

# **“Leading the Way for a Safer Pinellas”**



## **Pinellas County Upgrade Jail Campus Infrastructure**

# **Phase 1 Design Criteria**

**Volume 4 - Book 2 - Project Specifications**  
March 19, 2014



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TLC Engineering for Architecture



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**VOLUME 4 – BOOK 2 - TABLE OF CONTENTS****FIRE SUPPRESSION ..... DIVISION 21**

Common Motor Requirements for	
Fire Suppression Equipment.....	21 05 13
Sleeves and Sleeve Seals for Fire	
Suppression Piping.....	21 05 17
Escutcheons for Fire Suppression Piping .....	21 05 18
Identification for Fire Suppression	
Piping and Equipment.....	21 05 53
Facility Fire Suppression Water Service Piping	21 11 00
Fire Suppression Standpipes.....	21 12 00
Wet Pipe Sprinkler Systems .....	21 13 13
Dry Pipe Sprinkler Systems .....	21 13 16
Electric-Drive, Centrifugal Fire Pumps .....	21 31 13
Pressure Maintenance Pumps.....	21 34 00
Controllers for Fire Pump Drivers .....	21 39 00

**PLUMBING ..... DIVISION 22**

Common Motor Requirements for	
Plumbing Equipment.....	22 05 13
Sleeves and Sleeve Seals for	
Plumbing Piping.....	22 05 17
Escutcheons for Plumbing Piping .....	22 05 18
Meters and Gages for Plumbing Piping .....	22 05 19
General Duty Valves for Plumbing Piping .....	22 05 23
Hangers and Supports for Plumbing Piping .....	22 05 29
Identification for Plumbing Piping	
and Equipment .....	22 05 53
Plumbing Piping Insulation .....	22 07 19
Domestic Water Piping .....	22 11 16
Domestic Water Pumps.....	22 11 23
Domestic Water Packaged Booster Pumps	22 11 23.13
Facility Indoor Potable Water Storage Tanks...	22 12 23
Sanitary Waste and Vent Piping .....	22 13 16
Sanitary Waste Interceptors .....	22 13 23
Storm Drainage Piping.....	22 14 13
Compressed Air Piping.....	22 15 13
Air Compressors.....	22 15 19
Domestic Water Heat Exchangers.....	22 35 00
Emergency Plumbing Fixtures.....	22 45 00

**Project Specifications**

**HVAC..... DIVISION 23**

General HVAC.....	23 00 00
Common Motor Requirements	
for HVAC Equipment .....	23 05 13
Expansion Fittings and Loops for HVAC Piping	23 05 16
Sleeves and Sleeve Seals for HVAC Piping ....	23 05 17
Escutcheons for HVAC Piping .....	23 05 18
Meter and Gages for HVAC Piping .....	23 05 19
General-Duty Valves for HVAC Piping.....	23 05 23
Hangars and Supports for HVAC	
Vibration Controls for HVAC	
Piping and Equipment.....	23 05 48
Identification for HVAC Piping and Equipment.	23 05 53
Testing, Adjusting, and Balancing for HVAC....	23 05 93
Duct Insulation.....	23 07 13
HVAC Equipment Insulation .....	23 07 16
HVAC Piping Insulation .....	23 07 19
Commissioning of HVAC Systems.....	23 08 00
Instrumentation and Control for HVAC.....	23 09 00
Sequence Of Operations for HVAC Controls ...	23 09 93
Facility Natural-Gas Piping .....	23 11 23
Hydronic Piping .....	23 21 13
Underground Hydronic Piping.....	23 21 13.13
Hydronic Pumps .....	23 21 23
Steam and Condensate Heating Piping .....	23 22 13
Steam and Condensate Pumps .....	23 22 23
Refrigerant Piping.....	23 23 00
HVAC Water Treatment.....	23 25 00
Metal Ducts .....	23 31 13
Air Duct Accessories .....	23 33 00
Axial HVAC Fans.....	23 34 13
HVAC Power Ventilators.....	23 34 23
Air Terminal Units .....	23 36 00
Diffusers, Registers, and Grilles .....	23 37 13
HVAC Gravity Ventilators .....	23 37 23
Gas Fired Radiant Heaters .....	23 55 23
Heat Exchangers.....	23 57 00
Indirect-Fired Absorption Water Chillers ....	23 64 13.16
Centrifugal Water Chillers.....	23 64 16
Cooling Towers .....	23 65 00
Air-to-Air Energy Recovery Equipment .....	23 72 00
Packaged, Outdoor, Central-Station	

**Project Specifications**

Air Handling Units .....	23 74 13
Fan Coil Units .....	23 82 19

**ELECTRICAL ..... DIVISION 26**

Low Voltage Electrical Power	
Conductors and Cables .....	26 05 19
Grounding and Bonding for Electrical Systems .....	26 05 26
Hangars and Supports for Electrical Systems .....	26 05 29
Raceways and Boxes for Electrical Systems ...	26 05 33
Underground Ducts and Raceways	
for Electrical Systems .....	26 05 43
Sleeves and Sleeve Seals for	
Electrical Raceways and Cabling .....	26 05 44
Identification for Electrical Systems .....	26 05 53
Overcurrent Protective Device	
Coordination Study .....	26 05 73
Electrical Power Monitoring and Control .....	26 09 13
Lighting Control Devices .....	26 09 23
Network Lighting Controls .....	26 09 43
Low Voltage Transformers .....	26 22 00
Low Voltage Switchgear .....	26 23 00
Switchboards .....	26 24 13
Panelboards .....	26 24 16
Wiring Devices .....	26 27 26
Fuses .....	26 28 13
Enclosed Switches and Circuit Breakers .....	26 28 16
Engine Generators .....	26 32 13
Transfer Switches .....	26 36 00
Lightning Protection for Structures .....	26 41 13
Transient-Voltage Suppression .....	26 43 13
Interior Lighting .....	26 51 00
Exterior Lighting .....	26 56 00

**TELECOMMUNICATIONS ..... DIVISION 27**

Common Work Results for Telecommunications .....	27 05 00
Grounding and Bonding for	
Telecommunications .....	27 05 26
Cabinets and Enclosures for	
Telecommunications .....	27 11 16
CATV .....	27 11 20
Backbone Cabling for Telecommunications .....	27 13 00
Horizontal Cabling for Telecommunications .....	27 15 00

**ELECTRONIC SAFETY AND SECURITY..... DIVISION 28**

Common Work Results for Electronic Security	28 05 00
Maintenance, Service, and Warranty for	
Electronic Security .....	28 05 10
Backbone Cabling for Electronic Security .....	28 05 11
Horizontal Cabling for Electronic Security .....	28 05 12
Conductors and Cables for Electronic Security	28 05 13
Grounding and Bonding for Electronic Security	28 05 26
Cabinets and Enclosures for Electronic Security	28 11 16
Access Control System for Electronic Security	28 13 00
Video Surveillance for Electronic Security .....	28 23 13
Digital, Addressable Fire Alarm System.....	28 31 11
PLC Hardware for Electronic Security.....	28 46 19
PLC Software for Electronic Security .....	28 46 20
Integrated Intercom Paging System	
for Electronic Security .....	28 51 23

**EARTHWORK ..... DIVISION 31**

Site Clearing.....	31 21 10
Rough Grading .....	31 22 11
Excavation.....	31 22 22
Backfilling .....	31 22 23
Trenching .....	31 22 25
Base Courses.....	31 22 30
Stabilized Subgrade .....	31 22 42
Erosion and Sedimentation Control .....	31 22 80

**EXTERIOR IMPROVEMENTS ..... DIVISION 32**

Asphaltic Concrete Surface Course.....	32 12 16
Pavement Marking and Accessories.....	32 25 12
High-Security Chain Link Fence and Gates	32 31 13.53

**UTILITIES ..... DIVISION 33**

Site Storm Sewerage Systems .....	33 41 00
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## 21 05 13 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

### 1.1 MATERIALS

#### A. Polyphase Motors: Design B, medium induction motors.

1. Efficiency: Energy efficient.
2. Service Factor: 1.15.
3. Multispeed Motors: **[Variable torque] [Separate winding for each speed]**.
4. Rotor: Random-wound, squirrel cage.
5. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
6. Temperature Rise: Match insulation rating.
7. Insulation: **[Class F] <Insert class>**.
8. Code Letter Designation:
  - a. Motors **[15] <Insert number>** HP and Larger: NEMA starting Code F or Code G.
  - b. Motors Smaller than **[15] <Insert number>** HP: Manufacturer's standard starting characteristic.
9. Enclosure Material: Cast iron for motor frame sizes **[324T] <Insert number>** and larger; rolled steel for motor frame sizes smaller than **[324T] <Insert number>**.

#### B. Polyphase Motors with Additional Requirements:

1. Motors used with reduced-voltage and multispeed controllers.
2. **[Energy- and premium-efficient] [and] [Inverter-duty]** motors used with variable frequency controllers.
3. Severe-duty motors.

#### C. Single-Phase Motors:

1. Motors Larger than 1/20 HP: Permanent-split capacitor; split phase; capacitor start, inductor run; or capacitor start, capacitor run to suit starting torque and requirements of specific motor application.
2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 HP and Smaller: Shaded-pole type.
5. Internal thermal protection.

END OF SECTION 21 05 13







## **21 05 17 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING**

### **1.1 SLEEVE-SEAL SYSTEMS**

- A. Field-assembled, modular sealing-element unit for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM rubber.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating.

### **1.2 SLEEVE-SEAL FITTINGS**

- A. Manufactured plastic, sleeve-type, plastic or rubber waterstop assembly made for imbedding in concrete slab or wall.

### **1.3 GROUT**

- A. Nonshrink, factory packaged.

### **1.4 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Exterior Concrete Walls above Grade:
  - 1. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
  - 2. Piping NPS 6 and Larger: Cast-iron wall sleeves.
- B. Exterior Concrete Walls below Grade:
  - 1. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
  - 2. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
- C. Concrete Slabs-on-Grade:
  - 1. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
  - 2. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
- D. Concrete Slabs above Grade:
  - 1. Piping Smaller Than NPS 6: PVC-pipe sleeves.
  - 2. Piping NPS 6 and Larger: PVC-pipe sleeves.
- E. Interior Partitions:
  - 1. Piping Smaller Than NPS 6: PVC-pipe sleeves.
  - 2. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 21 05 17





## Specifications

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### 21 05 18 - ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

#### 1.1 PRODUCTS

##### A. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
2. Insulated Piping: One-piece, stamped-steel type.
3. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type; chrome plated.
4. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type; chrome plated.
5. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type; chrome plated.
6. Bare Piping in Equipment Rooms: One-piece, cast-brass type; chrome plated.

##### B. Floor Plates for New Piping: One-piece type.

END OF SECTION 21 05 18





**Specifications**

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**21 05 53 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT**

1.1 PRODUCTS

- A. Equipment Labels: Brass.
- B. Warning Signs and Labels: Multilayer, multicolor plastic for mechanical engraving, 1/8 inch thick, with fasteners.
- C. Pipe Labels: Self-adhesive.
- D. Valve Tags: Brass.
- E. Warning Tags: 3 by 5-1/4 inches minimum; brass grommet and wire fasteners.

