmons	
Water Hammer Arresters	Watts	LF15M2	Jay R. Smith, PPP	Pressure charged type
Water Filtration	3M	VH3 HF-40	None	Drinking water filtration base
	3M	HF-25-S	None	Ice machine filtration base
Water Heaters (Standard)	A.O. Smith	As specified	Approved Alternate	Electric or Gas
Water Heaters - (Tankless, Natural Gas Only)	Navien	As specified	Approved Alternate	

Division 23: Heating, Ventilating, and Air Conditioning (HVAC)

A. HVAC General Requirements and Installation Standards

1. Air filters shall be easily accessible with external filter racks manufactured by Modular Metal Fabricators (MMF) Inc.
2. All heating systems shall be electric heat, heating hot water or gas furnaces with no deviations. TOQC does not prefer using heat pump systems.
3. **All** Variable Air Volume (VAV) boxes shall have either electric or heating hot water coils. This is typical for all VAV boxes and not just boxes serving the building perimeter.
4. Systems equal to or greater than 25 tons shall be either air cooled or water cooled, chilled water systems. The following provisions shall be employed: 1) provide 2" taps with valves on chilled water closed loop systems for system cleaning requirements and 2) provide taps and valves for chilled and condenser water lines for temporary emergency equipment connections. Locate per TOQC direction.
5. Buildings utilizing evaporative coolers shall have self-closing pressure relief louvers.
6. Evaporative coolers shall have timed dump pumps and utilize rigid media.

7. All fire station, apparatus bays shall be designed with cooling and ventilation systems.
8. All MDF/IDF, electric and elevator machine rooms shall be primarily cooled separately from the main HVAC system and backed by the building's primary if feasible.
9. Where mini-split type air conditioning units are specified, Mitsubishi or Daikin units shall be used. Hardwired thermostats are preferred over wireless thermostats.
10. Industrial fans installed in buildings with operative overhead bay doors shall be tethered to prevent wind damage.
11. All HVAC equipment located above accessible ceilings shall be installed no higher than 24" above the ceiling and shall have a minimum clearance of a 2' x 2' x 2' space, accessible through a 4' x 2' ceiling tile, at all service panels. Isolation valves, control valves, service disconnect switches, etc. shall be located as close as practicable to the unit served.
12. HVAC equipment requiring regular maintenance located above permanent ceilings shall have a 24" x 24" access door and a work platform with a switched light and receptacle.
13. Equipment requiring working clearances must have such clearances permanently marked on the floor with Yellow/Black floor tape (Mighty Line 2RYCHV or equal).
14. All Split, Direct Expansion (DX) Systems shall have the refrigerant charge type and weight logged properly in the start-up documentation and included in the closeout documentation and physically labeled on the unit (see Labeling for HVAC Systems).
15. All roof-mounted (non-curb) equipment, ductwork, piping, etc., shall be supported by a Unistrut style frame/base and rubber Dura-Blok style sleepers.
16. All suspended equipment shall be supported with properly sized, spring isolators for the application used unless specified otherwise such as support for standard, non-fan powered VAV boxes.
17. Condensate piping shall be Type L copper and insulated for the entire length of the run, to the vertical drop. Unions installed within 12" of the condensate outlet and on both sides of the p-trap.
18. Install check valves where a backflow preventer serves two or more areas. Example: cooling towers, chilled water loops, etc.
19. Triple duty valves shall not be specified. A combination of check valves, isolation valves and balance valves shall be utilized in lieu of triple duty valves.
20. Variable Frequency Drives (VFD) shall be used for all pumps, regardless if the pump is variable flow or not. VFDs shall be used for balancing the pumps. TAB Contractors shall place drives at full flow and balance pump flow using valves and demarcate the valve positions using permanent marker or by scribing as a fall back in the event of a VFD failure.
21. All VFDs shall be manufactured by ABB, no exceptions.
22. Flexible duct shall be installed as such to prevent kinks and sags by properly supporting the duct using wide (min. 12") saddles supported by steel wires or straps. Maximum length of flexible duct shall be no more than 84" and properly supported as noted.
23. Flexible duct shall be secured to duct and register collars by means of stainless-steel, worm-gear driven bands. Outer insulation of flexible duct shall be secured using plastic, plenum rated Panduit bands.
24. All manual shutoff/balancing dampers for duct shall have standoff (elevated), hat channels with locking, quadrant handles, utilizing 3/8" square drive shafts for all applications regardless if duct is lined, externally insulated or not insulated.

25. After system Testing and Balancing (TAB) is completed, Contractors are required to secure all balancing damper handles using a screw to permanently mark the final damper position per the TAB Contractor's final determination.
26. Contractor shall provide Owner training for all associated HVAC systems. Factory Training at Owner/Operator level shall be provided by the Contractor for new equipment TOQC does not already maintain in its inventory. Costs for factory/supplier training shall be included in the Contractor's bid. For example, upon approval from Facilities, a Variable Refrigerant Flow (VRF) system is specified, the Contractor shall include in their bid, factory authorized training for at least two (2) TOQC personnel.
27. There shall be a minimum of 4" clearance between any HVAC component routed above removable ceiling tiles. There shall be sufficient space in the ceiling cavity to remove ceiling tiles without damage.

B. HVAC Piping Insulation Materials and Installation Standards

1. All chilled and heating hot water piping shall be insulated using pre-formed, Type I, mineral fiber insulation covered in factory applied ASJ consisting of white, kraft paper, fiberglass reinforced scrim with aluminum foil backing manufactured by Johns Mansville, Knauf, Owens Corning or equal. Adhesives for insulation and ASJ shall comply with MIL-A-3316C, Class 2, Grade A.
2. Refrigerant and condensate drain piping may conform to the same mineral fiber standards as the chilled and heating hot water systems or closed-cell, expanded rubber, flexible elastomeric insulation may be used. Flexible elastomeric adhesives shall comply with MIL-A-24179A, Type II, Class I. All joints shall be properly sealed using adhesive to ensure the vapor barrier is not compromised.
3. HVAC equipment and vessels can be insulated using flexible elastomeric as specified above or rigid mineral fiber insulation, however, all accessible components must be insulated as such that the insulation can be easily removed and re-installed without compromising the insulation system. Examples of providing accessibility are at pump or equipment strainer assemblies, pumps housings, pot feeders, etc.
4. All piping larger than 2" shall utilize thermal hanger shield inserts such as Pro-Shield Thermal Hanger Shields manufactured by ASC Engineered Solutions or equal. All piping, under 2" may utilize rigid insulation through the hanger; however, must ensure steel shields are installed between the insulation and hanger.
5. All bends in pipe shall be insulated using preformed PVC fitting covers with loose, mineral fiber insulation inserted into the fitting without voids. Mitering insulation to create fittings is not acceptable. Flexible elastomeric insulation can be an exception to this specification as such fittings do not exist; however, adhesives shall be applied at all miter joints.
6. Pipe insulation shall be continuous and full-sized when passing through walls, structural elements, etc. and shall run continuously through hangers as such to not compromise the vapor barrier. Where Unistrut trapeze hangers are used, Contractor shall use Hydra-Zorb, Klo-Shure, KS-8 Series insulation clamps to ensure proper pipe support and vapor barrier integrity and the insulation adhered to the cup of the Klo-Shure clamp.
7. Pipe insulation in exposed, indoor applications or subject to physical damage located in indoor and outdoor environments shall comply with the following standards:

(a) Indoor insulation - Field-applied, high impact resistant, UV resistant, white PVC jacket with factory fabricated fitting covers. Jacketing installed with 1" overlap at longitudinal seams and end joints and sealed with manufacturer specified adhesive.

