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Construction Standards

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General and Equipment Enclosures

1. Pipe component drains to floor drains. This includes pump drain pans, air gap drain on back flow preventer, pressure relief exhaust, and tower sweeper system. Manifold where possible, except for relief valves and any blow downs.

Benefit: Prevents water puddles in the packaged plant floor which will cause premature floor corrosion, and ensures proper runoff to drain if containment is required. The release of water in these drains only occurs on failure of a component, so it's common to ignore these drains or assume they're not needed.

2. Dielectric fittings are used where copper and steel pipes are connected. A brass fitting is used, where possible, to eliminate the need for dielectric fittings.

Benefit: Prevents galvanic corrosion on fittings.

3. Trough drains at both ends of the chillers. Drains to have sloped bottoms and be constructed of stainless steel or epoxy lined steel. Removable galvanized steel gratings are flush with the finished floor.

Benefit: Prevents water puddles and corrosion in the packaged plant floor. The lining allows the drain to completely drain without leaving water in the trough.

4. Floor drain located near each set of pumps (avoiding walkways).

Benefit: Provides ease of service and keeps water out of areas.

5. Full height structural base members under all major equipment and chillers.

Benefit: The weight of internal components is supported on the base instead of requiring the diamond plate to support internal components. Any vibration is transferred to the ground, not the flooring. (Deflection of the floor will cause the units to be unlevel, causing premature component failure.) Allows for the module to be rigged multiple times, while maintaining the integrity of its design. Prevents racking when re-assembling contiguous central plants.

6. Structural members under all major components.

Benefit: The weight of internal components is supported on the base instead of requiring the building or enclosure to support internal components, reducing the seismic and steel requirements on the structure and/or enclosure.

7. Floor drains tied together for a single 3" connection.

Benefit: A single drain connection lowers site installation costs, reduces the chance for a drain issue within the chiller plant, and minimizes the need to heat trace the drains in cold climates.

8. Components welded to 3/16" diamond plate.

Benefit: Provides a firm walking area that will not "oil can" or bounce when walked on.

9. Continuously welded ¼” diamond plate floor deck with 2” turn up around perimeter and other openings for water tight construction.

Benefit: Continuous welds, compared to spot welds, result in a stronger structure that lasts longer and is resistant to system fluctuations over time. Continuous welds and 2” turn up keep any water, chemicals or other items inside the plant and prevent them from spreading to other areas.

10. Floor deck is 1” stitch welded to the structural members every 12” from below for greater stability and integrity, and seal welded on top.

Benefit: A sturdy and stable floor deck lowers the risk of damage to the plant during shipping and installation. The greater stability prevents internal pipes from shaking loose and creating poor connections or water leaks.

11. Emergency door opening hardware with emergency lights at means of egress.

Benefit: Helps provide a safe work environment in the mechanical room.

12. Stainless steel door hardware with door closure and opening stops. All doors have a common key.

Benefit: Stainless steel hardware lasts longer and has less corrosion than standard hardware.

13. Service doors (roll-up, double, or bi-fold) for chiller maintenance.

Benefit: Service doors are needed for proper chiller service and will prevent cutting into or damaging walls or enclosures which helps keep the structural integrity and water tightness of the units. Other considerations are removable wall panels for replacement of chillers or addition of future chillers. The R-value of the door is considered during design for the HVAC needs of the equipment and personnel.

14. Three-way light switches at each means of egress. (not required at service doors)

Benefit: Provides a safe work area for facilities and helps with service and inspections.

15. T-8 interior lighting.

Benefit: Cost effective way of lighting the room. Provides the recommended lumens for operation in the space.

16. Equipment sections designed for no more than a four-point lift with removable lugs.

Benefit: Limiting the lifting points to four helps reduce rigging costs by allowing standard rigging equipment to be used for installation. By specifying the deflection of the units, it requires the base to be stronger.

17. Lifting lugs, installed per Systecon Standard.

Benefit: Factory installation of lifting lugs helps provide the rigging company with clear indication of the lifting points and prevents damage to the packaging and equipment during the rigging process.

18. Module sections provided with base pull together clips and base bolts.

Benefit: Factory pull together clips and base bolts reduce installation costs and the amount of time needed for installation while assuring proper alignment of connecting components.

19. Jacking bolts on either side of base bolts on each module section.

Benefit: Jacking bolts are adjustable and reduce installation costs and the amount of time needed for installation. They also assist with proper alignment and door closure – since most concrete pads are not flat, they allow the base to be adjusted.

20. Base and pipe components mechanically cleaned per SSPC* – surface preparation specification No. 2.

** SSPC (Society for Protective Coatings), originally founded as the Steel Structures Painting Council, is a non-profit organization that develops standards for the industry.*

Benefit: By using Industry standards, the owner is assured of proper cleaning and metal applications for longevity of the equipment.