END OF SECTION 21 05 53





## Specifications

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### 21 11 00 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

#### 1.1 QUALITY ASSURANCE

- A. Quality Standards: NFPA 24 and NFPA 70.
- B. Products: Listing in "Approval Guide," published by FM Global, or UL's "Fire Protection Equipment Directory" for fire-service-main products.

#### 1.2 MATERIALS

- A. Underground Piping NPS 4:
  - 1. Grooved-end, ductile-iron pipe; appurtenances; and fittings.
  - 2. Mechanical-joint, ductile-iron pipe; standard-pattern fittings; and gasketed joints.
  - 3. Push-on-joint, ductile-iron pipe; compact-pattern fittings; and gasketed joints.
  - 4. PVC, Class 150 pipe listed for fire-protection service; PVC fittings of same class as pipe; and gasketed joints.
- B. Underground Piping NPS 6 to NPS 12:
  - 1. Grooved-end, ductile-iron pipe; appurtenances; and fittings.
  - 2. Mechanical-joint, ductile-iron pipe; standard-pattern fittings; and gasketed joints.
  - 3. Push-on-joint, ductile-iron pipe; compact-pattern fittings; and gasketed joints.
  - 4. PVC, Class 150 pipe listed for fire-protection service; PVC fittings of same class as pipe; and gasketed joints.
- C. Aboveground Piping NPS 2 and Smaller:
  - 1. Schedule 40, black steel pipe with treaded ends and uncoated, gray iron fittings.
- D. Aboveground Piping NPS 2-1/2 and Larger:
  - 1. Schedule 40, black steel pipe with treaded ends and uncoated, gray iron fittings.
- E. Standard-Pressure, Aboveground Shutoff Valves NPS 3 and Larger:
  - 1. 175-psig, UL-listed or FM-approved, iron, OS&Y gate valves.
  - 2. UL-listed or FM-approved butterfly valves.
- F. Check Valves NPS 3 and Larger:
  - 1. UL-listed or FM-approved check valves.
  - 2. UL-listed or FM-approved detector check valves.

END OF SECTION 21 11 00







## Specifications

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### 21 12 00 - FIRE-SUPPRESSION STANDPIPES

#### 1.1 QUALITY ASSURANCE

- A. Quality Standards: NFPA 14 and NFPA 70.

#### 1.2 MATERIALS

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with cast-iron threaded fittings and couplings.
- B. Standard-Pressure, Wet-Type Piping, NPS 4 and Larger:
  - 1. Schedule 40, black-steel pipe with threaded ends and uncoated, gray-iron fittings.

#### 1.3 SPECIALTY VALVES

- A. Alarm valves.
- B. Pressure-reducing valves.
- C. Automatic (ball drip) drain valves.

#### 1.4 HOSE CONNECTIONS

- A. Nonadjustable-Valve Hose Stations: Angle, rough brass or bronze finish.

#### 1.5 ALARM DEVICES

- A. Electrically operated alarm bell.
- B. Water-flow indicators.
- C. Pressure switches.
- D. Valve supervisory switches.
- E. Indicator-post supervisory switches.

#### 1.6 MANUAL CONTROL STATIONS

- A. Hydraulic operation.



**Specifications**

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1.7 CONTROL PANELS

- A. Single-area, two-area, or single-area cross-zoned control panel with electric-operation, manual control stations.

1.8 PRESSURE GAGES

- A. 0- to 250-psig minimum range.

END OF SECTION 21 12 00

**21 13 13 - WET-PIPE SPRINKLER SYSTEMS****1.1 QUALITY ASSURANCE**

- A. Quality Standards: NFPA 13 and NFPA 70.

**1.2 PIPING MATERIALS**

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved-end fittings.
- B. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2 and Smaller:
  - 1. Schedule 40, black-steel pipe with threaded ends and uncoated, gray-iron fittings.
- C. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2-1/2 to NPS 4:
  - 1. Schedule 40, black-steel pipe with threaded ends and uncoated fittings.
- D. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 5 and Larger:
  - 1. Schedule 40, black-steel pipe with threaded ends and uncoated fittings.
  - 2. Schedule 40, black-steel pipe and welding fittings.

**1.3 SPRINKLER MATERIALS**

- A. Sprinkler Types:
  - 1. Rooms without Ceilings: Upright sprinklers.
  - 2. Rooms with Suspended Ceilings: Pendent/Recessed sprinklers.
  - 3. Wall Mounting: Sidewall sprinklers.
  - 4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers.
  - 5. Special Applications: Extended-coverage and quick-response sprinklers where allowed per NFPA 13.
- B. Sprinkler Finishes:
  - 1. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
  - 2. Upright Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

**1.4 LISTED FIRE-PROTECTION VALVES**

- A. Ball Valves:
  - 1. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
  - 2. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.



## Specifications

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- 3. Valves NPS 3: Ductile-iron body with grooved ends.
  - B. Bronze butterfly valves.
  - C. Check valves.
  - D. Bronze OS&Y gate valves.
  - E. Indicating-type butterfly valves.
    - 1. Valves NPS 2 and Smaller: Ball or butterfly.
    - 2. Valves NPS 2-1/2 and Larger: Butterfly.
    - 3. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch indicating device.
  - F. NRS gate valves:
  - G. Indicator Posts: Wrench or Hand-wheel operated.
- 1.5 TRIM AND DRAIN VALVES
  - A. Angle valves.
  - B. Ball valves.
  - C. Globe valves.
  - D. Plug valves.
- 1.6 SPECIALTY VALVES
  - A. Alarm valves.
  - B. Automatic (ball drip) drain valves.
- 1.7 FIRE-DEPARTMENT CONNECTIONS
  - A. Exposed type with Stortz inlets, polished chrome-plated finish, and NPS 5 outlet.
- 1.8 SPRINKLER SPECIALTY PIPE FITTINGS
  - A. Branch outlet fittings.
  - B. Flow detection and test assemblies.
  - C. Branch line testers.



## Specifications

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- D. Sprinkler inspector's test fittings.
- E. Adjustable drop nipples.
- F. Flexible, sprinkler hose fittings.
- G. Sprinkler Escutcheons:
  - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
  - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- H. Sprinkler guards.

### 1.9 ALARM DEVICES

- A. Electrically operated alarm bell.
- B. Water-flow indicators.
- C. Pressure switches.
- D. Valve supervisory switches.
- E. Indicator-post supervisory switches.

### 1.10 PRESSURE GAGES

- A. 0- to 250-psig minimum range.

END OF SECTION 21 13 13



## 21 13 16 - DRY-PIPE SPRINKLER SYSTEMS

### 1.1 QUALITY ASSURANCE

- A. Quality Standards: **[NFPA 13]** **[NFPA 13R]** **[NFPA 24]** and NFPA 70.

### 1.2 PIPING MATERIALS

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with **[cast-iron threaded fittings]** **[grooved-end fittings]**.
- B. Dry-Pipe Sprinkler System, **[NPS 2 and Smaller]** **<Insert pipe size range>**:
1. **[Standard-weight]** **[or]** **[Schedule 30]**, galvanized-steel pipe with threaded ends and galvanized, gray-iron fittings.
  2. **[Standard-weight]** **[Schedule 30]** **[or]** **[thinwall]**, galvanized-steel pipe and plain-end-pipe fittings.
  3. **[Standard-weight]** **[or]** **[Schedule 30]**, galvanized-steel pipe with cut-grooved ends and galvanized fittings.
  4. **[Type L]** **[Type M]**, copper tube with plain ends and **[cast-]** **[or]** **[wrought-]**copper fittings.
  5. **[Type L]** **[Type M]**, copper tube with plain ends and copper pressure-seal fittings.
  6. NPS 2, **[Type L]** **[Type M]**, copper tube with roll-grooved ends and copper fittings.
- C. Dry-Pipe Sprinkler System, **[NPS 2-1/2 to NPS 4]** **<Insert pipe size range>**:
1. **[Standard-weight]** **[or]** **[Schedule 30]**, galvanized-steel pipe with threaded ends and galvanized, gray-iron fittings.
  2. **[Standard-weight]** **[or]** **[Schedule 30]**, galvanized-steel pipe with cut-grooved ends and galvanized fittings.
  3. **[Type L]** **[Type M]**, copper tube with plain ends and **[cast-]** **[or]** **[wrought-]**copper fittings.
  4. **[Type L]** **[Type M]**, copper tube with plain ends and copper pressure-seal fittings.
  5. **[Type L]** **[Type M]**, copper tube with roll-grooved ends and copper fittings.
- D. Dry-Pipe Sprinkler System, **[NPS 5 and NPS 6]** **<Insert pipe size range>**:
1. **[Standard-weight]** **[or]** **[Schedule 30]**, galvanized-steel pipe with threaded ends and galvanized, gray-iron fittings.
  2. **[Standard-weight]** **[or]** **[Schedule 30]**, galvanized-steel pipe with cut-grooved ends and galvanized fittings.
  3. **[Type L]** **[Type M]**, copper tube with plain ends and **[cast-]** **[or]** **[wrought-]**copper fittings.
  4. **[Type L]** **[Type M]**, copper tube with roll-grooved ends and copper fittings.

### 1.3 SPRINKLER MATERIALS

- A. Sprinkler Types:
1. Rooms without Ceilings: **[Upright sprinklers]** **<Insert type>**.

## Specifications

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2. Rooms with Suspended Ceilings: **[Dry pendent sprinklers] [Dry recessed sprinklers] [Dry flush sprinklers] [Dry concealed sprinklers] [Dry pendent, recessed, flush, and concealed sprinklers, as indicated]**.
3. Wall Mounting: Dry sidewall sprinklers.
4. Spaces Subject to Freezing: **[Upright sprinklers] [Dry pendent sprinklers] [Dry sidewall sprinklers] [Upright, dry pendent sprinklers; and dry sidewall sprinklers as indicated] <Insert type>**.
5. Special Applications: **[Extended-coverage and quick-response sprinklers where indicated] <Insert type>**.

B. Sprinkler Finishes:

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. **[Upright,] [Pendent,] [and] [Sidewall]** Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

### 1.4 LISTED FIRE-PROTECTION VALVES

A. Ball Valves:

1. Valves NPS 1-1/2 and Smaller: Bronze body with threaded ends.
2. Valves NPS 2 and NPS 2-1/2: Bronze body with threaded ends or ductile-iron body with grooved ends.
3. Valves NPS 3: Ductile-iron body with grooved ends.

B. Bronze butterfly valves.

C. Iron butterfly valves.

D. Check valves.

E. Bronze OS&Y gate valves.

F. Iron OS&Y gate valves.

G. Indicating-type butterfly valves.

1. Valves NPS 2 and Smaller: Ball or butterfly.
2. Valves NPS 2-1/2 and Larger: Butterfly.
3. Valve Operation: Integral **[electrical, 115-V ac, prewired, single-circuit, supervisory switch] [electrical, 115-V ac, prewired, two-circuit, supervisory switch] [visual]** indicating device.