(b) Outdoor insulation – Field-applied, embossed aluminum jacket with 3-mil thick moisture barrier and factory fabricated fitting covers. Jacketing installed with 2" overlap at longitudinal seams and end joints and sealed with manufacturer specified, weatherproof adhesive and the jacket secured using stainless steel bands at 12" spacing. All seams shall be sealed using aluminum colored, silicone caulking.

8. Pipe insulation shall be continuous and full-sized where passing through walls, structural elements, etc.

C. Labeling for HVAC Systems

1. All HVAC equipment shall be properly labeled with an engraved, plastic tag with black lettering on white background that is permanently affixed to the equipment using screws or rivets. Label shall indicate the equipment identification delineated in the construction drawings such as AHU-3, CRAC-2, CH-1, CU-4, etc. and include the voltage, source and circuit(s). Example: "AHU-3, 208V, Panel H4, Ckts. 32,34,36".
2. All equipment service disconnect switches shall be labeled per Division 26 labeling requirements.
3. All Split System, Direct Expansion (DX) Systems shall have a plastic label permanently attached to the equipment with the refrigerant type and charge weight. Example: "R410A, 4 lbs., 6 oz.".
4. Insulated and non-insulated piping shall have self-adhesive labels indicating the type of service and an arrow indicating the direction of flow. Piping to be labeled includes chilled water, heating hot water, condenser water, condensate drain, steam, etc. Exterior piping shall have coil or strap type PVC, UV resistant labels or painted stencils.
5. Labels for overhead piping shall be placed at room entry and exit points. Exposed piping shall have labels every 50' and every 20' in accessible ceiling cavities.
6. Zone valves shall be sequentially numbered with a brass tag beginning with #1 at the main valve. A copy of the valve schedule shall be provided with all closeout documentation as well a hard copy installed in a frame and displayed in the mechanical room.
7. Where HVAC equipment is located above accessible ceilings, the ceiling grid shall be labeled using a P-touch labeler or similar, with clear tape and ½" black font indicating the equipment identification as defined in the construction drawings. This requirement also applies to access doors for HVAC equipment located above hard ceilings.
8. All thermostats, sensors, etc. shall be labeled using a P-touch labeler or similar, with clear tape and ¼" black font indicating the equipment identification as defined in the construction drawings.
9. All BAS control cabinets/enclosures shall be labeled using a P-touch labeler or similar, with clear tape and ½" black font indicating "BAS Controller" as well as the source and circuit number of the 120V circuit feeding the panel/controller (if applicable). BAS panels shall be fed with dedicated 120V circuits.
10. All air-side, balancing dampers and HVAC water valves such as chilled water (CHW) and heating hot water (HHW) located above ceilings shall have a 12" section of non-flammable warning tape attached to each handle and colored green for CHW, red for HHW and orange for air side balancing dampers.

D. Building Automation Systems (BAS) Materials and Installation Standards

1. All BAS systems specified shall be Alerton by Climatec and shall communicate via BACnet protocol.
2. All low voltage cabling for BAS systems, routed free-air in accessible ceiling spaces, shall be plenum rated, regardless of the application, and properly supported above accessible ceilings using j-hooks, rings or bails or equal, and supported no further than 60" apart. Cabling shall be routed as such to not obstruct access to equipment, removal of ceiling tiles or within 6" of lighting fixtures. Plastic zip ties are not an approved method of cable support; however, zip ties may be used to position or train cabling as long as cabling is not secured too tightly to materials where it may be kinked of chaffed. Contractor shall not secure any cabling to sheet metal hanger straps and shall not be secured to ceiling support wires.
3. Low voltage BAS cabling routed above hard ceilings, in exposed ceiling spaces or in exposed areas subject to the potential for damage such as mechanical rooms, exterior applications, etc. shall be installed in minimum trade size ¾" conduit and all raceways, interior and exterior shall comply with the most recent version of the National Electrical Code adopted by TOQC. All BAS control raceways shall be color coded white using painted or anodized, colored conduit or color-coded banding with painted and labeled junction box covers.
4. Where BAS cabling is routed free-air, above an accessible ceiling and passes through full height, framed or concrete/CMU walls, a minimum trade size 1" sleeve, with Arlington bushings on both ends, shall be provided for cabling to pass through. Sleeve size shall be determined by the amount of cables passing through and cable fill of said sleeve shall not exceed 40% of the capacity of the sleeve. Upsizing will be required when fill exceeds 40%.
5. BAS cabling at final termination points such as at zone controllers, central plant controllers, front end devices, etc. shall be neatly trained in wireways or bundled and secured using approved means and individual conductors or cables properly labeled.
6. All front end device locations shall be designed with at least one (1) data drop at each location, located within or directly adjacent to the BAS enclosure and a dedicated, 120V circuit with disconnect switch to isolate the control cabinet when necessary.
7. All larger, central plant controllers shall have integrated Hand/Off/Auto (HOA) switches built into the controller for override capabilities and a documented sequence or set of instructions for how to use the override switches if necessary.
8. The BAS graphical interface shall include, at minimum, interactive floorplans of the building indicating thermostat locations that display the current space temperature and links to the equipment serving those areas.
9. Graphics interface shall include a separate, full summary page of equipment displaying values as selected by the TOQC that provide a broad overview of the building conditions. For example, a two-story building with a VAV system, would have a summary page for each floor displaying all VAV boxes for each floor, on separate pages, and display the following points for each VAV box at minimum: Space Temperature, Space Setpoint, Supply Air Temperature, Current CFM, CFM Setpoint, Damper Position, Cooling Output %, Heating Output %, Heat Stage %. A summary page shall be typical for each class of equipment for the air delivery system such as AHU summary page, RTU summary page, VAV summary page, etc.
10. Prior to implementation and deployment of final programming and graphics, Contractor shall meet with TOQC Facilities Staff and review the graphics pages to ensure TOQC approves of the content and has the opportunity to make any reasonable changes or adjustments without being

subject to additional costs as would be the case if changes were requested at turnover of the system.

11. All large equipment such as chillers, boilers, etc. with the potential for BAS communication shall be equipped with a BACnet interface and a list of available points shall be provided to the TOQC Facilities Department for selection of desired points which will then be incorporated for display in the graphics pages.
12. BAS Contractor shall provide, permanent, laminated copies of control schematics of the as-built system at all main control panel locations, including the approved, final sequence of operations.
13. The BAS Contractor is responsible for ensuring 100% (not sampling) proper operability of the BAS system including point mapping, point verification, device responses, etc. The Contractor shall properly and thoroughly document this start-up and verification process and provide these documents with the closeout documentation, which includes point verification/start-up sheets, calibration of sensors (if performed), written sequence of operation and final control schematics.
14. After the Contractor has properly commissioned the BAS system, the Contractor shall provide a minimum of four (4) hours of operator training to TOQC Facilities Staff and demonstrate navigation of the system, system operability, sequence of operations or any other BAS related function as determined by TOQC.