21. Components will be primer coated prior to finish coat.

Benefit: Provides a seal against corrosion and allows the paint to last longer.

22. Internal components, except insulated components, will be painted with factory standard enamel.

Benefit: Helps reduce corrosion and provides a cleaner look for the piping system.

23. Exterior lighting at each means of egress.

Benefit: Helps provide a safe work area for facilities and helps with service and inspections.

24. Factory hydrostatic pressure test of all chilled and condenser piping loops.

Benefit: Factory testing of the system with water, and at a pressure that exceeds the jobsite pressures, assures that any leaks or issues are addressed in the factory environment without disruption to field installation operations.

25. Factory pressure testing of all other piping systems.

Benefit: Factory pressure tests assure that there are no leaks in the system prior to field installation. This is only done on small bore piping.

26. Factory performance flow test with verification of flow, head, and kW for all variable volume systems.

Benefit: A performance test with a report assures that the pump sets are measured and verified, giving the end user confirmation that they obtain the specified performance and efficiency.

27. Factory performance flow test with certified curve for each constant volume pump.

Benefit: Flow tests verify that the pumps provide the specified flow for the end user.

28. Functional testing of all control functions including equipment sequencing and alarm functions.

Benefit: A fully functional test, as opposed to a point to point only test, confirms that the controls are functioning and performing as designed. Completing this task at the factory prevents jobsite commissioning delays.

29. The complete package is listed by ETL under UL-778 listing.

Benefit: Electrical Testing Labs (ETL) and Underwriters Laboratories (UL) are independent certification companies that verify suppliers are building systems safely and within conformance to international, national and local codes. Having an ETL label assists with inspection approval and prevents construction delays, and shifts liability to the manufacturer and away from other parties.

30. Drains with ball valves at all low points.

Benefit: Having a drain connection with a ball valve allows for easy use. Drains at low points ensure that there is little to no water left in the system after it is drained and prevents freezing and potential pipe damage. In the case of maintenance, they allow for draining the pipe before servicing.

31. Air release with ball valves at all high points.

Benefit: A ball valve at the air release area allows for easy use of the air release. Provision of air release at high points assures that little to no air is left in the system after air release valve is opened. It provides a quick way of getting the air out of the system on startup. The air release on the air separator removes any additional air entrainment during normal operation.

32. Provide brass isolation valves at headers for equipment tie-in (shot feeder, chemical treatment, etc.).

Benefit: Isolation valves assist with service, are practical and often necessary. Brass valves offer better reliability and quality over lower cost components which can experience premature failure. Valves at the headers reduce the possibility of water leakage if the downstream piping is damaged or breaks, and reduces the risk of major flooding.

33. Temporary construction power connection (pigtail) for enclosure lights.

Benefit: This will aid in re-assembly of the equipment onsite until permanent power is established. Also allows work to be done to the package internally without full power.

Chillers and Boilers

1. Chiller and boiler restraints with shipping tie downs to prevent load shifting.

Benefit: Prevents damage to the internal components should the chillers shift during transportation & rigging.

2. Hinged water box covers on the evaporator and condenser on non-pipe connection end.

Benefit: A hinged water box for heat exchangers reduces the costs of eddy current tube tests, tube inspections and cleaning. This also makes it safer for maintenance.

3. Thermal displacement flow detection device located on the chiller side of the isolation valve.

Benefit: Thermal displacement flow detection provides for a higher quality flow verification over paddle switches and other similar devices. Verification of flow is critical to chiller operation and should be measured correctly. This is especially important on variable flow systems.

4. Refrigerant relief lines piped to the exterior of the enclosure, complete with dirt leg (to prevent clogging or collection of water in the line), blow down valve, and flexible connector. (Material type is dependent on refrigerant type. See chiller manual for recommended materials)

Benefit: A correctly designed and built relief line provides safety for operators.

5. Ball valves with plugs or caps for drain and vent connections on chiller end bells. Valves and plugs are removed from end bells prior to shipment.

Benefit: Installation of drains on chillers at the factory reduces field installation costs and reduces chances of standing water freezing. In the case of tube cleaning, it allows the chiller to be completely drained before opening the water boxes. The air vent valves allow air to be vented from the chiller.

6. Pressure gauges and thermometers at the inlet/outlet of each chiller evaporator and condenser barrel. Any sensing lines are provided as stainless steel braided hose.

Benefit: Instrumentation on the piping system assists the operator with system inspections, troubleshooting and diagnostics. This allows visual indication to verify the temperature control instrument read outs. Stainless steel braided hose provides a reliable, corrosion proof connection for sensing lines.

7. Neoprene vibration dampeners, provided under all centrifugal and screw compressor chillers.

Benefit: Isolation pads reduce vibration and noise.

8. Chillers must be factory insulated by the chiller manufacturer.

9. 1-1/2" chiller evaporator barrel bypass line with blow down valve located on system side of isolation valves. Drain included.