H. NRS gate valves.

I. Indicator Posts: **[Wrench] [Hand-wheel]** operated.





## Specifications

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### 1.5 TRIM AND DRAIN VALVES

- A. Angle valves.
- B. Ball valves.
- C. Globe valves.
- D. Plug valves.

### 1.6 SPECIALTY VALVES

- A. Dry-pipe valves with **[air-pressure maintenance device] [air compressor]**.
- B. Deluge valves with **[air-pressure maintenance device] [air compressor]**.
- C. Automatic (ball drip) drain valves.

### 1.7 FIRE-DEPARTMENT CONNECTIONS

- A. Exposed type with **[two] [three]** inlets, **[polished chrome-plated] [rough brass or bronze] [rough chrome-plated]** finish, and **[NPS 4] [NPS 5] [NPS 6]** outlet.
- B. Flush type with **[horizontal] [square] [vertical]** body style, **[two] [three] [four] [six]** inlets, **[polished chrome-plated] [rough brass or bronze] [rough chrome-plated]** finish, and **[NPS 4] [NPS 5] [NPS 6] [NPS 8]** outlet.
- C. Yard type with **[175-psig minimum] [300-psig]** pressure rating, **[two] [three] [four]** inlets, **[brass sleeve] [no sleeve], [polished chrome-plated] [rough brass or bronze] [rough chrome-plated]** finish, and **[NPS 4] [NPS 5] [NPS 6]** outlet.

### 1.8 SPRINKLER SPECIALTY PIPE FITTINGS

- A. Branch outlet fittings.
- B. Flow detection and test assemblies.
- C. Branch line testers.
- D. Sprinkler inspector's test fittings.
- E. Adjustable drop nipples.
- F. Flexible, sprinkler hose fittings.
- G. Sprinkler Escutcheons:



## Specifications

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1. Ceiling Mounting: **[Chrome-plated steel, one piece, flat]** **[Chrome-plated steel, two piece, with 1-inch vertical adjustment]** **[Plastic, white finish, one piece, flat]**.
2. Sidewall Mounting: **[Chrome-plated steel]** **[Plastic, white finish]**, one piece, flat.

H. Sprinkler guards.

### 1.9 ALARM DEVICES

- A. Water-motor-operated alarm.
- B. Electrically operated alarm bell.
- C. Pressure switches.
- D. Valve supervisory switches.
- E. Indicator-post supervisory switches.

### 1.10 MANUAL CONTROL STATIONS

- A. Hydraulic operation.

### 1.11 CONTROL PANELS

- A. Single-area, two-area, or single-area cross-zoned control panel with **[electric]** **[hydraulic]**-operation, manual control stations.

### 1.12 PRESSURE GAGES

- A. **[0- to 250-psig minimum]** **[0- to 300-psig]** range.

END OF SECTION 21 13 16

**21 31 13 - ELECTRIC-DRIVE, CENTRIFUGAL FIRE PUMPS****1.1 PERFORMANCE REQUIREMENTS**

- A. Minimum Working-Pressure Rating: 175 psig.

**1.2 QUALITY ASSURANCE**

- A. Quality Standards: NFPA 20 and NFPA 70.

**1.3 PRODUCTS**

- A. In-Line Fire Pumps:

1. Standard: UL 448.
2. Casing: Radially split case, cast iron.
3. Impeller: Cast bronze.
4. Wear Rings: Replaceable bronze.
5. Shaft and Sleeve: Steel shaft with bronze sleeve.
6. Shaft Bearings: Grease-lubricated ball bearings.
7. Seals: Stuffing box.
8. Mounting: Motor above pump and pump on base, with vertical shaft.
9. Coupling: None or rigid.
10. Inlet Flange: Class 125.
11. Outlet Flange: Class 125.
12. Volts: 460.
13. Phase: Three.

- B. Horizontally Mounted, Single-Stage, Split-Case Fire Pumps:

1. Standard: UL 448
2. Casing: Axially split case, cast iron.
3. Impeller: Cast bronze.
4. Wear Rings: Replaceable bronze.
5. Shaft and Sleeve: Steel shaft with bronze sleeve.
6. Shaft Bearings: Grease-lubricated ball bearings.
7. Seals: Stuffing box.
8. Mounting: Pump and driver on same base, with horizontal shafts.
9. Coupling: Flexible, with metal guard.
10. Inlet Flange: Class 125.
11. Outlet Flange: Class 125.
12. Volts: 460.
13. Phase: Three.

- C. Fire-Pump Accessories and Specialties:

1. Circulation Relief Valves: Brass.



## Specifications

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2. Relief Valves: Bronze or cast iron.
3. Inlet Fitting: Eccentric tapered reducer.
4. Outlet Fitting: Concentric tapered reducer.
5. Discharge Cone: Closed or open type.
6. Hose Valve Manifold:
  - a. Body: Flush type, brass or ductile iron with rough brass finish on exposed parts.

D. Flowmeter Systems: UL listed or FM Approved.

1. Pressure Rating: 175 psig minimum.
2. Sensor: Annubar probe, orifice plate, or venturi.
3. Permanently mounted.

END OF SECTION 21 31 13



## Specifications

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### 21 34 00 - PRESSURE-MAINTENANCE PUMPS

#### 1.1 PERFORMANCE REQUIREMENTS

- A. Minimum Working-Pressure Ratings: 175 psig minimum unless higher pressure rating is indicated.

#### 1.2 MANUFACTURED UNITS

- A. Multistage, Pressure-Maintenance Pumps:

1. Barrel: Stainless steel.
2. Suction and Discharge Chamber: Cast iron with flanged inlet and outlet.
3. Pump Head/Motor Mount: Cast iron.
4. Impellers: Stainless steel, balanced, and keyed to shaft.
5. Pump Shaft: Stainless steel.
6. Seal: Mechanical type with carbon rotating face and silicon-carbide stationary seat.
7. Intermediate Chamber Bearings: Aluminum-oxide ceramic or bronze.
8. Chamber-Base Bearing: Tungsten carbide.
9. O-Rings: EPDM or NBR.
10. Power Cord: 10 feet long.
11. Working Pressure: 175-psig minimum.
12. Electrical Characteristics:
  - a. Volts: 120.
  - b. Phases: Three.
  - c. Hertz: 60.

- B. Vertical-Turbine, Pressure-Maintenance Pumps:

1. Pump Head: Cast iron, for surface discharge, with flange except connections may be threaded in sizes in which flanges are not available.
2. Pump Head Seal: Stuffing box and stuffing.
3. Line Shaft: Stainless steel or steel, with corrosion-resistant shaft sleeves and rubber-sleeve, water-lubricated bearings.
4. Impeller Shaft: Monel metal or stainless steel.
5. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers.
6. Column Pipe: Galvanized-steel pipe with strainer.
7. Power Cord: 10 feet long.
8. Working Pressure: 175-psig minimum.
9. Flange: Class 125.
10. Electrical Characteristics:
  - a. Volts: 120
  - b. Phases: Three.
  - c. Hertz: 60.

END OF SECTION 21 34 00



**21 39 00 - CONTROLLERS FOR FIRE-PUMP DRIVERS****1.1 FULL-SERVICE CONTROLLERS**

- A. General Requirements for Full-Service Controllers: Combined automatic and nonautomatic operation; factory assembled, wired, and tested; continuous-duty rated.
- B. Method of Starting: Pressure-switch activated.
  - 1. Magnetic Controller: Wye-delta (open transition) or Wye-delta (closed transition) type.
  - 2. Solid-State Controller: Reduced-voltage type.
  - 3. Emergency Start: Mechanically operated start handle.
- C. Method of Stopping: Automatic and nonautomatic shutdown after automatic starting.
- D. Door-Mounted Operator Interface and Controls:
  - 1. Local and remote alarm and status indications.
- E. Optional Features:
  - 1. Extra output contacts.
  - 2. Local alarm bell.
  - 3. Door-mounted printer for alarm and status logs.
  - 4. Operator Interface: USB, Ethernet, and RS485.
- F. ATS:
  - 1. Integral with controller.
  - 2. Automatically transfers fire-pump controller in event of power failure.
  - 3. Allows manual transfer.
  - 4. Alternate-source isolating and disconnecting means.
  - 5. Local and remote alarm and status indications.
  - 6. Audible alarm, with silence push button.
  - 7. Nonautomatic (manual, nonelectric) means of transfer.
  - 8. Engine test push button.
  - 9. Start generator output contacts.
  - 10. Timer for weekly generator tests.

**1.2 CONTROLLERS FOR PRESSURE-MAINTENANCE PUMPS**

- A. Features:
  - 1. Type: Factory assembled, -wired, and tested, across-the-line; for combined automatic and manual operation.
  - 2. Enclosure: Wall-mounted.
  - 3. Fusible disconnect switch.
  - 4. Pressure switch.



## Specifications

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5. Hand-off-auto selector switch.
6. Pilot light.
7. Running period timer.

### 1.3 REMOTE ALARM PANELS

- A. Supervisory and Normal Control Voltage: 120-V ac; single source.
- B. Audible and visual alarm and status indications.
- C. Audible alarm, with silence push button.
- D. Pump REMOTE START push button.

### 1.4 FIELD QUALITY CONTROL

- A. Testing: By Owner-engaged agency.

END OF SECTION 21 39 00



**22 05 13 - COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT****1.1 MATERIALS****A. Polyphase Motors: Design B, medium induction motors.**

1. Efficiency: Energy efficient.
2. Service Factor: 1.15.
3. Multispeed Motors: Variable torque.
4. Rotor: Random-wound, squirrel cage.
5. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
6. Temperature Rise: Match insulation rating.
7. Insulation: Class F.
8. Code Letter Designation:
  - a. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - b. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
9. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

**B. Polyphase Motors with Additional Requirements:**

1. Motors used with reduced-voltage and multispeed controllers.
2. Inverter-duty motors used with variable frequency controllers.
3. Severe-duty motors.

**C. Single-Phase Motors:**

1. Motors Larger than 1/20 HP: Permanent-split capacitor; split phase; capacitor start, inductor run; or capacitor start, capacitor run to suit starting torque and requirements of specific motor application.
2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 HP and Smaller: Shaded-pole type.
5. Internal thermal protection.

END OF SECTION 22 05 13



## **22 05 17 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

### **1.1 SLEEVE-SEAL SYSTEMS**

- A. Field-assembled, modular sealing-element unit for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM rubber.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating.

### **1.2 SLEEVE-SEAL FITTINGS**

- A. Manufactured plastic, sleeve-type, plastic or rubber waterstop assembly made for imbedding in concrete slab or wall.

### **1.3 GROUT**

- A. Nonshrink, factory packaged.