E. HVAC Products

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments
Boilers	Cleaver Brooks	Condensing	Lochinvar	Where specified, condensing boilers are preferred and shall have condensate neutralization kits
Chillers (Air Cooled)	Daikin	As specified by Engineer	Carrier, McQuay or Trane	Must have sound attenuation package, hail guards and be multi-stage
Chillers (Water Cooled)	Daikin	As specified by Engineer	Carrier, McQuay or Trane	
Cooling Towers	Evapco	As specified by Engineer	BAC	Towers shall have stainless steel basins and Lakewood Instruments 1500 Series Controllers
Evaporative Coolers	Aerocool	As specified by Engineer	UMP	All Stainless Steel Construction
Exhaust Fans	Greenheck	Direct Drive	Cook or Aerovent	
External Filter Rack	MMF Inc.	Sized as needed		External filter racks where applicable
Pumps (Chilled and Heating Hot Water)	Taco	As specified by Engineer	Grundfos	End suction, base mount, close-coupled

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments
Rooftop Packaged DX Cooling with Gas/Electric Heat	Trane	As specified by Engineer	Carrier	All rooftop units shall have hail guards, economizers and high efficiency (Not heat pumps)
Split System DX Cooling with Gas/Electric Heat (Standard)	Trane	As specified by Engineer	Carrier	All units should be high efficiency (No heat pumps)
Split System DX Cooling (Mini-Split)	Mitsubishi	As specified by Engineer	Daikin	Shall have hail guards and low ambient kits and hardwired thermostats

Division 26: Electrical

A. Electrical General Requirements and Installation Standards

1. Performing work on energized equipment or circuits is strictly prohibited.
2. A remote, Main Ground Bus (MGB) or Electrical Ground Bus (EGB) bonded to the Service Entrance Section (SES) per NEC 250.66 shall be installed in the electrical room closest to the SES. All building bond including water, fire sprinkler, gas, steel, etc. shall be terminated at the remote ground bus. Bonding from the telecommunications grounding system shall be terminated at this location as well. The remote EGB or MGB shall be a minimum of 24" in length to ensure all bonds can be properly bolted to the bus. Two-hole, compression fittings shall be used for all grounding/bonding conductors terminated at the EGB or MGB.
3. All conductors #12 AWG and larger shall be stranded copper except where grounding or grounding electrode conductors require the use of a solid conductor.
4. All conductors in exposed, exterior conduits greater than 36" in length or feeder conductors installed in underground conduit shall be 90-degree rated THHW or XHHW-2 type wire.
5. Exposed conduits below 60" AFF shall utilize compression-type connectors and couplings.
6. Where necessary (machine rooms, open ceilings) all HVAC control wire, including thermostat wiring, shall be in EMT or FMC.
7. All duplex receptacles and light switches shall be commercial grade.
8. Service disconnect switches for HVAC equipment shall be fused and heavy-duty rated.
9. All branch circuit panelboards rated 600A and less shall have hinged, dead front panels.
10. Aluminum junction boxes shall not be used in damp/wet locations.
11. Conduit shall be minimum trade size ¾" for all circuits.
12. Conduit shall be used for lighting circuits from the branch panel to the first junction box in an accessible ceiling space and Metal Clad (MC) Cable may be used thereafter to fixture terminations. Anti-short bushings shall be used at all terminations. MC shall be properly supported and be installed parallel and perpendicular to structural elements and shall not have more than four bends (90 degrees maximum) between pull points. Cables shall be grouped and run together in a neat and workmanlike manner.
13. Recessed panels shall have four (4), ¾" spare conduits stubbed up into an accessible ceiling space and labeled as "spare".

14. All in-ground pull boxes located in landscape areas that are subject to TOQC maintenance vehicles, shall be traffic rated.
15. All wiring connections, splices, etc. located inside in-ground pull boxes shall be waterproof.
16. All conduits shall enter in ground pull boxes from the bottom and shall extend 6” minimum into the pull box. Seal conduit entries watertight.
17. All storage room and closet lighting shall be controlled by wall switch-style, motion sensors.
18. Receptacles shall be placed 6” (center to center) from adjacent data outlets.
19. PVC conduit is not permitted for use in exposed, interior or exterior locations, or in HVAC return plenums.
20. Receptacles requiring GFCI protection shall be GFCI rated.
21. Weatherproof receptacle covers shall be metal, deep, in-use, lockable cover plates such as Taymac Extra Duty series or equal.
22. GFCI protection shall not be provided by an upstream GFCI receptacle unless otherwise noted.
23. Grounding electrode system connections to ground rods, water pipes, building frames, UFER grounds, etc. shall consist of individual runs back to the SES ground bus or external MGB.
24. All conduits mounted on roof surfaces shall be supported by a Unistrut style frame/base and rubber Dura-Blok style sleepers.
25. Conduit penetrations through below-ground foundation walls shall be sleeved and provide minimum of clearance required per link seal manufacturer’s recommendations. The conduit shall be centered in the sleeve. Approved sleeve seals, such as Link-Seal by Garlock, Eaton Crouse-Hinds Link Seal or approved equal shall be used to seal the penetration.
26. Conduit routed under building footers shall be sleeved. Sleeves for conduit up to 4” shall be 8”. Sleeves for conduit over 4” shall be a minimum of 6” larger than the conduit(s). Conduit shall be centered in the sleeve. Sleeves shall extend a minimum of 12” past the edge of the footer.
27. All conduit passing through slabs shall be Rigid Galvanized Steel Conduit (GRC) wrapped in 20 mil tape at all locations except where conduit enters bottom fed equipment that is anchored to the floor, protecting the conduit. In these instances, conduit may remain as PVC; however, must extend at least 3” above the finished floor and have bell end bushings installed.
28. All circuit breakers shall be bolt-on type only.
29. All lighting systems and schedules shall be programmed by the contractor.
30. All lighting control systems shall have Hand-Off-Auto switches incorporated within the lighting control panel or separately to allow Facilities the ability to override lighting controls in the event of a control failure.
31. Photo sensors for exterior lighting shall be installed in series, after timers/controllers.
32. Receptacles shall be installed on all roofs regardless of the presence of mechanical equipment. Specific locations will be designated by the Facilities Department during design review.
33. All equipment requiring working clearances must have such clearances permanently marked on the floor with yellow/black floor tape (Mighty Line 2RYCHV or equal).
34. Panel schedules shall have specific, accurate device and location information matching the record construction drawings’ room numbers and room descriptions. Contractor is responsible for ensuring accuracy of the information provided and tracing circuits as necessary. Schedules shall be typed or neatly written in block letters. Digital copies of final panel schedules shall be provided with the closeout documentation.

35. Contractor shall provide Owner training for all associated electrical systems. Supplier training necessary for specific systems shall be provided by the installing Contractor and costs for the training included in the Contractor's bid.