Benefit: Under normal cleaning and flushing, chemicals should not be allowed in the chiller. The bypass allows chemicals to bypass the chiller to completely clean the piping system.

10. ASHRAE Standard 15 compliant, with the following features:

- Individual chiller leak detection
- Emergency break glass stop
- Interior/exterior audible and visual alarm indications
- Main egress signage
- Refrigerant exhaust with motorized intake complete with exterior indication and control
- Louvers with bird screen and 3 break moisture elimination

Benefit: Provision of an ASHRAE 15 compliant system at the factory reduces installation and overall costs, and provides a pre-verified system for the site inspection teams. Provides for the safety of individuals inside an equipment enclosure with a refrigerant present.

11. When boilers are provided with an enclosure, exhaust flue, sealed combustion piping (for some high efficient boilers), combustion air and individual or main gas regulators will be provided by Systecon.

Benefit: These are costly features that are often omitted by the competition.

Pumping Equipment

1. Maintenance rail with hoist/trolley system provided for service removal over pumps with motors 15 HP and higher. Rail extends beyond pump set end for placing motors on dolly. Rail to be set at a minimum height of 80" above finished floor.

Benefit: Provision of a maintenance rail assists the operator with pump service, maintenance, and repair.

2. Pumps on sub bases with decking for rigidity.

Benefit: Sub bases provide for a more rigid, reliable design. Allows pump sets to be tested independently of the central plant and accelerates the project's construction.

3. Drain pans under each pump piped to main drain.

Benefit: Drain pans help prevent water from getting to unintended areas within the package. Most pumps do not have this as a standard feature.

4. Ball valve and hose bib with cap on suction diffuser.

Benefit: Ball valves with hose bib assist with pump service and maintenance.

5. Laser alignment of all pumps. Shims put under both pump and motors.

Benefit: Laser alignment and shims allow for proper pump alignment, improving reliability and performance, and extend the life of the pump. Systecon responsible for re-alignment of pumps onsite as the pumps will go out of alignment during shipping. Ensures this step is not missed by the installing contractor for reasons stated above.

6. Pump shaft couplings shall be paired at opposite ends to balance the weight.

Benefit: This balances the weight of the key ways for the pump and motor by balancing the axial forces, reducing vibration.

7. Adjustable pipe supports with thermal break to assure no weight on pumps. Pipe supports to lift pipe for service.

Benefit: By avoiding weight on the pumps, the pumping system operates at a higher performance with greater reliability, and protects the pump connections. (The number one case of pump failure is weight bearing on the pump.) Thermal breaks prevent condensation and corrosion.

8. Electronic pressure transmitters with ball valve and clean out port. Easy installation of gages.

Benefit: Ball valves and clean out ports provide a more serviceable pressure transmitter system compared to systems without these devices. Electronic devices allow for a central control screen that will show all pressures in the system.

9. Jacking bolts on pipe supports for pump headers.

Benefit: Jacking bolts are adjustable and allow for proper alignment of pipe supports and pump headers. In the event of service, these can be used to lift the pipe to remove components such as gaskets or valves.

Hydronic Specialties

1. Pete's plugs on header, as well as air separators.

Benefits: Allows field verification of pressure and temperature.

2. Air separator air vent piped to drain.

Benefit: This is a necessary feature of an operable and serviceable system. Provision and installation at the factory reduces field installation and/or operator costs.

3. Expansion tank with associated piping.

Benefit: This is a necessary feature of an operable and serviceable system. Provision and installation at the factory reduces field installation and/or operator costs.

Make Up Water Systems

1. Make up water assembly with PRV (Pressure Reducing Valve), isolation valves, bypass, and pressure relief for closed loop systems. Optional back flow preventer.

Benefit: Inclusion of a PRV prevents over pressurization of the piping system from the municipal water supply. The inclusion of isolation valves, bypass, pressure relief and a backflow preventer improves system operation and assists the operators with maintenance and service.

2. Type L copper pipe with ProPress™ fittings.

Benefit: Type L copper pipe is thicker than Type M or Type DWV (Drain, Waste & Vent) pipe and is better quality and longer lasting than Plastic PVC pipe. Type L is suitable for systems with reasonably high water pressures and assures that the owner has a high quality, reliable product.

ProPress™ is a series of products based on copper pressed fittings from Viega, a family owned international manufacture of Plumbing and HVAC solutions founded in 1899. **ProPress fittings do not require sweating of copper pipe with tin and lead solder. Using this standard fitting reduces costs and provides the owner with a proven reliable copper connection.**

Closed Loop Chemical Treatment

1. Connection points in piping with brass isolation valves at headers for equipment tie-in.

Benefit: Connection points with isolation valves reduce field installation costs and the costs for chemical treatment companies to provide and install their treatment systems. Assure that the onsite chemical company installs the injection of chemicals properly and more permanently.