### **1.4 SLEEVE AND SLEEVE-SEAL SCHEDULE**

- A. Exterior Concrete Walls above Grade:
  - 1. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
  - 2. Piping NPS 6 and Larger: Cast-iron wall sleeves.
- B. Exterior Concrete Walls below Grade:
  - 1. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
  - 2. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
- C. Concrete Slabs-on-Grade:
  - 1. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
  - 2. Piping NPS 6 and Larger: Cast-iron wall sleeves with sleeve-seal system.
- D. Concrete Slabs above Grade:
  - 1. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
  - 2. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.
- E. Interior Partitions:
  - 1. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
  - 2. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 22 05 17





## Specifications

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### 22 05 18 - ESCUTCHEONS FOR PLUMBING PIPING

#### 1.1 PRODUCTS

##### A. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
2. Chrome-Plated Piping: One-piece, cast-brass type; chrome plated.
3. Insulated Piping: One-piece, stamped-steel type.
4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type; chrome plated.
5. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type; chrome plated.
6. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type.
7. Bare Piping in Equipment Rooms: One-piece, stamped-steel type.

END OF SECTION 22 05 18





## **22 05 19 - METERS AND GAGES FOR PLUMBING PIPING**

### **1.1 PRODUCTS**

#### **A. Liquid-In-Glass Thermometers:**

##### **1. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:**

- a. Case: Cast aluminum; 9-inch size unless otherwise indicated.
- b. Case Form: Adjustable angle unless otherwise indicated.
- c. Tube: Glass with magnifying lens and blue organic liquid.
- d. Tube Background: Nonreflective aluminum with etched scale in deg F
- e. Window: Glass.
- f. Stem: Aluminum.

#### **B. Pressure Gages:**

##### **1. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:**

- a. Case: Liquid-filled type(s); cast aluminum or drawn steel; 6-inch diameter.
- b. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
- c. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
- d. Dial: Nonreflective aluminum with etched scale in psi and kPa.
- e. Window: Glass.
- f. Ring: Metal.
- g. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

#### **C. Test Plugs: Test-station fitting made for insertion into piping tee fitting.**

#### **D. Test-Plug Kits: Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case.**

END OF SECTION 22 05 19







## Specifications

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### 22 05 23 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

#### 1.1 LOW-PRESSURE, COMPRESSED-AIR VALVES

##### A. Pipe NPS 2 (DN 50) and Smaller:

1. Ball Valves: Two piece, full port, brass or bronze with stainless-steel trim.

#### 1.2 DOMESTIC, HOT- AND COLD-WATER VALVES

##### A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze Angle Valves: Class 125, nonmetallic disc.
2. Ball Valves: One piece, full port, bronze] with bronze trim.
3. Bronze Swing Check Valves: Class 125 nonmetallic disc.
4. Bronze Gate Valves: Class 150, NRS.

##### B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Ball Valves: Class 150.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, EPDM seat, stainless-steel disc.
3. Iron Swing Check Valves: Class 125, nonmetallic-to-metal seats.
4. Iron Gate Valves: Class 125, NRS.

END OF SECTION 22 05 23





**Specifications**

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**22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT**

1.1 PERFORMANCE REQUIREMENTS

- A. Pipe hangers and equipment supports designed by Contractor.

1.2 QUALITY ASSURANCE

- A. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. ASME Boiler and Pressure Vessel Code.

1.3 COMPONENTS

- A. Metal Pipe Hangers and Supports: Carbon steel.
- B. Trapeze pipe hangers.
- C. Fiberglass pipe hangers.
- D. Metal Framing Systems: MFMA manufacturer.
- E. Fiberglass strut systems.
- F. Thermal-hanger shield inserts.
- G. Fastener Systems: mechanical-expansion anchors.
- H. Pipe positioning systems.
- I. Equipment supports.

END OF SECTION 22 05 29





## Specifications

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### 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

#### 1.1 PRODUCTS

- A. Equipment Labels: Plastic.
- B. Warning Signs and Labels: 1/8 inch (3.2 mm) thick with adhesive.
- C. Pipe Labels: Self-adhesive
- D. Valve Tags: Brass, 0.032-inch (0.8-mm) or Stainless steel, 0.025-inch (0.64-mm)..
- E. Warning Tags: Approximately 4 by 7 inches (100 by 178 mm); brass grommet and wire fasteners.

END OF SECTION 22 05 53



**Specifications**

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**22 07 19 - PLUMBING PIPING INSULATION****1.1 QUALITY ASSURANCE**

- A. Surface-Burning Characteristics: Flame-spread index of 25, and smoke-developed index of 50 for insulation installed indoors; according to ASTM E 84.
- B. Mockup of each type of pipe insulation and finish.

**1.2 FIELD QUALITY CONTROL**

- A. Field Inspections: By Contractor-engaged agency.

**1.3 PIPING INSULATION SCHEDULE, GENERAL**

- A. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Below-grade piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

**1.4 INDOOR PIPING INSULATION SCHEDULE**

- A. Domestic Cold Water: None.
- B. Domestic Hot and Recirculated Hot Water: mineral-fiber, preformed pipe insulation, Type I.
- C. Stormwater and Overflow: mineral-fiber, preformed pipe insulation, Type I.
- D. Roof Drain and Overflow Drain Bodies: flexible elastomeric.
- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: mineral-fiber, preformed pipe insulation, Type I.
- F. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F: mineral-fiber, preformed pipe insulation, Type I.

**1.5 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE**

- A. Domestic Water Piping: mineral-fiber, preformed pipe insulation, Type I.

END OF SECTION 22 07 19





## **22 11 13 - WATER DISTRIBUTION SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. The work under this Section includes providing a complete system of water distribution pressure piping and appurtenant items.
- B. Provide a complete disinfected, tested and operating system.

#### **1.2 RELATED SECTIONS**

- A. Section 312225 - Trenching: Excavation and Backfilling

#### **1.3 REFERENCES**

- A. ANSI/AWWA C151/A21.51 for ductile iron pipe and ANSI/AWWA C111/A21.11 for push-on-joints.
- B. ASTM D-2241 and AWWA C-900-75 for Polyvinyl Chloride (PVC) pipe.
- C. ANSI/AWWA C110/A21.10 and ANSI/AWWA C111/A21.11 for cast iron and ductile iron mechanical joint fittings.
- D. ANSI/AWWA C115/A21.51 and C110/A21.10 for ductile iron flanged pipe.
- E. ASTM D1785 Type I Grade I Schedule 40 for PVC Schedule 40 service pipe.
- F. AWWA C902 for polybutylene service pipe.
- G. ASTM B-88-62 Type "K" or "L" seamless copper service tubing.
- H. AWWA C509 for resilient seat gate valves.
- I. AWWA C502 for swing check valves.
- J. SEES C502 for fire hydrants NFPA No. 194 for outlet nozzle threads.
- K. AWWA C800 corporation and curb stops.
- L. ASTM A-120 for galvanized steel Schedule 40 service pipe.
- M. NW-P-521 Federal Specification for galvanized malleable iron pipe fittings for galvanized steel pipe.
- N. ASTM A139 and AWWA C206 for casing pipe.
- O. AWWA C500 for gate valves 3-inches and larger. Federal Specification WW-V-54 CL54 type I for gate valves less than 3-inch diameter.
- P. AWWA C504 for butterfly valves.

#### **1.4 REGULATORY REQUIREMENTS**

- A. Watermains and appurtenances to be installed, backfilled, pressure tested, bacteriologically tested and placed in service in accordance with the requirements of the local Health Department and the Florida Department of Environmental Protection.

## Specifications

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### 1.5 SUBMITTALS

- A. Acceptance of Material:
1. The Owner reserves the right to sample and test any pipe or fitting after delivery and to reject all pipe and fittings represented by any sample which fails to comply with the specified requirements.

### 1.6 JOB CONDITIONS

- A. Water shall not be allowed in the trenches while the pipes are being laid and/or tested. The Construction Manager shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the Architect. The Installer shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working. In no case shall the pipelines being installed be used as drains for such water and the ends of the pipe shall be kept properly and adequately blocked during construction by the use of approved stoppers and not by improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand or other obstructing matter into the pipelines. If on completion of the work any such material has entered the pipelines, it must be cleaned as directed by the Architect so that the entire system will be left clean and unobstructed.

## PART 2 - PRODUCTS

### 2.1 PIPE AND FITTINGS

- A. Ductile Iron Pipe and Fittings
1. Ductile Iron Pipe: Ductile iron pipe shall conform to the requirements of ANSI Standard A21.51, Class 51 for 4-inch lines and Class 50 for all other sizes, unless otherwise specified. Pipe interior shall have a bituminous seal coat over a cement mortar lining conforming to ANSI Standard A21.4. Exterior of pipe shall have a bituminous coating.
  2. Fittings:
    - a. All ductile iron fittings shall be mechanical joint or single gasket, push on type with a minimum pressure rating of 350 psi and shall conform to the requirements of ANSI Standard A21.10.
    - b. Mechanical joint and/or single gasket, push on type fittings shall be cement lines, seal coated and outside coated as specified above for ductile iron pipe.
  3. Joints: Mechanical joints consisting of bell, socket, gland, gasket, bolts and nuts shall conform to ANSI Standard A21.11. Bolts shall be high strength, annealed, cast iron, or high strength low alloy steel, T-head type having hexagonal nuts. Bolts and nuts shall be machined true and nuts shall be tapped at right angles to a smooth bearing surface. Single seal gasket push on type joints shall conform to the requirements of ANSI A21.11 and shall be "Tyton", "Fastite", "Super Bell Tite", "Altite" or approved equal.
  4. Restrained Joints: Restrained joints may be of the types fabricated by the various manufacturers, upon approval by the Architect of details submitted by the Installer and/or Construction Manager. Restrained joints that require field welding will not be acceptable and the thickness of the pipe barrel remaining at grooves cut for restraint shall not be less than that required for the design wall thickness. Joints using set screws will not be acceptable. Restrained joints shall be furnished for 24-inches and larger pipe at changes in direction of the watermain.
  5. Gaskets: Gaskets shall be of vulcanized crude rubber or polyvinyl chloride plastisol. Gaskets shall have plain tips unless otherwise specified.