B. Light Pole Requirements and Installation Standards

1. Where hardscaped, all light poles shall have a concrete pull box with tamper proof bolts securing the lid and be located within 48" of the base. The branch circuit serving the light pole shall be routed from the pull box to the light pole.
2. Install inline fuses in the light pole hand hole. The cover plate shall be secured with tamper proof screws.
3. All circuits entering pull boxes shall have 24" of spare conductor neatly coiled in the box prior to exiting to the next pull box. Secure coils of wire with plastic zip ties.
4. GFCI receptacles are required for 120v receptacles mounted on light poles
5. All light poles shall be installed on minimum 18" round, cylindrical, concrete pole bases extending a minimum of 36" above finished grade.
6. Where media converters or extenders are installed on light poles, 120 volt, GFCI receptacles are required to provide power to the equipment. Provide a remote GFCI reset button directly above the light pole handhole and provide a secure, lockable, metal cover for the reset button.
7. Wherever possible, ground boxes shall not be located in turf or softscaped areas such as decomposed granite. In these instances, junctions shall be made in the light poles. If locating ground boxes in said softscaped areas is necessary and unavoidable, proper coordination with Facilities is required.

C. Solar Photovoltaic Systems

1. The exterior wire gutter shall be the ventilated type.
2. All system conductors shall be in dedicated conduits, junction boxes, etc.
3. Multi-conductor cables shall not be used without written pre-approval.

D. Labeling for Electrical Systems

1. All electrical equipment including panelboards, switchboards, distribution boards, lighting panels, service disconnect switches, transformers, automatic transfer switches, generators, etc. shall be properly labeled with an engraved, plastic tag with black lettering on white background that is permanently affixed to the equipment using screws or rivets. Label shall indicate the equipment identification delineated in the construction drawings such as SES-1, Panel H-1, G-1, ATS-1, T-1, DB-1, etc. and include the voltage, phase, source and circuit(s). Example: "H1, 480V, 3Ø fed from SES-1".
2. Circuit breakers or switches in larger electrical equipment such as SES, Switchboards or Distribution Boards where panel directories are not typical, individual circuit breakers and switches shall be labeled with engraved, plastic tags with black lettering on white background, permanently affixed to the equipment. Label shall indicate the equipment being fed from the switch or circuit breaker.
3. Label each grounding electrode conductor connected to the SES ground bus with its connection description and location i.e. "water pipe bond, room #107"

4. Circuits in exterior in-ground pull boxes shall be labeled with waterproof labels indicating the circuit source and circuit number i.e. “Panel H1-16”.
5. Light switch and receptacle cover plates shall be labeled with their panel/circuit numbers.
6. Where electrical equipment such as emergency battery packs or lighting control device panels, etc. are located above accessible ceilings, the ceiling grid or access door frame shall be labeled using a P-touch labeler or similar, with clear tape and ½” black font indicating the equipment located above.
7. Lighting control switches that are grouped in a single location shall be labeled with the zone controlled for each switch. Labels shall have a clear background and black ¼” letters indicating the controlled zone i.e. “Lobby Recessed Lights”.
8. All raceways and sleeves shall be anodized, color coded conduit per the schedule below. Junction box covers can be color-coded per the schedule in lieu of having the entire box colored. Snap on, color coded bands may be used in lieu of using anodized conduit. Bands must be installed at each end of the raceway and at each coupling or every 10’ in the run. All Conduit shall be color coded as follows:

System	Conduit Color
General Power	Natural
Emergency Power	Orange
Telecommunications	Yellow
Access Control/Video Surveillance	Green
Paging/Intercom	Blue
Fire Alarm	Red
HVAC EMS/BAS	White

E. Electrical Products

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments
Emergency/Standby Generators	Kohler	As specified by Engineer	Cummins	With AMP Series Control Panel
Switchboards and Panelboards	Eaton	As specified by Engineer	Square D, Siemens	Panelboards 600A and less shall have hinged dead front panels
Lighting Control Systems (Sports Field)	Musco Lighting	As specified by Engineer	None	
Lighting Control Systems (Parks)	Lutron	As specified by Engineer	Leviton	
Lighting Control Systems (Building)	Lutron	As specified by Engineer	Leviton	
Occupancy Sensors (Ceiling)	Lutron	As specified by Engineer	Leviton	
Occupancy Sensors (Wall)	Lutron	As specified by Engineer	Leviton	
Dimmer Switches	Lutron	As specified by Engineer	Leviton	

Division 27: Communications

A. General Requirements and Installation Standards

1. Refer to the "Town of Queen Creek Information Technology Cabling Standards" manual, version 2.0.2, dated February 2, 2023.
2. The following are minimum MDF/IDF/DMARC Room (Telecommunications and Equipment Rooms) requirements. Please refer to the reference TOQC standards for further details:
   (a) In general, all MDF Rooms shall be a minimum of 275 sq. ft. and located on the first floor of the building. Whenever possible, the MDF Room shall be located at the midway point of the building.
   (b) In general, IDF Rooms shall be a minimum of 144 sq. ft. and are typically located on floors above the first level. Whenever possible, the IDF Room shall be located at the midway point of the building to ensure horizontal cabling lengths do not exceed 295'.
   (c) TOQC prefers raised flooring in all MDF rooms and should initially be designed as such. However, as an alternative to raised flooring, MDF/IDF Room floor covering shall be Vinyl Composite Tile (VCT) or Electrostatic Discharge (ESD) Tile.
   (d) Doors for telecommunications equipment rooms shall be minimum 3' wide x 7' tall with TOQC approved hardware and locksets. Doors shall be provided with access control using door frames that have been pre-piped with conduit/raceways for routing low voltage cabling to electrified latches and door contacts, or any other component required for access control within the frame.
   (e) All MDF/IDF Rooms shall have dedicated, filtered cooling sources with full redundancy, capable of achieving a minimum of one air change per hour and sized as such to achieve between 64°F and 75°F and between 30% and 55% RH.
   (f) MDF/IDF fire suppression systems shall not be water, including the use of pre-action systems. Novec 1230, clean agent, suppression systems shall be used.
   (g) Equipment rooms shall have a dedicated and interconnected telecommunications grounding/bonding system. Refer to "Grounding and Bonding Requirements" of this section.
   (h) Rooms shall not be shared with any other building services that may interfere with the telecommunications systems including storage, custodial, electrical (other than dedicated or UPS), plumbing chases, etc.
   (i) Lighting shall have a minimum of 50-foot candles measured at the lowest point of termination.
   (j) A minimum of two (2) dedicated duplex or two (2) dedicated simplex electrical outlets, each on separate circuits, shall be provided for equipment power. Locations of receptacles shall be coordinated with TOQC IT Department. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.
   (k) Walls, as selected by TOQC IT Project Manager, shall be lined with ¾" x 48" x 96" fire-retardant treated plywood and painted with two (2) coats of latex, non-conductive, fire retardant paint. Care shall be taken as to not paint over the manufacturer's label that demonstrates fire resistant rating of the plywood.
   (l) Dropped ceilings are not permitted for use in telecommunications equipment rooms.
3. Equipment racks shall be Eaton, Tripp-Lite, model SR42UB and shall conform to the following, minimum standards:

(a) Four post design, 19" wide rack, 7' tall with the ability to adjust device depths from 22" to 36" in 1" increments
(b) Be constructed of black, powder-coated, 12-gauge steel
(c) Self-leveling and squaring
(d) Have standard CEA-310-E mounting holes having a full 45U on front and back of the rack
(e) Availability in both 12-24 tapped and Cage Nut Rail designs
(f) Static load rating of 3000 lbs.
(g) Utilize symmetrical components to reduce orientation errors and allow for ready assembly in less than 20 minutes
(h) Allow interface and support of ladder and wire basket style cable tray systems entering in both perpendicular and parallel orientations
(i) Footers that face inwards to maximize space and have pre-punched, floor mounting holes
(j) Have the ability to interface to the VCM, VPC-6, VPC-12, RS-CNL and RS-CNL3 vertical cable managers as well as all 45U Versa POD Zero-U products
(k) Optional baying brackets to properly align adjoining racks for the purposes of aligning rows of racks and proper operation of Zero-U products
(l) Eight (8) ground attachment points, with (2) ground lugs sized for minimum size #6 AWG bonding conductors
(m) UL listed for compliance with UL 60950-1
(n) Provide a minimum of 36" clearance at the front and back of each rack and 36" on the side of racks where adjacent racks are not installed (end rack)

4. Where media converters or extenders are installed on light poles, 120 volt, GFCI receptacles are required to provide power to the equipment. Provide a remote GFCI reset button directly above the light pole handhole and provide a secure, lockable, metal cover for the reset button.
5. All faceplates shall conform to the following:
   (a) Be applicable to both fiber and copper applications
   (b) Be available in 2 and 4 port single-gang configurations or 6 and 8 port double-gang configurations
   (c) Allow modules to be removed from the front of the faceplate
   (d) Allow UTP modules to pass through faceplates even after termination
   (e) Have write on designation labels for circuit identification together with a clear plastic cover
   (f) Feature easily removable designation label covers which can be removed without use of tools
   (g) Minimum standard colors of black, white, gray, ivory, and light ivory
   (h) Have designer style faceplates and mounting frames available
   (i) Have surface mount boxes and standoff rings available for both single and double gang faceplates
   (j) Be manufactured using UV resistant, high impact thermoplastic to prevent color fading and provide additional durability
   (k) Certified by UL Standards and C22.2 Canadian Telecommunications Standards

B. Horizontal Cabling Requirements and Installation Standards

1. Refer to the "Town of Queen Creek Information Technology Cabling Standards" manual, version 2.0.2, dated February 2, 2023.

C. Backbone Cabling Requirements and Installation Standards

1. Refer to the "Town of Queen Creek Information Technology Cabling Standards" manual, version 2.0.2, dated February 2, 2023.

D. Cable Testing Requirements for Communications Systems

1. Refer to the "Town of Queen Creek Information Technology Cabling Standards" manual, version 2.0.2, dated February 2, 2023.

E. Communications Systems Raceway Requirements and Installation Standards

1. Refer to the "Town of Queen Creek Information Technology Cabling Standards" manual, version 2.0.2, dated February 2, 2023.
2. Telecommunications cabling installed above accessible ceilings shall be routed either in a cable tray system or installed free-air and supported by listed J-hooks. Free-air cabling shall be properly supported every 60" using Caddy CAT J-hooks or approved equal.
3. Cable supports shall be supported from building structure. All thread or wires used for J-hook attachment shall not be supported from other systems such as plumbing, HVAC, electrical, etc.
4. J-hook hangers shall be sized per the manufacturer's listed cable fill.
5. Free-air cabling shall not be installed through structural members, be in contact with pipes, ducts or other foreign systems to the telecommunications network and shall have a minimum clearance of 6" from electrical conduit.
6. Conduit sleeves shall be used where cabling passes through walls or passes above hard ceilings. Sleeves shall have insulated conduit bushings, at both ends, such as Arlington EMT insulating bushings, or equal, and installed prior to cable installation. Sleeves shall extend a minimum of 2" into the accessible space.
7. Where possible, conduit raceway systems shall not exceed 100' in length and shall not contain more than two (2), 90° bends in any length of the run. After 180° of bends, a properly sized pull box shall be installed.
8. Cabling installed in walls shall be contained in raceways sized properly for cable fill per BICSI Standards, but no smaller than 1", stubbed into the accessible space a minimum of 12" and turned towards the cable point of origin (IDF/MDF).
9. Telecommunications backboxes for data and phone jacks shall be 5" x 5" x 2 7/8" deep manufactured by Randl or equivalent.
10. All raceways shall have nylon pull string installed for future cable pulling.
11. Conduit sleeves passing through floors, slabs and fire rated assemblies shall be RGS conduit with insulated bushings and intumescent firestop putty or pillows utilized in the conduit voids where required or fire rated sleeve seals such as STI SpecSeal Ready Firestop Sleeves or equal. Conduit penetrations through fire rated assemblies shall be fire caulked around the perimeter of the raceway at the rated assembly.
12. Raceways passing through slabs and between floors shall be RGS conduit, wrapped with 20 mil rubberized tape and extended a minimum of 6" above the finished surface of the floor. Spare conduits shall be sealed with threaded metal caps.
13. All raceway systems entering a telecommunications room such as IDF, MDF, etc. shall be bonded to the Telecommunications Ground Bus (TGB) within that room (see section for Grounding and Bonding) and shall extend a minimum of 2" into the room(s).

14. Cable tray systems shall be galvanized, welded steel wire, minimum 2" deep tray and width as specified by the Engineer per cable fill requirements. Preferred manufacturer and product is CADDY WBT Performance Cable Tray; however, acceptable, alternate manufacturers shall be WireRun Cobia, Legrand Cablofil or approved equal.
15. Cable tray shall be grounded per "Grounding and Bonding" requirements for Division 27.
16. Cable trays shall be supported using wall brackets or trapeze hangers. Where trapeze hangers are used, minimum 3/8" threaded rod shall be used to support the trapeze.
17. Cable fill for cable tray systems shall comply with BICSI Standards and per the manufacturer's listed fill capacity.
18. Where cable trays pass through fire rated assemblies, approved intumescent firestop pillows or rated sleeves such as STI Square Fire Barriers or approved equal shall be used.
19. A minimum distance of 12" shall be provided above cable tray systems to allow adequate access to the tray for adding or removing cabling.
20. Threaded rod used to support cable tray systems shall be trimmed down at finished elevation to not allow more than 1" of thread beyond the last nut.
21. Cable ladder trays for MDF/IDF Room installation shall be black, powder coated, ASTM A570 structural steel configured with two I-beam side rails with transverse rungs welded to the side rails such as Middle Atlantic Cable Ladder CL Series or approved equal.
22. Rung spacing for cable ladder trays shall be no more than 9" and sections connected with splice plates and bolted hardware rated for bonding continuity.
23. All exit points from the ladder tray to network equipment below shall be done using manufactured and listed radius-drop, waterfall style fittings. Fittings shall be of the same manufacturer of the cable ladder.
24. Manufactured fittings shall be used for all changes in direction for cable ladder tray systems except at multiple intersecting points.
25. Vertical cable ladder trays shall be used on all vertical cabling entering an IDF/MDF or similar room where the vertical span exceeds 18" and inside or outside bend, 90° fittings shall be used.
26. Cabling installed on ladder tray systems shall be loosely and cleanly bundled and secured to the tray using hook and loop strips such as Velcro, cut to size that properly secures the cable bundle to the tray without kinking any cables.