2. Shot feeder for chilled water loop piped across common suction and discharge headers of chilled water pumps.

Benefit: Shot feeders reduce field installation costs and costs for the chemical treatment companies to provide and install their treatment systems.

3. Shot feeder supply and return piping is type L copper with Pro Press fittings.

Benefit: Type L copper pipe is thicker than Type M or Type DWV (Drain, Waste & Vent) pipe and is better quality and longer lasting than Plastic PVC pipe. Type L is suitable for systems with reasonably high water pressures and assures that the owner has a high quality, reliable product.

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Open Tower Water Filtration for Basin Sweeper Systems

1. Water filtration system with circulating pump, solid separator, and closed solid recovery vessel for tie-in to the tower basin sweeper system.

Benefit: This is our preferred system to clean towers. **The centrifugal separator provides good filtration, the sweeper moves the dirt to the filter, and the closed solid vessel removes the dirt without water waste.**

2. Monitoring of the solid recovery vessel.

Benefit: Alerts the end user when the equipment needs maintenance

3. Full service valves.

Benefit: Service valves assist the operator.

4. Separate blow down lines.

5. CPVC pipe between the filtration system and tower basin connections. Suction line to be upsized to increase NPSH available to the filter pump.

Pipe Construction

1. ASME Section 9 B31.1 compliant, 150 # ANSI class

Benefit: The American Society of Mechanical Engineers (ASME) and the American National Standards Institute (ANSI) provides industry standard practices that assures that items such as piping are constructed in a manner than meets minimum quality and reliability standards. Enforcing these standards enables the owner to own and operate a high quality, reliable system.

2. Butt weld (welds of two sections of parallel pipe that do not overlap) fittings with slip-on and/or weld neck flanges.

Benefit: This method reduces the pressure drop compared to field fabricated fittings because the connection is smoother.

3. Indirect saddle welds on branches less than 2/3 the size of the main header.

Benefit: Ensures the integrity of the pipe by not cutting out too much material to install the branch fitting. The competition and stick built plants will exceed the 2/3 standard and use a fish-mouth weld because it is cheaper and faster, but it causes system efficiency loss and can weaken the pipe.

4. All vertical flanges are two-hole center.

Benefit: Allows proper pipe alignments. This is a USA standard.

5. All valves (butterfly/ball) provided with handle extensions to accommodate pipe insulation.

Benefit: Handle extensions allow the operator to use the ball valves properly, even when the added thickness of insulation is applied.

6. No pipe spacer required on condenser water piping unless more convenient for shop assembly. (project dependent)
7. Exterior piping:
 - Cold climate – heat traced and insulated
 - Warmer climate – non-insulated and painted

Benefit: Heat traced and insulated piping helps prevent freezing and pipe damage in cold climates. The omission of this item in warmer climates where heat trace is not necessary saves costs. The pipe is then primed and painted to match the color of the enclosure.

8. Minimal use of grooved end/couplings, except:
 - Section splits
 - Wall penetrations
 - Chiller and cooling tower connections
 - Chiller branch to header (when required for expansion compensation)

Benefit: Welded and flanged couplings tend to be more reliable. By reducing the number of grooved couplings, the system is more reliable.

9. Schedule 40 pipe up to and including 10", standard weight 12" and larger.

Benefit: The National Pipe Standards (NPS) designates pipe thickness based on the size of pipe. Use of Schedule 40 pipe up to and including 10" and 12" pipe sizes is at the upper end of pipe thickness requirements for these standards. This means the owner has a high thickness standard and better long-term reliability versus systems that do not meet this standard.

10. Type L copper for all applicable lines.

Benefit: Type L copper pipe is thicker than Type M or Type DWV (Drain, Waste & Vent) pipe and is better quality and longer lasting than Plastic PVC pipe. Type L is suitable for systems with reasonably high water pressures and assures that the owner has a high quality, reliable product.

11. ProPress™ fittings on copper piping systems.

Benefit: ProPress™ is a series of products based on copper pressed fittings from Viega, a family owned international manufacture of Plumbing and HVAC solutions founded in 1899. ProPress fittings do not require sweating copper pipe with tin and lead solder. Using this standard fitting reduces costs and provides the owner with a proven, reliable copper connection.

Pipe Insulation

1. 1" Armaflex pipe insulation for interior chilled water pipe and components. Painted white.

Benefit: The requirement of a pipe insulation standard assures that the owner has an adequate insulation system. (A pipe insulation jacket is an available option.) The white paint makes the room brighter. It is also easier to clean the insulation. (This standard is often altered for owner preference.)

2. Minimum 1 ½" pipe spacer for thermal break.

Benefit: The inclusion of a thermal break is important to prevent the transmission of heat which can cause undesirable sweating of components, which can cause premature component failure.