## Specifications

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- B. Cast Iron Pipe Fittings: Cast iron pipe fittings for PVC pipe shall be mechanical joint or single gasket, push-on type with a minimum pressure rating of 150 psi and shall conform to the requirements of ANSI Standard A21.10. Fitting interior shall have a bituminous seal coat over a cement mortar lining conforming to ANSI Standard A21.4. Exterior of fitting shall have a bituminous coating.
- C. Polyvinyl Chloride Pipe and Fittings:
1. Pipe:
    - a. Polyvinyl Chloride (PVC) pipe 2-inches and larger in diameter shall conform to the requirements of AWWA C-900-75 or ASTM Designation D2241, Class 1120 or 1220, SDR 26 for a minimum pressure rating of 160 psi at 73.4°F. All PVC pipe shall bear the approval seal of the National Sanitation Foundation (NSF) for potable water pipe. Material for "C900" PVC pipe shall meet the requirements of AWWA C900 Class 150 with a Standard Dimension Ratio of 18.
    - b. Polyvinyl Chloride pipe smaller than 2-inches shall conform to the requirements of ASTM Designation D1785, Class 1120 or 1220, Schedule 80 pipe with a minimum pressure rating of 40-0 psi at 73.4° for unthreaded pipe.
  2. Fittings:
    - a. PVC pipe fittings 2-inches and larger shall be furnished by the manufacturer of the pipe with which they are used and conform to the requirements of ASTM Designation D2467. All PVC pipe fittings shall bear the approval seal of the National Sanitation Foundation (NSF) for potable water pipe.
    - b. Fittings for PVC pipe smaller than 2-inches shall be Schedule 80 PVC with solvent weld or threaded joints and conform to the requirements of ASTM Designation D2467 and D2464 respectively.
  3. Joints:
    - a. PVC pipe 2-inches and larger shall have provision for expansion and contraction provided in the joints. All joints, except solvent weld and threaded joints, shall be designed for push on make up connection. A push on joint may be a coupling manufactured as an integral part of the pipe barrel consisting of a thickened section with an expanded bell with a groove to retain a rubber sealing ring of uniform cross-section similar and equal to Johns-Manville Ring-Tite and Davis Meter Dav-Tite, or may be made with a separate twin gasket coupling similar and equal to Certainteed Fluid-Tite. Joints shall conform to the requirements of ASTM Designation D3139 and provide for the pressure rating of the pipe.
    - b. Joints in PVC pipe smaller than 2-inches shall be solvent welded in accordance with the recommendations of the pipe manufacturer using the solvent welding compound furnished with the pipe, or shall be threaded. Threaded joints shall be used only with Schedule 80 pipe, or better. At threaded joints between PVC and metal pipes, the metal shall contain the socket end and the PVC side the spigot. A metal spigot shall not, under any circumstances, be screwed into a PVC socket.
- D. Galvanized Steel Pipe:
1. Pipe Material: Galvanized steel pipe shall be Schedule 40 and conform to the requirements of ASTM Designation A1120.
  2. Fittings: Fittings for galvanized steel pipe shall be galvanized malleable iron pipe fittings, 150 pound, Type II, conforming to Federal Specification WW-P-521.
  3. Joints: Joints shall be standard screw thread type, made with an approved compound, similar and equal to Crane thread lubricant.

## Specifications

- E. Polyethylene Tubing: Polyethylene tubing for service lines shall be municipal service tubing copper tube sized and approved by the National Sanitation Foundation for use in transmitting fluids for human consumption. The tubing shall be designed for a minimum burst pressure of 630 psi and water at 23°C (73.4°F). Tubing shall conform to the requirements of ASTM Designation D2737, SDR9, PE3406 and shall be as manufactured by Phillips Products Company or equal.
- F. Polyethylene Pipe: Polyethylene pipe for service lines shall be iron pipe sized and approved by the National Sanitation Foundation for use in potable water systems. The pipe shall be designed for a minimum burst pressure of 630 psi for water at 23°C (73.4°F). Pipe shall conform to the requirements of ASTM Designation D2239, SDR7, PE3406 and shall be as manufactured by Phillips Products Company or approved equal.
- G. Polybutylene water service tubing shall be as defined by ASTM D-2581-67, Type II, Grade I (PB 2110) having a working pressure of 160 psi, at 73.4°F. A gooseneck or bend, shall be used at all service connections to allow for settlement or expansion or contraction.
- H. Polyethylene Encasement Tube: Polyethylene tube for ductile iron pipe encasement shall conform to the requirements of ANSI Standard A 21.5, shall be manufactured from virgin polyethylene material and shall have a 8 mil minimum thickness.
- I. Casing Pipe: Casing pipe shall be steel pipe that conforms to the requirement of ASTM Designation A139, Grade B and have a yield strength of 35,000 psi. Joints for steel casing shall be single-butt weld and shall conform to AWWA Standard C206. Casing pipe wall thickness in inches shall not be less than that listed in the following schedule:

<u>Roadway Crossings (FDOT)</u>		<u>Railroad Crossings (AREA)</u>		<u>Railroad Crossings (FEC)</u>	
Nominal Outside Diameter	*Nominal Thickness	Nominal Diameter	Nominal Thickness	Nominal Diameter	Nominal Thickness
12 or less	0.188	Under 14	0.188	6-16	0.250
24	0.250	14 & 16	0.219	18-20	0.312
30	0.312	18	0.250	22-24	0.375
36	0.375	20	0.281	26-28	0.438
42 or greater	0.500	22	0.312	30-34	0.500
		24	0.344	36-38	0.563
		26	0.375	40-48	0.623
		28 & 30	0.406	52-56	0.688
		32	0.438	60-66	0.750
		34 & 36	0.469	72-78	0.813
		38, 40 & 42	0.500	84-90	0.875
				96-102	0.935
				108-114	1.000
				120	1.125

\* Minimum thickness for pipe diameter not shown shall be the same as required for the next larger size listed above.

- J. Gate Valves:
  - 1. All valves shall be adaptable to PVC or Asbestos cement according to location. 6-inch valve for fire hydrant shall have one end flanged and one end adaptable to Asbestos-cement or PVC pipe, according to plans.

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**Specifications**

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2. Gate valves 16-inches in diameter and larger, installed horizontally, shall be provided with bevel gearing, a gear case that can be repacked from the outside, rollers, tracks and scrapers constructed so that the weight of the gate is carried on the rollers through the entire length of travel. The design shall conform to the requirements of AWWA Standard C500.
  3. Valves 4-inches and larger shall be suitable for 150 psi working pressure, iron body, bronze mounted gate valves and shall turn to the left (counter clockwise) to open with 2-inch square operating nut. The seat and disc rings shall have smooth, perfectly machined surfaces and shall be watertight when in contact. The design and machining of the valves shall be of such as to permit packing the valves while in service without undue leakage. 2-inch valves shall meet Federal specifications WW-V-54b Class A., type I, namely 125 lb SWP, 200 lb WOG, bronze body meeting ASTM B-62. They shall be double disc or wedge disc, non-rising stem type, opening left (counter clockwise) with operating wheel. Pewter or pot metal operating wheels are not acceptable.
- K. Butterfly Valves:
1. General: All butterfly valves shall be of the tight-closing, rubber-seat type with rubber seats that are securely fastened to the valve body or disc. No metal to metal seating surfaces will be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction and shall be satisfactory for applications involving frequent operation and for applications involving valve operation after long periods of inactivity and for buried installation. Valve discs shall rotate 90° from the full open position to the tight shut position. Valves shall meet the full requirements of AWWA Standard C504 for Class 150B. The manufacturer shall have manufactured tight-closing, rubber seat butterfly valves for a period of at least five years. All valves shall be Henry Pratt Company, Allis-Chamber, Dresser or approved equal.
  2. Valve Body: Valve bodies shall be constructed of cast iron ASTM A126 Class B. Ends shall be mechanical joint. Two trunnions for shaft bearings shall be integral with each valve body. When the disc has the rubber seat, the valve body shall have an 18-8 type 304 stainless steel body seat.
  3. Valve Discs: Valve discs shall be constructed either of alloy cast iron ASTM A436 Type I (Ni-Resist), ductile iron ASTM A 536, or cast iron ASTM A 48 each with Type 316 stainless steel. The stainless steel seating edge is not applicable to rubber-seat disc type valves.
  4. Valve Seats: Valve seats shall be of a synthetic or natural rubber compound and may be mounted on the disc or valve body.
  5. Valve Bearings: Valves shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and self-lubricating.
  6. Buried Operators: Buried service operators shall be permanently lubricated, sealed for submersion in water for pressures of 20 feet and equipped with a 2-inch square AWWA operating nut which shall indicate the direction to open. The operator shall be constructed such that the valve will open when the nut is turned to the left (counter clockwise) to open.
- L. Check Valves:
1. Swing check valves 4-inches and larger shall have a cast iron or cast steel body with a bronze or stainless steel seat ring, a noncorrosive shaft for attachment of weight and lever and a 300 psi hydrostatic test pressure rating. Check valves shall absolutely prevent the return of water back through the valve when the inlet pressure decreases below the delivery pressure.
  2. The valve must be full opening, tight seating and its seat ring shall be renewable and must be securely held in place by a threaded joint; the valve disc shall be of cast iron or cast steel and shall be suspended from a non-corrosive shaft which will pass through a stuffing box.
  3. Check valves smaller than 4-inches shall be bronze, bronze disc, swing check valves conforming to Federal Specification WW-V-51D, Type 4 Class A-125 pound. Ends shall be as shown on the Drawings.

## Specifications

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- M. Plastic Ball Valve: All thermoplastic ball valves shall be Chemtrol TU Series, manufactured of the same material as the piping, with Teflon seats and Vitron seals as manufactured by Celanese Piping System, Inc., Plastic Line, Inc. or approved equal. Ball valves shall be designed for 150 psi at 73°F working pressure and shall be provided with double unions.
- N. Valve Boxes: Cast iron valve boxes shall be provided for all valves installed underground. The valve boxes shall be adjustable to fit the depth of earth cover over the valve and shall be designed so as to prevent the transmission of surface loads directly to the valve or piping. Valve boxes shall have an interior diameter of not less than 5-inches. The valve boxes shall be provided with covers marked WATER which shall be so constructed as to prevent tipping or rattling. Boxes shall be Clow Corporation No. H-10357 or approved equal. Extension sections shall be cast iron only. The protective ring shall be constructed of Class B concrete.
- O. Valve Vaults: Valve vaults shall be of precast concrete of the type shown on the drawings and shall conform to the applicable requirements of Section 03000. The cover for the nontraffic bearing vault shall be constructed of 3/16-inch steel floor plate with reinforcement. After fabrication, the steel covers shall be galvanized by the hot dip method in conformance with the requirements of ASTM Designation A123.
- P. Hydrants: Fire hydrants shall be of the compression type with break away upper sections capable of ready replacement without water loss in the event of traffic damage. They shall be designed for a working pressure of 150 pounds per square inch and shall conform to AWWA Standard C502 "Dry Barrel Fire Hydrants". Each hydrant shall have a 6-inch bottom inlet connection and valve opening at least 4-1/2-inch diameter. Hydrants shall turn to the left (counter clockwise) to open. Each hydrant shall be fitted with one 4-1/2-inch pumper connection and two 2-1/2-inch hose connections, both having threads that conform to the Fire Division Standard for the area. Hose caps shall be chained to the hydrant barrel and fitted with nuts similar to the hydrant operating nuts. Each hydrant shall have a barrel of sufficient length to bring the bottom of the 6-inch pipe connection 30-inches below the surface of the finished ground. Each hydrant shall be made in at least two sections bolted together. All interior working parts of the hydrant shall be removable from the top of the hydrant to allow repairs without removing the hydrant barrel after it has been installed. Hydrants shall have renewable O-ring stem seals and shall be U.S. Foundry Break-A-Way, Mueller Break-A-Way Type No. A24012 or A-434 Centurion, American Darling or approved equal. Hydrant barrels shall be painted chrome yellow.
- Q. Hydrant Guard Posts: Guard posts for hydrants shall conform to the requirements of ASTM Designation A 53, galvanized steel pipe Schedule 40.
- R. Siamese:
1. Sidewalk siamese shall be 2-1/2-inches x 3-1/2-inches x 4-inches, cast brass 90° siamese with brass escutcheon, brass sleeve to cover riser pipe, male outlet threaded to local fire department standards, caps and chain. Branding on escutcheon plates shall be "standpipe".
  2. The siamese shall be Allenco No. 230-90° cast brass body and trim or approved equal having two individual drop clapper valves with plugs and chains and "STANDPIPE" lettering on head. Threads shall conform to the Fire District Standard for the area.
- S. Tapping Sleeves and Valves: Tapping sleeves and tapping valves used to make "wet" taps into existing mains shall be provided and installed at locations as shown on the drawings. Tapping sleeves shall be split cast iron units and rated for 150 psi working pressure. Steel units will not be acceptable. The Installer shall determine the outside diameter of the existing main before ordering the sleeve. Valves shall be of the nonrising stem type with O-ring seals and applicable to requirements as specified above for gate valves.