F. Grounding and Bonding Requirements and Installation Standards for Communications Systems

1. Refer to the "Town of Queen Creek Information Technology Cabling Standards" manual, version 2.0.2, dated February 2, 2023.
2. Installation contractor is responsible for providing a low impedance telecommunication grounding system with a stable ±0 volt to ground signal reference point for communication system equipment and infrastructures.
3. The data/telecommunication grounding system shall meet the requirements of NEC Articles 250 and 800. The Contractor shall bond individual electronic components and equipment to the grounding system per the equipment manufacturer's recommendations and instructions.
4. Telecommunication bonding backbone (TBB) shall be sized per NEC Table 250-66 (based on largest service entrance conductor or equivalent area for parallel conductors), minimum of a #2 AWG copper conductor.

5. Telecommunications Ground Buses (TGB) in each IDF/MDF/DMARC Room shall be bonded together to form one telecommunications grounding network and ultimately bonded to the Main Ground Bus (MGB) or Electrical Ground Bus (EGB) for the building or independent grounding electrode.
6. All grounding/bonding conductors terminated on the IDF/MDF Room Telecommunications Ground Bus (TGB) shall be labeled with point of origin and/or termination, i.e. "Rack 1 Bond, To IDF Room #XX or From MDF Room #XX, Main Bonding Conductor, etc."
7. TGB in IDF/MDF Rooms shall be installed at 84" A.F.F.
8. All bonding conductors shall be minimum size #6 AWG, (green) insulated, stranded copper
9. Two-hole compression lugs shall be utilized for backbone cable terminations of #2 AWG and larger. One-hole compression lugs may be utilized for cable terminations of #6 AWG up to #2 AWG. Set screw lugs are not acceptable.
10. All racks shall be individually bonded to the TGB using #6 AWG, stranded copper conductors.
11. All telecommunications, access control sleeves entering an IDF or MDF room shall have bond bushings installed on the open ends and a continuous #6 AWG bonding conductor routed through the bond bushings and terminated at the TGB in the room. Individual bond conductors for sleeves are not required.
12. Cable tray systems shall have a continuous #6 AWG bonding conductor routed within or secured on the exterior of the cable tray throughout the length of the tray system and terminated at the TGB in the room where the tray terminates. The conductor shall be bonded to each section of tray using split-bolt connectors listed for grounding.
13. Ladder racks and tray systems within equipment rooms shall be connected using fittings listed for bonding/grounding or #6 AWG jumpers used to ground each segment. This includes vertical cable trays/ladders.

G. Labeling for Communication Systems

1. Refer to the "Town of Queen Creek Information Technology Cabling Standards" manual, version 2.0.2, dated February 2, 2023.
2. All labels shall be computer printed labels where font properly contrast the cable jacket color and in accordance with TIA/EIA-606-A and specific component requirements shall be as follows:
   (a) Horizontal and Backbone cabling shall be labeled within 4" of each termination point.
   (b) All terminal strips and screw terminals in each cabinet, rack or panel
      (1) Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
      (2) Label each unit and field within distribution racks and frames.
   (c) Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
3. A unique identifier shall be marked on each faceplate to identify if as connecting Hardware
4. Each port in the faceplate shall be labeled with its identifier and protected with a clear plastic cover and easily removable without the use of tools
5. A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware

6. Each port on the connecting hardware shall be labeled with its identifier
7. Fiber enclosures shall have labeling that can be viewed with doors open or closed and meets or exceeds ANSI/TIA-606t-A requirements and also be laser printable and have a snap on front shield to be used as labeling surface and to protect jumpers
8. Where multiple racks are installed, the racks shall be labeled individually i.e. "Rack 1, Rack 2, Rack 3, etc."
9. Final cable schedules and Equipment Room drawings/schematics for the completed, as-built installation shall be laminated and provided in each IDF and MDF Room
10. All grounding/bonding conductors terminated on the IDF/MDF Room Telecommunications Ground Bus (TGB) shall be labeled with point of origin and/or termination, i.e. "Rack 1 Bond, To IDF Room #XX or From MDF Room #XX, Main Bonding Conductor, etc."

H. Cable and Conduit Color Coding Standards

1. All raceways and sleeves shall be anodized, color coded conduit per the schedule below. Junction box covers can be color-coded per the schedule in lieu of having the entire box colored. Snap on, color coded bands may be used in lieu of using anodized conduit. Bands must be installed at each end of the raceway and at each coupling or every 10' in the run. All Conduit shall be color coded as follows:

System	Conduit Color
General Power	Natural
Emergency Power	Orange
Telecommunications	Yellow
Access Control/Video Surveillance	Green
Paging/Intercom	Blue
Fire Alarm	Red
HVAC EMS/BAS	White

2. All Category 6 patch cabling shall conform to the following color-coding standards:

TOQC System	Cable Color
Traffic Data	Yellow
Utilities Data	Brown
Municipal Data	Blue
Police Data	Grey
Police Body Cams	Purple
Fire Data	Red
Cameras (Video Surveillance)	Green
Access Control (Doors and Gates)	Black
HVAC	White
Conf. Room Equipment (not Municipal Data)	Pink

Division 28: Electronic Safety and Security (Access Control, Video Surveillance, Fire Alarm)

A. Fire Alarm Systems General Requirements and Installation Standards

1. It is preferred that all new fire alarm systems are installed in conduit; however, if budgetary restrictions arise or where retrofitting an existing building, **upon approval from the Facilities**

Superintendent, a combination of free-air cabling and conduit installation may be specified under the following requirements:

(a) Free-Air Cabling Installation

(1) All Notification Appliance Circuits (NAC), Signaling Line Circuit (SLC) and Speaker circuit cabling shall be plenum-rated, UL Listed as Fire, Power-Limited, Plenum (FPLP) type. If applicable, cabling routed in underground conduit shall be Aquaseal and UL Listed FPL cable. Aquaseal must transition to FPLP cabling within 20' of entering the building from below grade and terminated at a labeled termination block in a UL listed and properly labeled enclosure. Upon completion of the installation, ensure all cables are free of kinks, sharp bends, twists, gouges, cuts, or any other physical damage.

(2) Free-air cabling shall be supported using j-hooks, rings or bails listed for such use. Supports shall be attached to building structure and spaced 60" apart. Where structural members are spaced as such that achieving 60" spacing is not practical, a larger span of spacing may be acceptable upon review and approval by the City's Contract Administrator. Cables or cable supports shall not be supported from ductwork, piping, plumbing systems, ceiling tile and lighting fixture suspension wires, or building structure.

(3) Attaching cable supports to ceiling grid support wires is not permissible. If the Contractor elects to use ceiling support style wire for support attachment, wires must be independent of the ceiling grid support system. The support wire shall be anchored to a yellow, drop wire or breakaway clip such as Caddy, Model #EC311 or equal.

(4) Where free-air cabling passes thru walls the cabling shall be sleeved using EMT with Arlington bushings provided at both ends of the sleeve. Sleeves shall be securely fastened to the assembly at one or both ends depending on the length of the sleeve. Sleeves passing thru fire rated walls shall have the cable void sealed with UL listed fire sealant meeting the requirements of ASTM E 814 or UL 1479 tested assemblies that provides a fire rating equal to that of construction being penetrated.

(5) Cabling routed to devices above hard ceilings, in open ceiling areas, in areas where physical damage is possible, and outdoors shall be contained within minimum trade size ¾" EMT raceways and only compression type EMT connectors are permitted for use. Listed, raintight fittings shall be used for all raceways installed outdoors. All raceways installed for fire alarm systems shall have a red, anodized finish. Faceplates for fire alarm junction boxes shall be painted red. In locations where the City approved re-use of existing raceways, exceptions to the minimum ¾" EMT requirement shall be permitted.