3. Uninsulated make-up water pipe.

Benefit: Make-up-water pipe is typically not insulated.

4. Expansion tanks and associated piping will not be insulated.

Benefit: Expansion tanks and associated piping are typically not insulated which helps reduce costs and allows for easy access to the tank.

5. Free cooling heat exchangers with chilled water side piping up to the exchanger.

6. Exterior insulation to be PVC jacketed unless otherwise specified. More than likely, this will be done in the field.

Benefit: Exterior insulation will be exposed to elements, not seen inside the enclosure or equipment room, and is often jacketed.

7. Make accommodations for insulation on all pipe penetrations through enclosure.

Benefit: By accommodating a large enough space for field application of insulation, the integrity of the enclosure is protected since field cuts to the enclosure will not be required.

Enclosure HVAC Requirements

1. Bard self-contained air conditioning units with strip heaters and ventilation where required. (Strip heater is dependent upon jobsite location).
2. Enclosure internal temperature will be maintained as follows:
 - Heating – 50° F minimum
 - Cooling – 85° F maximum
 - Ventilation – 100° F maximum
3. Occupancy ventilation as required.

Benefit: A conditioned enclosure package will assist with preserving the longevity of the internal electronics and provide a comfortable work environment for the facilities and service teams. (Fan coils for a/c when a chiller is present and electric unit heaters are also an option.)

4. The interior of multiple enclosure modules is open and provides continuous clearance between components, unless required by code.

Benefit: Allows for easy access to the entire plant for service and maintenance

5. All floor, wall, and roof deflections shall be less than 1”/360” span including internal compartment pressures. A deflection limit of L/180 shall apply to wall panel.

Benefit: Specifying the deflection of the units requires the base to be stronger.

6. Wall & Roof Core Insulation: Foamed In Place, Non-CFC, FM Class I approved, polyurethane. R-Value to be determined.

Benefit: Provides longevity for the integrity of the insulation. Some competitors use foil backed or rigid board exposed “stick-on” insulation.

7. An electrical receptacle on 10 ft. centers shall be provided on each wall. Each receptacle shall be equipped with a ground fault interruption (GFI) device. Outdoor receptacles shall be provided for maintenance considerations. Each receptacle shall be equipped with GFI and outdoor-rated enclosure.

Benefit: Allows end-users easy access to power their service and maintenance equipment.

8. A 60-mil white TPO (thermoplastic polyolefin) roof membrane roof system shall be used when the roof is flat or non-standing seam. Wood blocking and polyisocyanurate insulation used to provide a taper of ¼” per foot.

Standing seam is acceptable in warm weather areas or when a high pitch on the roof is available.

Benefit: TPO offers the best protection from the elements in cold and snowy environments.

Electrical

1. Panelboard with main lugs are a minimum 65,000 AIC (Amps Interrupting Capacity).

Benefit: A rating of 65,000 AIC is considered a high interrupt level and provides a reliable system for the owner.

2. 1200 amps or above requires two (2) means of egress.

Benefit: Provides a safe environment for service and facilities teams.

3. Stand-alone VFD reduces line length and allows for heat dissipation.

- Drive parameters set up for pump operation.
- Hardwired stop, start and failed.
- Separate communication link.
- Carrier frequency tuned for low noise with lowest carrier frequency.
- Drives with individual disconnects.
- Drip pan installed over VFD's when pipe runs exist above them

Benefit: Long line lengths can lead to voltage spikes which damage motors. The hardwire inputs do not rely on communication links which can be unreliable. Drive parameters are setup for hydronic systems using years of drive experience. Drive disconnects allow the drive to be isolated for trouble shooting and service without taking down the system.

- Drives provided with manual bypass starters for cooling tower fans applications.

Benefit: Most pump applications have standby pumps so bypass is not needed. Also, putting a pump into bypass can cause overpressure. Overpressure is not a concern with the cooling tower fan. The bypass then gives you the option to run the fan in the event of drive failure.

4. NEC (National Electric Code) clearance on all electrical components.

Benefit: This standard provides a safe working environment. By complying with this, and other standards, construction delays are prevented and the inspectors approve the plant construction methods.

5. No trip hazards in front of electrical panels.

Benefit: Provide a safe work environment.

6. Equipment disconnect height shall not exceed 78" above the finished floor.

Benefit: Assures that the disconnect can be quickly accessed when needed.

7. Pipe cannot be routed over MCC's (Motor Control Center), panel boards, load centers, or switch boards.

Benefit: Removes the possibility of damage from water or condensate from these pipes to these electrical components.

8. Large 115-volt junction boxes with terminal strip used for splits. Segregate the 120 VAC (Volts-Alternating Current) powered circuits from the 24 VAC powered circuits in the box.

Benefit: Although this is often not required by code, a separation of the low voltage (24 volts) circuits from the more dangerous 120-volt circuits helps prevent accidental electric shock. The junction box with terminal strip makes the reconnection of wiring across split more reliable versus wire nuts.