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**Specifications**

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- T. Detector Check Valve: The detector check shall be a Hersey Model DC or approved equal with bypass taps on both sides and plugged.
- U. Detector Meter: The Detector Meter shall be a Hersey Model MFM-MCT or approved equal. The meter shall have full magnetic drives with hermetically sealed register and gear train with no remote readers. The water meter shall be able to handle low and high flow rates with a mainline and bypass metering sections. The meter shall be UL and FM approved.
- V. Meter Vaults: Meter vaults shall be of precast concrete of the type shown on the drawings and shall conform to the applicable requirements of Section 03000 concrete. The cover for the nontraffic bearing vault shall be constructed of 3/16-inch steel floor plate with reinforcement. After fabrication, the steel covers shall be galvanized by the hot dip method in conformance with the requirements of ASTM Designation A 123.
- W. Meter Boxes: Meter boxes shall be of the style shown on the drawings and shall be as manufactured by Brooks Products of Florida, Inc., Cast Crete Corporation or approved equal. The bottom box section shall be set on a firm bed of pearock which shall extend down at least 6-inches below the pipe and meter. the steel cover and lid shall be fabricated from steel tread plate and hot dipped galvanized after fabrication in accordance with ASTM Designation A123.
- X. Flushing Assembly: The flushing assembly shall include 2-inch pipe and fittings, 2-inch bronze angle valve Crane 125 No. 2, ITT Grinnel Corp. Fig. No. 3220 or approved equal, No. 3 cast iron valve box with lid and concrete for thrust blocking and valve box collar.
- Y. Corporation Stops and Service Clamps:
  - 1. Corporation stops shall be Mueller Co. type II -15000 for 1-inch service and Type H-10002 for 2-inch service or approved equal.
  - 2. Corporation stops shall be Ford Meter Box Co. Type F-1000, Mueller Co. Type H-15009 or approved equal with inlet having AWWA tapered threads and outlet for polyethylene or copper tubing with stainless steel insert stiffener.
  - 3. Service clamps for PVC mains shall be full circle bearing type and for ductile iron mains service clamps shall be the double-strap tapped saddle type.
- Z. Service Terminal Fittings:
  - 1. Single 1-inch terminal fitting shall be 1-inch ringstyle valve, drilled for wire sealing, angle inverted key meter valve cat. No. KV-23W by Ford Meter Box Co., Mueller No. H-14259, Hays No. 25012DF or approved equal.
  - 2. Twin 1-inch shall be 1-inch branch valve assembly with standard 7-1/2-inch spacing between outlet centers, drilled for wire sealing, Ford Meter Box Co. No. UV63-42W, Hays No. 25040 DF or approved equal.
- AA. Castings: The manhole frame and cover shall conform to the ASTM Designation A 48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength, or otherwise make them unfit for the service intended. The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown on the drawings. The words "WATER VALVE" shall be case in the manhole cover. The manhole frame and cover shall be traffic bearing.
- BB. Hose Bibb and Backflow Preventer:
  - 1. Hose bibb shall be 3/4-inch cast bronze sediment faucet with wheel handle, stem and seat seals of Buna-N or TFE rubber and backflow preventer. Hose bibb shall be Mueller Co. No. H-8260, Chicago Faucet Co. No. 998 or approved equal.
  - 2. Backflow preventer shall be equal to Watts Regulator Co. No. 8A 3/4-inch atmospheric type backflow preventer.



## Specifications

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- CC. Tie Rods: Steel for tie rods and tie bolts shall conform to the requirements of ASTM Designation A 242, and rods shall be galvanized in conformance with requirements of ASTM Designation A123. Tie rods and tie bolts shall be Super Star Tierod Figure No. SS12 and Tiebolt Figure No. SST7 respectively as manufactured by Star National Products.
- DD. Additional Work: Additional items of construction necessary for the complete installation of the systems, shall conform to specific details shown on the drawings and shall be constructed of first-class materials conforming to the applicable portions of these specifications.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that trench excavation is ready to receive work and excavations and layout area as indicated on drawings.

#### 3.2 PREPARATION

- A. Bedding:
  - 1. Pipe Cradle: Upon satisfactory installation of the pipe bedding material as specified in Section 02225, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.
  - 2. Cleanliness: The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

#### 3.3 INSTALLATION

- A. Pipe:
  - 1. Gradient: Lines shall be laid straight and depth of cover shall be maintained uniform with respect to finish grade, whether grading is completed or proposed at time of pipe installation. When a grade or slope is shown on the drawings, batter boards with string line paralleling design grade or other previously approved means shall be used to assure conformance to required grade.
  - 2. Pipe Joint Deflection: Whenever it is desirable to deflect pipe, the amount of deflection shall not exceed the maximum limits as shown in AWWA Standard C600 for ductile iron pipe and the maximum limits as established by the manufacturer of PVC pipe.
  - 3. Rejects: Any pipe found defective shall be immediately removed and replaced with sound pipe at the Installer's expense.
  - 4. Joint Compounds: No sulphur base joint compound shall be used.
  - 5. Anchors: concrete thrust blocks shall be placed at all bends, tees, plugs and other fittings to provide lateral support, except when restrained joints are specified. Thrust blocks shall conform to the details shown on the drawings and shall be a Class C concrete.



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**Specifications**

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**B. Ductile Iron Pipe Joints:**

1. Type: The joints of all pipelines shall be made absolutely tight. The particular joint used shall be approved by the Owner prior to installation. Where shown on the drawings or where, in the opinion of the Owner, settlement or vibration is likely to occur, all pipe joints shall be bolted.
2. Mechanical Joints: All types of mechanical joint pipes shall be laid and jointed in full conformance with manufacturer's recommendations, which shall be submitted to the Architect for review and approval before work is begun. Only especially skilled workmen shall be permitted to make-up mechanical joints. Torque wrenches set as specified in AWWA Standard C111, shall be used; or spanner type wrenches not longer than specified therein may be used without the permission of the Architect.
3. Push On Joints: Push on joints shall be made in strict, complete compliance with the manufacturer's recommendations. Lubricant, if required, shall be an inert, nontoxic, water soluble compound incapable of harboring, supporting or culturing bacterial life. Manufacturer's recommendations shall be submitted to the Architect for review and approval before work is begun.

**C. Polyvinyl Chloride Pipe Joints:** The joints of all piping shall be made absolutely tight, and joints in polyvinyl chloride pipe shall be threaded. The male threaded end shall be wrapped with teflon pipe tape when the joint is made up. At threaded joints between PVC and metal pipes, the metal shall contain the socket end and the PVC side the spigot. A metal spigot shall not, under any circumstances, be screwed into a PVC socket.**D. Thrust Blocks:**

1. Thrust blocks shall be provide at all bends, ties or dead ends. Size shall be specified by the Architect.
2. Thrust blocks shall be provided under all valves 4" or larger.
3. Thrust blocks shall be placed between solid ground and fittings will be anchored in such a manner that the pipe and fitting joints will be accessible for repairs. Concrete shall be 3,000 pound concrete.
4. All bends, tees and plugs shall be braced with concrete placed between the outside face of the fitting and the trench wall. Concrete shall extend from bottom of trench to at least 4-inches above centerline of pipe and shall be full width of fittings with minimum thickness of 1-inch between pipe and trench.
5. All hydrants and plugs shall be braced with concrete plugs not less than 6-inch square and securely wedged into position between the plug or hydrant and a substantial anchorage. all concrete shall be Class "B". All blocking shall be included in the unit price for the corresponding size pipe.

**E. Restrained Joints**

Sections of piping designated on the drawings as having restrained joints or those requiring restrained joints due to insufficient time to allow curing of concrete thrust blocks shall be constructed using pipe and fittings with restrained "locked-type" joints, retainer glands, or tie rods, and the joints shall be capable of holding against withdrawal for line pressures up to 150 pounds per square inch (psi). Tie rods, clamps or other dissimilar metal shall be protected against corrosion by hand application of a 2.0 mils thick bituminous coat. Bolts, nuts, and tie rods shall be hot dipped galvanized, low alloy, high-strength steel. Toe rods, tie bolts, and hairpins shall have a minimum diameter of ¾ inch, and 7,000 pound tensile strength.

Contractor shall submit type and method of restrained joints to Engineer for approval prior to use.

## Specifications

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F. Backfilling:

1. After pipe has been laid, inspected and found satisfactory, sufficient backfill shall be placed along the pipe barrel to hold the pipe securely in place during the conduction of the preliminary hydrostatic test. No backfill shall be placed over joints until the preliminary test is satisfactorily completed, leaving them exposed to view for the detection of visible leaks.
2. Upon satisfactory completion of the preliminary hydrostatic test, backfilling of the trench shall be completed.

3.4 FIELD QUALITY CONTROL

- A. Flushing: All water mains shall be flushed to remove all sand and other foreign matter. The velocity of the flushing water shall be at least 4 feet per second. Flushing shall be terminated at the direction of the Architect. The Installer shall dispose of the flushing water without causing a nuisance or property damage.
- B. Hydrostatic Tests: Testing shall be conducted as outlined herein or by the standards and specifications of the governing municipality, whichever is more restrictive.
1. All components of the water distribution system, including fittings, hydrants, connections and valves of the water distribution system shall remain tested and accepted in accordance with AWWA C600 Section 4; No testing shall be done until all concrete trust blocking is in place and set. If high-early strength concrete is used, testing may be conducted 48 hours after the concrete is placed; otherwise, thrust block concrete must cure 5 days before pressure testing commences. In testing, the part of the system under test shall be filled with water and subjected to a sustained pressure of 200 pounds per square inch for fire lines, 150 pounds per square inch for all other lines 2 inches in diameter and greater and 100 pounds per square inch for all other lines less than 2 inches in diameter. The piping shall be tested in sections, thereby testing each valve for secure closure. While the system is being filled, air shall be carefully and completely exhausted. If permanent air vents are not located at all high points, the Installer shall install corporation stops or fittings and valves at such points so the air can be expelled as the pipe system is slowly filled with water.
  2. Test pressure shall be maintained by pumping for at least 2 hours and until all sections under test have been checked for evidence of leakage. Rate of loss shall not exceed that specified hereinafter. Visible leaks shall be corrected regardless of total leakage shown by test.
  3. The system as a whole, or any part, shall be retested after completion of backfilling. Such retest will be required for final acceptance.
  4. All pumps, gauges and measuring devices shall be furnished, installed and operated by the Installer and all such equipment and devices and their installation shall be approved by the Architect. All pressure and leakage testing shall be done in the presence of a representative of the Owner.
  5. Water for testing and flushing shall be potable water provided by the Installer from a source approved by the Architect.
  6. Preliminary pressure testing may be waived by the Architect for pipe 24-inches in diameter and larger.