(6) Fire alarm cabling shall not be spliced at any location throughout the building.

(b) Raceway Installation Schedule

(1) Outdoors: Apply raceway products as specified below unless otherwise indicated:
   (i) Exposed conduit: GRC or IMC.
   (ii) Concealed conduit, aboveground: GRC, IMC or EMT.
   (iii) Underground conduit: RNC, Type EPC-40-PVC or Type EPC-80-PVC, direct buried or concrete encased.
   (iv) Connection to vibrating equipment (Including hydraulic, pneumatic, electric solenoid, or motor-driven equipment): LFMC.
   (v) Boxes and enclosures, aboveground: NEMA 250, Type 3R.

(2) Indoors: Apply raceway products as specified below unless otherwise indicated.
   (i) Exposed, not subject to physical damage: EMT.

(ii) Exposed, not subject to severe physical damage: EMT.
(iii) Exposed and subject to severe physical damage: GRC or IMC. Raceway locations include the following but not limited to:
(i) Loading dock.
(ii) Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
(iii) Gymnasiums.

(3) Concealed in interior walls and partitions: EMT.
(4) Concealed above non-accessible ceilings: EMT.
(5) Connection to vibrating equipment (Including hydraulic, pneumatic, electric solenoid, or motor-driven equipment): FMC, except use LFMC in damp or wet locations.
(6) Damp or wet locations: GRC or IMC.
(7) Boxes and enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

(c) Junction and Pull Boxes for Raceway Systems

(1) Boxes shall be as manufactured by Steel City, Appleton, Raco, or approved substitute. Conduit bodies shall be Appleton Unilets, Crouse-Hinds, or approved substitute.
(2) All boxes shall be of the proper size to accommodate the quantity of conductors enclosed in the box. Boxes shall not be less than 4" square and 1-1/2" deep unless otherwise noted.
(3) Boxes shall be hot-dipped galvanized steel with knockouts. On exterior surfaces, surface mounted in finished spaces, or in wet or damp locations, boxes shall be corrosion resistant, cast malleable iron. Boxes shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Conduit bodies such as condulets or LB fittings, shall be corrosion resistant, cast malleable iron and shall have threaded hubs for rigid conduit and neoprene gaskets for their covers. Where recessed, boxes shall have square cut corners.
(4) Deep boxes shall be used in walls covered by wainscot acoustical wall panels or paneling and in walls of glazed tile, brick, or other masonry which will not be covered with plaster. The bottom of the box shall be located on the horizontal joint. Through-the-wall type boxes shall not be used unless specifically called for. All boxes shall be non-gangable. Boxes in concrete shall be of a type to allow the placing of conduit without displacing the reinforcing bars.
(5) All devices shall be provided with approved boxes, suitable for their function. Back boxes shall be furnished and installed as required for the equipment and/or systems under this contract. Where surface mounted boxes are required in finished spaces, furnish decorative boxes which match the device. (Galvanized steel with knockouts is not acceptable).
(6) Pull and junction boxes shall be substantially made code gauge boxes with screw covers. Boxes shall be rigid under torsional and deflecting forces and shall be provided with angle-iron framing where required. Boxes shall be 4" square with a blank cover in unfinished areas and with a plaster ring and blank cover in finished areas and shall be installed where required to pull cable or wire, but only in finished areas by approval of the Town of Queen Creek. Boxes shall be rigidly attached to the structure, independent of any conduit support. Cover plates for all boxes shall be readily and easily accessible. Covers shall be fastened to boxes with machine screws to ensure continuous contact all around. Covers for surface mounted boxes shall line up evenly with the edges of boxes. Covers for flush

mounted oversize boxes shall extend 3/4" past boxes all around. Covers for 4" square and 4" ganged boxes shall extend 1/4" past box all around.

(7) Furnish and install all plaster rings as required. Plaster rings shall be installed on all boxes where the boxes are recessed. Plaster rings shall be of a depth to reach the finished surface. Extension rings, where required, shall be installed so that the plaster ring is flush with the finished surface.

(8) All cabinets and boxes shall be secured by means of toggle bolts on hollow masonry; expansion shields and machine screws or standard precast inserts on concrete or solid masonry; machine screws or bolts on metal surfaces and wood screws on wood construction. All wall, ceiling mounted and ceiling grid mounted device boxes shall be supported by bar supports extending from the studs or channels on either side of the box. Boxes mounted on drywall or plaster shall be secured to wall studs or adequate internal structure.

(9) Boxes with unused punched-out openings shall have the openings filled with factory made knockout seals.

B. Labeling for Fire Alarm Systems

1. Fire alarm junction boxes shall be labeled with the zone number(s) the circuiting serves. Example: “FA Zone 3”. Circuiting inside the junction box shall have labels indicating which zone they serve. Example: “2”.
2. All fire alarm devices shall be labeled with the programmed address designation using vinyl, p-touch labels with clear or white tape with black lettering.
3. Fire alarm panels, power supplies and other equipment requiring power circuits shall have the power circuit labeled inside of the cabinets indicating source panel and circuit designation. Labels shall be vinyl, p-touch labels with white tape and black lettering.
4. Batteries for all fire alarm equipment shall have the installation dated labeled on each battery using vinyl, p-touch labels with white tape and black lettering.
5. Circuit breakers feeding fire alarm equipment shall have lock-on devices installed to prevent incidental opening of the supply circuit, as required by Code.
6. The source panel schedule shall be updated to reflect the power supply circuit for fire alarm equipment as necessary.

C. Testing and Closeout Requirements for Fire Alarm Systems

1. All new or retrofit fire alarm systems shall be tested in accordance with NFPA 72, 2019 edition or newer.
2. System acceptance testing shall be properly documented by submitting an approved NFPA 72 pre-test form per NFPA 72, Figure 7.8.2(a).
3. Contractor shall provide the minimum required documentation per NFPA 72, Section 7.2.
4. All closeout documentation shall be provided in electronic, PDF format, with a table of contents and tabbed and hyperlinked bookmarks for each section. Contractor shall provide the minimum following documentation in O&M manuals:
   (a) A copy of the NFPA 72 Maintenance and Test Procedures
   (b) A copy of the NFPA 72 Pre-Test, Record of Completion form
   (c) Full points list of system

(d) Written narrative of the Sequence of Operations
(e) As-built drawings
(f) Manufacturer data sheets for all equipment
(g) Proof of AHJ acceptance of the fire alarm system

D. Fire Alarm Products/Application

1. Radio Dialers shall be AES Corporation IntelliNet 2.0 Fire Subscriber model 7707P-88-ULP-M. No exceptions or substitutions shall be permitted.
2. All fire alarm systems specified shall be addressable and shall communicate with the central station via radio dialer (as specified) only.
3. Fire alarm control panels (FACP) shall be Edwards EST4 as standard for larger buildings requiring more than 64 devices addresses. For buildings requiring less than 64 device addresses, Edwards IO-Series, addressable FACP shall be used.
4. If an Emergency Responder Radio Communication System (ERRCS) or Distributed Antenna System (DAS) is required for coverage within a facility, the annunciation of the Bi-Directional Antenna (BDA) shall communicate through the Fire Alarm System and the BDA located in the MDF Room.