9. All power wires are tape color coded as a minimum.

Benefit: Tape color coded wiring assists with service and diagnostics, and is a much better alternative than common color wiring. This allows one to identify phase. The phases are concurrent so all equipment rotates correctly. Phase continuity is checked at the factory before shipment.

10. All control wires are numbered.

Benefit: Wiring numbers assist with service and diagnostics, and is a much better alternative to wiring without numbers. All junction boxes are tagged with circuit breaker designators.

11. Provide a 2" minimum separation between Class 1 and Class 2 wiring in open cable trays. Class 1 and Class 2 wiring cannot reside in the same closed conduit. Provide separate conduits.

Benefit: The separation allows compliance with codes and prevents wiring interference and system malfunction. Class 2 wire is rated for lower voltage and must be separated.

12. Separate circuit breaker panels for all 115-volt loads.

Benefit: Separate circuit breakers for these loads provide for better operation, service and diagnostics versus systems that "gang together loads" and do not adhere to a system with separate breakers. A separate breaker can be sized for a lower overload, offering better shock and wire protection. At the same time, individual circuits can be disconnected without system shutdown.

13. Ideally, we want to avoid running conduit on the floor. In cases where this is unavoidable, the conduit must be raised off the floor a minimum of 1-5/8".

Benefit: Raising the conduit or eliminating floor conduit all together prevents damage to the conduit. Raising floor conduit also prevents water entry into the conduit and allows the floor to drain to the drain pans.

14. When dry rooms are required by specification (not preferred):

- 1200 amp and larger feeds require two (2) means of egress.
- Line of site disconnects are required for each motor.
- If commercial market, no open tray power distribution.

Benefit: The above standards allow for a safer operation of the system. See comments above.

15. Standard power distribution arrangement is:

- Individual power feed to each chiller.

Benefit: Only one chiller is affected if a power feed is disabled or disconnected. Other chillers can continue to operate, where used and where power is available, providing greater system redundancy.

- Common feed for remaining loads to a switchboard with a main lug minimum.
- Switchboard will have a single breaker for each set of pumps, fans, etc., so that a single power feed is provided to a power distribution lug located near the set of motors that it feeds. The line power to the motor controller comes from the lug.

Benefit: Greater system redundancy is achieved by separating the power distribution in this manner. If a power feed or breaker becomes unavailable, other feeds that are operational and have power can continue to operate.

16. Compression fittings are used for all EMT (Electrical Metallic Tubing) conduit connections.

Benefit: Compression fittings are water resistant versus screw fitting. EMT is used rather than flexible conduit such as BX (a generic term for armored, flexible cable).

17. EMT is standard conduit for indoor use.

Benefit: Use of EMT is a better alternative to plenum rated, open cable systems which can look sloppy, and are more prone to damage or disconnection than an EMT conduit system.

18. Galvanized rigid conduit with Meyers™ hubs is standard conduit for outdoor use.

Benefit: Rigid conduit is a better alternative than EMT or other means for an outdoor system, and will provide for a more reliable installation. Rigid conduit uses threaded connections within electric pipe dope providing a water tight connection. Meyers™ Hubs are manufactured by Cooper Crouse-Hinds, which is the originator of this hub device and the industry leader in quality and reliability.

19. Depending on the connected load, Meltric™ plugs* are utilized to facilitate package splits for higher voltages (460 VAC), while junction boxes with terminal strips are utilized for lower voltages.

*Meltric™ plugs are a product from the Marechal Corporation, a company founded in the 1950s.

Benefit: Meltric™ plugs are safer and more reliable than less expensive alternative plugs.

20. 3' maximum length of flexible Seal-Tite® runs to final, end device.

Seal-Tite® is a trademark of Seal-Tite, LLC a company based in the Cincinnati area with origins beginning nearly 100-years ago.

Benefit: Used for connections to vibrating equipment only. Seal-Tite tubing is analogous to flex-duct in air conditioning systems—good for short runs but not optimized for longer lengths. Keeping the length to a minimum helps the overall quality and reliability of the system.

21. Three-way light switches at each means of egress.

Benefit: Multiple lighting locations assist with the safety of the maintenance and facilities teams.

22. T-8 interior lighting.

The “T” is a measure of thickness of a bulb in a florescent lighting system. T-5 lighting is about the thickness of a dime and T-8 is about the thickness of a nickel. Both are efficient.

Benefit: T-8 lighting is common which makes it easy for facilities operators to change bulbs, when needed.

23. Weather rated receptacles for outside service.

Benefit: Outdoor receptacles assist with service and code compliance.

24. Electrical conduits will be at least 1 5/8” above the finished floor.

Benefit: Raising the conduits above the floor, prevent any water puddles on the floor from damaging the electrical systems.