## Specifications

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C. Allowable Limits for Leakage:

1. The hydrostatic pressure tests shall be performed as hereinabove specified and no installation, or section hereof, will be acceptable until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{SD}{P} \\ 133200$$

L = Allowable leakage, in gallons per hour

S = Length of pipe being tested in feet

D = Nominal pipe diameter; in inches

P = Average test pressure during the test, in psi gauge.

2. Water shall be supplied to the main during the test period as required to maintain the test pressure as specified. The quantity used, which shall be compared to the above allowable quantity, shall be measured by pumping from a calibrated container. A 5/8-inch meter installed on the discharge side of the pump may be used to measure the leakage for large mains when approved by the Architect.

- D. Correction of Work: Where leakage exceeds the allowable limit, as specified hereinbefore, the defective pipe or joints shall be located and repaired. If the defective portions cannot be located, the Installer shall remove and reconstruct as much of the work as is necessary in order to conform to the specified limits. Any visible leaks or any defective pipe or joint shall be repaired or replaced as directed by the Architect even though the total leakage is within the specified allowable limits. No additional payment will be made for the correction of defective work, or to damage to other parts of the work resulting from such corrective work.

E. Disinfection:

1. Before any portion of water distribution system is to be placed in service it shall be disinfected in accordance with the requirements of AWWA Standard C601; and its disinfection shall be demonstrated by bacteriological test conducted in accordance with "Standard Methods for Examination of Water and Wastewater" for the coli-aerogenes group, by an approved laboratory, acceptable to the Architect and the County Health Department having jurisdiction.
2. The disinfecting agent shall be free chlorine in aqueous solution, with sustained concentration for 12 hours or more or not less than 50 parts per million. Chlorine may be derived from chlorine gas, or 70 percent (high test) calcium hypochlorite (HTH or Perchloron, or equal). Administration may be by any of the several methods described in AWWA Standard C601 as proposed by the Construction Manager and approved by the Architect. Proposals as to method must be made prior to commencement of the disinfection process.
3. Following contact with chlorine solution, the system shall be thoroughly flushed out. Samples shall then be taken using sterile containers obtained from the County Health Department. Samples shall be taken by the Installer and delivered by him to the County Health Department or approved laboratory for analysis.
4. If samples do not demonstrate satisfactory results, the disinfection procedure shall be repeated until two series of satisfactory samples are obtained, the period between such series of samples to be a minimum of twenty-four hours.

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**Specifications**

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3.5 SCHEDULE

A. Connection To Existing System.

1. All connections to existing mains shall be made after complete disinfection of the proposed system and shall be made under the direction of the Owners of the existing system. Valves separating the mains being installed from existing mains shall be operated by or under the direction of said Owner's representative. The cost of the work in making the connections shall be paid for by the Installer.
2. In the event the proposed main is to be connected to a main which has one or more active services between the point of connection and the first existing line valve, a temporary plug or cap shall be installed on the new main until the pressure tests and disinfecting are completed. Upon satisfactory completion, the cap or plug shall be removed from both mains and the connection made with pipe which has been swabbed out with a solution of chlorine and water. The connection shall be made as swiftly as possible and any water in the ditch shall be kept below the level of the pipe. The pipeline shall then be placed in service by the Owners' personnel.
3. In the event any existing users will be without water while a connection is being made, the Installer shall notify them when the water will be turned off and when he estimates service will be resumed. In some instances, these connections may have to be made at night. No user shall be without water service for more than two hours.

END OF SECTION 22 11 13



## Specifications

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### 22 11 16 - DOMESTIC WATER PIPING

#### 1.1 UNDER-BUILDING-SLAB, DOMESTIC WATER, BUILDING SERVICE PIPING

- A. Pipe NPS 3 (DN 80) and Smaller:
  - 1. Soft copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper solder-joint fittings; and brazed.
- B. Pipe NPS 4 (DN 100) and Larger:
  - 1. PVC, Schedule 80 pipe; PVC, Schedule 80 socket fittings; and solvent-cemented joints.

#### 1.2 ABOVEGROUND DOMESTIC WATER PIPING

- A. Pipe NPS 2 (DN 50) and Smaller:
  - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought- copper solder-joint fittings.
- B. Pipe NPS 2-1/2 to NPS 4 (DN 65 to DN 100):
  - 1. Hard copper tube, [ASTM B 88, Type L (ASTM B 88M, Type B)] [ASTM B 88, Type M (ASTM B 88M, Type C)]; wrought- copper solder-joint fittings; and brazed joints.

#### 1.3 PRODUCTS

- A. Wall Penetrations below Grade: Sleeve and sleeve seal.

END OF SECTION 22 11 16





## Specifications

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### 22 11 23 - DOMESTIC WATER PUMPS

#### 1.1 PRODUCTS

##### A. In-Line, Sealless Centrifugal Pumps:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type.
2. Casing: Bronze.
3. Impeller: Plastic.
4. Motor: Single speed, unless otherwise indicated.

##### B. Controls:

1. Thermostats: Electric; adjustable for control of hot-water circulation pump.
  - a. Type: Water-immersion temperature sensor, for installation in piping.
  - b. Operation of Pump: On or off.
2. Timers: Electric, for control of hot-water circulation pump.
  - a. Type: Programmable, seven-day clock with manual override on-off switch.
  - b. Operation of Pump: On or off.
3. Time-Delay Relays: Electric, for control of hot-water circulation pump between water heater and connected hot-water storage tank.
  - a. Type: Adjustable time-delay relay.
  - b. Range: Up to five minutes.
  - c. Operation of Pump: On or off.

END OF SECTION 22 11 23







**Specifications**

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**22 11 23.13 - DOMESTIC-WATER PACKAGED BOOSTER PUMPS**

1.1 QUALITY ASSURANCE

- A. Quality Standards for Packaged Booster Pumps: UL 508, UL 508A, UL 778, and UL 1995.
- B. Booster pumps listed and labeled as packaged pumping systems.

1.2 MANUFACTURED UNITS

- A. Multiplex, Variable-Speed Booster Pumps

END OF SECTION 22 11 23.13





## Specifications

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### 22 12 23 - FACILITY INDOOR POTABLE-WATER STORAGE TANKS

#### 1.1 PRODUCTS

##### A. Plastic, Nonpressure, Potable-Water Storage Tanks:

1. FRP Potable-Water Storage Tanks: Vertical; complying with NSF 61 barrier materials for potable-water tanks.
  - a. Construction: Contact-molded FRP.
2. PE Potable-Water Storage Tanks: Vertical, flat bottom; complying with NSF 61 barrier materials for potable-water tanks.
  - a. Construction: ASTM D 1998, molded PE.

END OF SECTION 22 12 23



## **22 13 13 - SITE SANITARY SEWAGE SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. The work included under this section consists of furnishing all labor, equipment and materials necessary for the construction of sanitary sewers, sewer connections and appurtenances as shown on the Drawings or specified herein.

#### **1.2 RELATED WORK**

- A. Section 312222 - Excavation
- B. Section 312223 - Backfilling
- C. Section 312225 - Trenching

#### **1.3 QUALITY ASSURANCE**

- A. Design Requirements: Sewer pipe shall be laid with a minimum separation of ten (10) feet from a parallel water pipe line, and 18" minimum vertical clearance.
- B. Storage: Polyvinyl chloride pipe shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the polyvinyl chloride pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.

#### **1.4 SUBMITTALS**

- A. Shop Drawings
  - 1. In general, six (6) copies of the following data or shop drawings shall be submitted to the Architect for approval prior to construction:
    - a. Precast manholes.
    - b. Manhole frames, covers and other castings.
    - c. Manufacturer's Certified test report on castings.
    - d. Certified test records for polyvinyl chloride pipe.
    - e. Mill Test Certificates on ductile iron pipe.
    - f. Electronic marker and locator.
    - g. Pipe adapters.
- B. Record Information: The Installer shall submit to the Architect the stations and left or right offsets of all services (terminal ends) as measured from the nearest downstream manhole along the center line of the sewer, along with the elevations of the north edge of the manhole covers and inverts of all pipes in the manholes.

#### **1.5 REFERENCES**

- A. AASHTO T-180/ANSI/ASTM D1557 - Moisture-Density Relations of Soils.
- B. AASHTO T99/ANSI/ASTM 0698 - Moisture-Density Relations of Soils.
- C. ANSI Std. A21.51 for Ductile Iron Pipe ASTM A746.

## Specifications

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- D. ASTM D1248 - Vinyl Lining for Pipe.
- E. ASTM A48 - Cast Iron Appurtenances.
- F. ASTM C32 - Brick
- G. ASTM D1785 - Polyvinyl Chloride (PVC) Plastic Pipe Schedule 40, 80, 120.

### 1.6 REGULATORY REQUIREMENTS

- A. Conform to applicable Florida Department of Environmental Regulation, and permit requirements or procedures.
- B. Conform to applicable municipality or utility to assume maintenance at the completion of construction.

### 1.7 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Plastic gravity sewer pipe and fittings shall be polyvinyl chloride (PVC) and conform to the requirements of ASTM Designation D 3034, Type PSM, SDR-35. Large diameter plastic gravity sewer pipe and fittings (18 to 27 inch) shall conform to the requirements of ASTM Designation F679. Elastomeric gasket joints shall conform to ASTM Designation F477. PVC pipe and fittings shall be as manufactured by Johns-Manville, CertainTeed or approved equal.
- B. Ductile iron sewer pipe shall conform to the requirements of ANSI Standard A21.51, Class 50 (ASTM Designation A 746, Class 50). Pipe smaller than twelve (12) inches shall have a bituminous coating on the inside, and pipe twelve (12) inches and larger shall be polyethylene lined. Bituminous coating shall be applied to the outside of pipe as specified in ANSI standard A21.51. Joints shall be mechanical or push-on and conform to ANSI A21.11. Gaskets shall be of neoprene and shall have plain tips unless otherwise specified.
- C. Virgin polyethylene for pipe lining shall comply with ASTM Designation D 1248 and shall be compounded with enough carbon black during manufacture to resist ultra violet rays during above ground storage. The polyethylene lining shall be fused in place, approximately 20 mils. (.02 inches) in thickness, shall be tightly adherent to the pipe wall and shall extend from the spigot end to the gasket seat in the bell socket. The inside surface of the pipe to be lined with polyethylene shall be thoroughly ground and cleaned of oil, dirt and foreign matter.
- D. Concrete and reinforcing steel shall conform to the requirements of Section 03000. Concrete classes for the various purposes shall be as follows:
  - 1. Manhole bottoms, Class A.
  - 2. Precast manholes, Class B minimum
  - 3. Pipe and riser encasement, Class C.
  - 4. Protective slabs, Class C.