E. Access Control Systems General Requirements and Installation Standards

1. Access control system shall utilize Verkada Access Systems, Inc. software, controllers and communications devices. No software exceptions permitted.
2. All card readers for access control shall be manufactured by Verkada Model AD33 or approved alternate.
3. All doors shall be programmed with these minimum alarm notifications: Forced Entry, Hold Open (duration).
4. Card reader voltage is 12V standard and all other field devices such as locks, electrified hinges, panic assemblies, motion sensors, etc. utilize 24V power.
5. Access control systems shall be fully tested prior to turnover to the Owner. Results of testing shall be accurately recorded on start-up and commissioning forms and submitted as part of the project closeout documentation.

F. Labeling for Access Control Systems

1. Access Control/Security junction boxes and relay enclosures shall be labeled with the zone number(s) the circuiting serves.
2. All access control devices shall be labeled with the programmed address designation using vinyl, p-touch labels with clear or white tape with black lettering.
3. Access Control panels, power supplies and other equipment requiring power circuits shall have the power circuit labeled inside of the cabinets indicating source panel and circuit designation. Labels shall be vinyl, p-touch labels with white tape and black lettering.
4. Batteries for all access control equipment shall have the installation dated labeled on each battery using vinyl, p-touch labels with white tape and black lettering.
5. Circuit breakers feeding access control equipment shall have lock-on devices installed to prevent incidental opening of the supply circuit.
6. The source panel schedule shall be updated to reflect the power supply circuit for access control equipment as necessary.

7. Wiring/control schematics shall be provided in all access control cabinets and equipment enclosures.

G. Testing Requirements for Access Control Systems

1. All doors shall be tested for the following functions minimum: Access granted - no entry, Access granted – with access, Door Forced Open, Door Held Open and Door Forced Restored.
2. All access control devices shall be programmed, tested and properly commissioned on every Town project and documented accordingly, identifying pass/fail, resolution of any issues, etc.

H. Access Control Systems Products

1. (RESERVED FOR FUTURE USE)

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments

I. Video Surveillance Systems General Requirements and Installation Standards

1. (RESERVED FOR FUTURE USE)

J. Labeling for Video Surveillance Systems

1. (RESERVED FOR FUTURE USE)

K. Testing Requirements for Video Surveillance Systems

1. (RESERVED FOR FUTURE USE)

L. Video Surveillance Systems Products

1. (RESERVED FOR FUTURE USE)

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments

Division 32: Exterior Improvements (Asphalt Paving, Fences, Gates, Landscape, Irrigation, etc.)

A. Automatic Gate Systems General Requirements and Installation Standards

1. All gates shall have card readers for entering at gate locations. Gate entering readers must be card readers and pin pads in one device.
2. Pedestrian gates are required next to automated gates where possible. Card readers at these gates are not absolutely necessary, but preferred. Can be keyed access if needed.
3. SRP Key access at one gate if the service is metered behind.
4. Electrical safety edges shall be used in lieu of pneumatic pressure switches.
5. Optical Preemption Gate operation required for entering and exiting (no exception).
6. In ground loop detectors shall not be used.
7. All vehicle gates shall utilize fast acting, gate operators manufactured by HySecurity or Maximum Controls. SlideDriver model as basis of design (B.O.D.), utilizing a rail drive system is preferred. If a chain drive system is specified as an alternate option, SlideSmart HD operators shall be used. When using a swing gate application, HySecurity SwingSmart CNX or Maximum Controls Max Megatron 1400/2200 HP Pro operators shall be used.
8. The preferred sliding gate option is a fast acting, drive rail system. Chain driven systems are acceptable, alternate operators. Drive rail and chain driven operators shall have the minimum characteristics:
   (a) Drive Rail Systems (HySecurity Slide Driver for B.O.D.)
      (1) Single Phase or Three Phase, Input Voltage 115V, 208-230V or 460V 50/60 Hz, depending on Engineer selection
      (2) UPS Battery Backup Systems
      (3) Hydraulic drive
      (4) Two (2) 6” or two (2) 8” AdvanceDrive wheels dependent on weight of gate controlled
      (5) 1 ft./s. rate of travel (minimum)
      (6) Minimum gate weight capacity of 1500 lbs. up to 20,000 lbs. max
      (7) Continuous duty cycle
      (8) Built-in relays for remote control or connection to access control systems
      (9) 5-year manufacturer’s warranty on all components
   (b) Chain Driven Systems (HySecurity SlideSmart HD for B.O.D.)
      (1) Input Voltage 115V or 208-230V 50/60 Hz
      (2) Operating Voltage of 24VDC
      (3) UPS Battery Backup Systems
      (4) Hydraulic drive
      (5) 1 ft./s. rate of travel
      (6) Minimum gate weight capacity of 1500 lbs.
      (7) Continuous duty cycle
      (8) 500,000 cycle rated
      (9) Built-in relays for remote control or connection to access control systems
      (10) 5-year manufacturer’s warranty on all components
   (c) Swing operators shall have the minimum features:
      (1) Continuous duty cycle

(2) 24 VDC operated with the ability to be powered by solar panels or 115V/230V, single phase
(3) Brushless DC motor driven
(4) Gate capacity of 1300 lbs. for 12' leaf
(5) Built-in battery to provide a minimum of 300 cycles in the event of a power failure
(6) Programmable speed controls
(7) Built-in relays for remote control or connection to access control systems
(8) 5-year manufacturer's warranty on all components, 1-year warranty on batteries

B. Automatic Gate Systems Products

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments
Automatic Gate Operators	HySecurity	SlideDriver	None	For Rail Drive System (preferred). Model selection per weight of gate
Automatic Gate Operators	HySecurity	SlideSmart HD	Maximum Controls Max1500/2200	For Chain Drive System. Model selection per weight of gate
Automatic Gate Operators	Maximum Controls	Max Megatron 1400 or 1400 HP Pro	Hy Security SwingSmart CNX or SwingSmart DC	For Swing Gate Systems
Optical Access Gate and Door Opener	Tomar	Strobeswitch/1790-1014-SM2 (verify latest with TOQC)	None	Detector and Dual Power Module Detector

C. Irrigation Systems General Requirements and Installation Standards

1. (RESERVED FOR FUTURE USE)

D. Labeling for Irrigation Systems

1. All irrigation zones shall be accurately labeled, identifying the valves fed by each zone. Contractor shall provide a full as-built site plan of irrigation zones.
2. Labeling shall withstand outdoor conditions and be machine printed. Handwritten valves and zone schedules will not be acceptable.
3. All irrigation valves shall have a stamped brass tag identifying the valve and zone number or equivalent, permanent marking that can withstand the environment.

E. Irrigation Systems Products

1. Weathermatic Smartline controllers, model SLM12-4800 shall be used for all irrigation control. Controllers shall be mounted on exterior pedestals.
2. Rainbird LFV series plastic valves shall be used.
3. All irrigation piping shall be rigid, schedule 40 PVC minimum. Poly tubing can be used for ¼" emitter lines only.

Item	Preferred Manufacturer	Model/Type	Approved Alternate	Comments
Irrigation Controllers	Weathermatic	Smartline/SLM12-4800	None	Controller to be mounted on exterior pedestal

For questions or comments, please contact the Town of Queen Creek Facility Services at (480) 358-3811