25. Where conduit or cable tray runs through walkways, the minimum height from the finished floor to the bottom of the conduit/tray is 6'-6". Higher is preferred. We do not have a standard when we use cable tray versus conduit, it is project dependent.

Benefit: By removing as much conduit or cable tray as possible from walkways, the electrical system does not obstruct service and facilities operation, and is less likely to be damaged.

Controls

1. Individual remote I/O (Input/Output) panels at section splits.

Benefit: The use of individual panels at section splits provides for a more reliable system compared to common panels. Provides quick & foolproof re-assembly across shipping splits by using one twisted communication cable between splits versus multiple standard electrical wiring.

2. Rosemount™ RTD (Resistive Temperature Device) temperature transmitters for supply/return temperature indication for the chilled water and condenser water loops.

Benefit: Rosemount™ is known as providing the highest quality transmitters in the industry. They're more expensive, but very reliable and do not need to be recalibrated each year like thermistors.

3. Rosemount differential pressure transmitters for zone loop control and minimum flow control.

Benefit: The Rosemount transmitter is guaranteed to be in calibration for 10 years and can withstand 2000psi pressure pulses. We've been using these for over 30 years without one failure; they're one of the most important instruments in the plant.

4. Onicon™ SF1210 insertion type flow meter for chilled water flow monitoring.

Benefit: Onicon™ manufactures flow meters of outstanding quality and value, with accuracy better than +/- 2% of flow when correctly applied. The SF 1210 insertion flow meter is more affordable than the SF3500 electromagnetic model and can be used in a reliable fashion on closed systems such as chilled water systems. Use of a high-quality flow meter is important to system operation and assists with controls operation and system optimization.

5. Onicon™ SF3500 on condenser water applications.

Benefit: The Onicon™ SF3500 model is electromagnetic and not as susceptible to debris or clogging as the SF 1210 model. This is the preferred model for an open condenser water system open to the elements.

6. Pressure transmitters hard wired back to the control system for pump monitoring, failure sequencing at the suction, discharge of each pump, and at the inlet/outlet of each chiller evaporator/condenser, and heat exchangers.

Benefit: These pressure transmitters and method of connection have multiple benefits. First, the use of a hardware transmitter versus a transmitter that utilizes a communication protocol is more reliable. Second, by monitoring the pressure at both the inlet and outlet of chillers and pumps, the operation of these items can be accurately determined. This information, fed back to the controls, can allow the controller to respond to a failure and can assure that the devices are safe to operate because they have flow. Normal expected response rate experience of ATC devices shows a latency of nearly a minute, causing unstable operation.

7. Pressure transmitters hard wired back to the control system for pressure monitoring at the main supply and return header connections for the chilled and condenser water loops.

Benefit: These pressure transmitters help optimize system performance and help reduce energy costs. By using the information from these transmitters, the variable frequency drive settings for flow can be optimized for reliability and energy consumption.

8. All actuated control valves with all aluminum NEMA* 4 enclosure and heaters to avoid condensation. Valves with opening and closing switches, as well as, visual location arrow.
*National Electrical Manufacturers Association

Benefit: NEMA 4 is a rating for an outdoor device. Even though the valves described here are typically used indoors, the outdoor rated device is more robust. Also, valves are often used without heaters which can cause internal condensation. The internal condensation can cause equipment malfunction and premature equipment failure.

Although this valve standard is more expensive than alternatives, it is a proven reliable system. The end switch positively indicates the valve position. Most control valves do not have this feature.

9. All actuated control valves provided with manual override clutch and wheel handle operator.

Benefit: Provides a back-up method for the facilities and service teams to operate the valve in the event of a power failure or emergency.

10. Valve control relays in control panel with individual disconnecting service circuit breaker for both control and power. Light indicating DC (direct current) voltage relays.

Benefit: The use of relays and individual disconnecting service circuit breakers for control and power assist with service, diagnostics and maintenance. The indication lights are a standard offering. This control architecture has all the relays in the control panel versus having them distributed all over the plant, which allows for quicker trouble shooting.

11. All valves have HOA (Hand-Off-Auto) switch or potentiometers for override. Switches are mounted in the control panel door. Main control enclosure valve HOA switch operation is integrated into control logic.

Benefit: This switch allows different modes of operation and assists with maintenance, diagnostics and service. In the case of emergency, all devices can be manually opened.

12. Industrial PLC (Programmable Logic Controller) based control system.

Benefit: PLC systems are more reliable, faster acting and robust than less expensive Direct Digital Control (DDC) systems. PLC systems are most often used for amusement rides, critical hospital equipment and in nuclear power plants. Once they are configured and optimized properly, they are less susceptible to “re-programming” mistakes and problems because they require special training and knowledge to disrupt the optimized program. Specifying the MUP manufacturer to provide and test their controls in their factory provides faster commissioning and single-source responsibility.

13. Full 15” color graphic screen.

Benefit: The large color graphic screen assists the operator and service teams with graphical representation of the entire chiller plant.

14. Control panel with color coded and tagged wires.

Benefit: Color coded and tagged wiring assists with maintenance, diagnostics and service.

15. Individual control power disconnect.

Benefit: The separation of the control power from other systems allows for better service and diagnostics. This also allows each device to be serviced without shutting down the entire system.

16. External receptacle and service port for computer connection to controls.

Benefit: The ability to connect and power a computer assists with service and maintenance without opening the control panel door.

17. Full integration of all components to single BAS interface (BacNet Ethernet, BacNet MSTP, BacNet IP, Modbus, LON).

Benefit: PLC systems have flexible protocols which make this system compatible with any owner selected control system. There is only one connection made to the entire plant. We integrate all the controlled items feedback into one connection. This includes drive chiller, boiler and auxiliary equipment.

18. Spare control and signal conductors are provided as follows:

- VFD – 2 sets for control, 1 set for signal
- Chillers – 4 sets for control, 1 set for signal

Benefit: Spare parts benefit the owner and operator and help keep the systems on line.

19. Interactive Optimization with Wire-to-Water efficiency optimization of the entire central plant and full equipment sequencing and failure routines.

Benefit: Interactive Optimization and Wire-to-Water system efficiency optimization provides the most efficient systems in the industry.

20. Minimum of six (6) each DI (Digital Input), DO (Digital Output), and AI (Analog Input) and two (2) AO (Analog Output) spare I/O, wired to terminal strips.

Benefit: The use of all these additional control values allows the owner and controls contractor flexibility in how the system is controlled.

21. Control panel UL 508A listed under cULus. (UL stands for Underwriters Laboratory and the “c” is for Canada.)

Benefit: Having a UL Listed panel assures that the site inspectors will accept the installation which will aid in the construction process.

22. NEMA 1 enclosures provided with gasketed doors.

Benefit: The use of a NEMA rating standard assures the integrity of the cabinet.

Options

- Fire suppression system with sprinkler heads to match existing.
- Fire pull boxes and conduit to central junction box for fire protection alarm and monitoring. **Systecon never provides the wiring for these systems since this falls under the fire protection contractor scope.**
- Fiberglass pipe insulation with fitting covers. (PVC fitting cover and a fiber glass insert)
- Electrical dry room with air conditioner.
- Interior hose bibs for maintenance of equipment.
- 2" make-up water connection to the cooling towers.
- Make-up water metering.
- Exterior windows.
- Perforated interior wall and ceiling panels for sound absorption.
- Exit lights at each exterior door.
- LED lighting.
- Exterior paint and siding options.
- Chiller vibration elimination options.
- Wingert two (2) coupon rack for chilled water loop. PVC piping to and from rack (no copper). This is for corrosion monitoring.
- Non-chemical treatment systems for open towers.
- Solid separator purge systems.
- Equipment installation supervision is provided for all central plants and an option for pump modules
- Space for future equipment.
- Chiller VFD refrigerant service valves.
- Flexible pipe connectors at the inlet/outlet of each chiller evaporator and condenser barrel.
- Roll up maintenance doors.
- Removable wall panels.
- Color graphics exportable to BAS.
- Main breaker.
- Internet router.
- OSHPD (Office of Statewide Health Planning & Development) compliant equipment, state of California. Seismic approval for hospitals & other human services buildings
- Enclosure to be large Missile Impact tested and approved by Miami-Dade per the following tests: TAS 201-94, 202-94, 203-94.
- Insulated pump boxes.
- Fan coils and associated insulated piping for enclosure cooling.
- Calsil spacer/oversized U-bolt for vapor barrier.
- 300 PSIG high pressure piping.
- Bypass filter feeder with insulation.
- Heat traced and insulated exterior cold climate piping.
- Glycol feed units.
- Aegis grounding rings on pump motors.
- Gutters and downspouts on multi-section assemblies.
- Emergency eye wash and shower station

Open Tower Chemical Treatment (when required by specifications)

1. Nalco is the preferred vendor.
2. Injection pumps.
3. Coupon rack w/PVC piping.

Physical Constraints

1. Maximum size and weight restraints for any equipment section:
 - Height - 12'-6"
 - Length - 40'
 - Width - 12'
 - Weight - 80,000 lbs.
2. Optional horizontal split for enclosures over 12'-6" in height.
3. Any deviations must be approved by Systecon Management.

Seismic Requirements

1. Category A.
2. Equipment and anchoring only.
3. Beyond our standard requires additional analysis.

Exceptions (but not limited to)

1. Life safety, smoke alarms, etc.
2. Lightning rods.
3. Traps on sanitary lines.
4. Overflow and drain lines on cooling towers.
5. Conduits for outside signals.