## Specifications

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- E. Gray iron castings for manhole frames, covers and other items shall conform to the ASTM Designation A 48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions, which would impair their strength, or otherwise make them unfit for the service intended. The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provide, but shall not penetrate the cover. Casting patterns shall conform to those shown or indicated on the drawings.
- F. Brick for manhole construction shall be dense, hard burned, shale or clay brick conforming to ASTM Designation C32, Grade MM or C62, Grade MW, except that brick absorption shall be between five (5) and twenty-five (25) grams of water absorbed in one (l) minute by dried brick, set flat face down, in 1/8 inch of water.
- G. Cement mortar for manhole construction shall be one (1) part cement and three (3) parts clean sharp sand to which may be added lime in the amount of not over ten percent (10 %) volume of cement. It shall be mixed dry and then wetted to proper consistency for use. No mortars that have stood for more than one (1) hour shall be used.
- H. Pipe Adapter:
  - 1. Donut pipe adapter shall be manufactured from virgin polyvinyl chloride (PVC) or polyurethane adaptable to similar or dissimilar pipes of the same or different sizes. Donuts shall be as manufactured by Fernco Joint Sealer Company, Dickey Company or approved equal.
  - 2. Flexible couplings shall be manufactured from virgin polyvinyl chloride (PVC) or polyurethane adaptable to dissimilar pipes of the same or different sizes. The flexible couplings shall be as manufactured by Fernco Joint Sealer Company, Can-Tex or approved equal and supplied with #300 stainless steel bands.
  - 3. Flexible manhole sleeves for connecting sewer pipe to precast manholes shall be of a synthetic rubber compound resistant to ozone, weather, acid and water. The sleeve shall have a cast-in-place water stop and accommodate settlement up to 15° (degrees). The binding of the sleeve to the pipe shall be a non-corrosive, non-magnetic type 300 stainless steel strap.
- I. The electronic marker shall be constructed of high-density polyethylene. The marker shall be a passive device capable of operating at a depth of six (6) feet with a special response, frequency and be the color for sanitary use to conform to APWA's, Uniform Markings and Surface Field Identification by Uniform Color Code Standards. The marker shall be designed to have a forty (40) year life.
- J. Coat Tar Epoxy: Coal tar epoxy shall be Koppers Bitumastic No. 300M, Tnemec Tneme-Tar No. 46-413 or approved equal.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that the trench, bedding and connections to existing sewers are ready to receive work and are as indicated on drawings.

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**Specifications**

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**3.2 PREPARATION**

- A. Upon satisfactory installation of the pipe bedding, as specified in Section 02225, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous uniform support and no pressure shall be exerted on the pipe joints from the trench bottom.

The interior of all pipes shall be thoroughly cleaned of all foreign material before being lowered in the trench and shall be kept clean during laying operations by means of plugs, or other approved methods. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe laid to prevent mud or other foreign material from entering the pipe.

**3.3 INSTALLATION**

- A. Pipe:
1. Pipe laying shall proceed upgrade with spigot ends pointing in the direction of flow. Before pipe is joined, gaskets shall be cleaned of all dirt and stones and other foreign material. The spigot ends of the pipe and/or pipe gaskets shall be lubricated lightly with a lubricant as specified by the pipe manufacturer and approved by the Architect. Sufficient pressure shall be applied to the pipe so as to properly seat the socket into the bell of the pipe. All pipe shall be laid straight, true to the lines and grades shown on the Drawings in each manhole section.
  2. Any pipe which is disturbed or found to be defective after laying shall be taken up and relaid or replaced.
  3. Polyvinyl Chloride Pipe:
    - a. Transportation: Care shall be taken during transportation of the pipe that it is not cut, kinked or otherwise damaged.
    - b. Handling Pipe Lengths: Ropes, fabric or rubber protected slings and straps shall be used when handling pipes. Chains, cables or hooks inserted into the pipe ends shall not be used. Two (2) slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped onto rocky or unprepared ground.
    - c. Handling Pipeline: The handling of the joined pipe line shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Sections of the pipes with deep cuts and gouges shall be removed.
    - d. Lowering Pipe Into Trench: Care shall be exercised when lowering pipe into the trench to prevent damage to or twisting of the pipe.
    - e. Special Precautions: Polyvinyl chloride pipe connected to heavy fittings, manholes and rigid structures shall be supported in such a manner that no subsequent relative movement between the pipe and the joint with the rigid structures is possible.
- B. Service Connections:
1. Service connections, of the type called for on the Drawings, shall be provided in accordance with the details therefore as shown or indicated on the Drawings.
  2. Where called for on the drawings, sewer pipe of the size and type noted shall be extended to the street right-of-way line and plugged with an approved removable plastic plug. All connections and changes of direction shall be made using standard fittings designed for the purpose.
  3. An electronic marker shall be placed at least six (6) inches above each sanitary sewer service connection, at the property line. The unit shall be used in locating the service line for future connection. The marker shall be buried in a level position and at a depth of not less than two (2) feet and not more than five (5) feet.



## Specifications

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C. Concrete Encasement:

1. Class C concrete encasement shall be constructed in accordance with details shown on the Drawings. Encasement shall be constructed where:
  - a. The sewer or service pipe shall have less than thirty (30) inches of cover between the top of the pipe and the final top of pavement or ground line.
  - b. The PVC sewer or service pipe crosses over, or at a depth which provides less than eighteen (18) inches clear distance between pipes when crossing under water mains. Encasement shall extend a minimum of ten (10) feet on each side of the point of crossing.
  - c. The lateral separation of the PVC sewer pipe and potable water piping is less than ten (10) feet.
  - d. The Architect shall order the line encased.
2. Payment for the above described work shall be made at the unit price stated in the Proposal.
3. If, through failure to provide suitable trench sheeting, or other causes, the maximum width for trench excavations, as specified elsewhere in these specifications, is exceeded, the Installer shall construct concrete encasement around the pipe for the length of the excessive excavation. No payment will be made for the concrete encasement required due to excessive trench widths.
4. The points of beginning and ending of sewer, or service pipe encasement shall be not more than six (6) inches from a pipe joint to protect the pipe from cracking due to uneven settlement of its foundation or the effects of superimposed live loads.

D. Manholes:

1. Brick Manholes:
  - a. brick manholes shall be constructed of brick, concrete and cement mortar, with cast iron frames and covers in accordance with the details shown on the Drawings. All brick shall be thoroughly wet before laying up and shall be laid with a shove joint in full mortar beds and shall be thoroughly sloshed up with mortar at every course. Standard manholes shall have a depth measured from manhole top to lowest invert and not more than six (6) feet. Standard manholes with extra depth shall be over, or in excess of six (6) feet from manhole frame top to lowest invert.
  - b. Stubouts for the future extension shall be placed as shown on the drawings. Both the manhole and exterior ends of all such stub-outs shall be closed with watertight plugs removable without damage to the pipe. One (1) section of pipe, one (1) foot long, shall be laid at each manhole stub-out.
  - c. Outside drop connections shall be made in accordance with the details therefore shown on the Drawings.
  - d. The invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Steep slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. Changes in the direction of the sewer or entering branch shall be a smooth curve with radius as long as practicable invert channels shall also be formed for pipe stub-outs.
  - e. All manholes shall be plastered inside and outside with 1/2 inch thickness of cement mortar. The manhole interior walls shall be coated with two (2) applications of coal tar epoxy (16 mils dry total thickness). The cement mortar shall be permitted to cure not less than three (3) days before application of the coating.
  - f. Frames and covers shall be set accurately to grade to conform to the finished grade of the adjacent areas.

## Specifications

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2. Precast Concrete Manholes:
  - a. Precast concrete manholes may only be used in lieu of brick manholes when the following conditions are satisfied:
    - 1) Details and shop drawings of the manholes, proposed to be furnished for this work, are submitted to and approved by the Architect prior to the manufacture of the units. Manholes which are not manufactured in strict compliance with the approved shop drawings and these specifications will be rejected.
    - 2) The design and manufacture of the manholes and special pipe construction at manholes shall conform to these specifications.
    - 3) Manhole excavation, bedding and pipe trench excavation and bedding at manhole junctions shall be performed in accordance with the provisions of Section 02225.
  - b. Precast manholes shall conform to the requirements of ASTM Designation C478 with reinforcement of Grade 40 bars and the following modifications thereto:
    - 1) The minimum shell thickness shall be eight (8) inches.
    - 2) Cement to be used in precast manholes shall be Type II.
    - 3) Joints, whose position in the complete structure are below an elevation of six (6) feet above sea level, shall be compression type, neoprene gasket joints of a design approved by the Architect. the unfilled portion of the joint shall be filled with Ram-Nek plastic joint sealing compound. Height of wall sections shall not be less than three (3) feet.
    - 4) Lifting holes through the structures are not permitted.
    - 5) The design of the structure shall include a precast base of not less than eight (8) inches in thickness poured monolithically with the bottom section of the manhole walls.
    - 6) All gasket used for sealing around pipe openings shall be of a type acceptable to the Architect and designed for use in water. All openings and joints shall be sealed watertight.
    - 7) Precast manhole tops, if used, shall terminate at such elevations as will permit laying up brick courses under the manhole frame to make allowance for future street grade adjustments.
    - 8) Drop connections, where required on precast manholes, shall be manufactured with the manhole elements at the casting yard. The manufacturer shall submit for approval the method of drop manhole construction.
  - c. The interior walls shall be coated with two (2) applications of coal tar epoxy applied as recommended by the coating manufacturer to form a 16 mil dry film thickness.
  - d. Shallow manholes may substitute an eight-inch precast reinforced slab on the top in lieu of the cone section. Slabs shall be laid in a full bed of mortar and pointed to form a dense joint.
  - e. Precast manholes that are installed in conjunction with PVC pipe shall utilize approved coupling adapters set in the concrete wall and with a stainless steel band to join PVC pipe to concrete manholes.
  - f. The invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Steep slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. changes in the direction of the sewer or entering branch shall be a smooth curve with radius as long as practicable. Invert channels shall also be formed for pipe stub-outs.

**Specifications**

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**E. Connections to Existing structures and Sewers:**

1. Various sewer lines shall be connected to existing manholes and structures. Provisions have been made in some of the existing structures for future connections and may require only the removal of a plug and the connection of the proposed line, while other connections will require cutting into the existing structure. The Installer shall exercise care in cutting into the existing structure and any damage done to the structure shall be repaired as required by the Architect and at the Installer's expense. Drop connections to existing manholes shall be installed as detailed on the Drawings for new construction.
2. The drop connection for existing Manhole shall be constructed of SDR 35 polyvinyl chloride (PVC) pipe. Anchor straps shall be not less than 3/16 inches by 1/2 inches and constructed of AISI 304 stainless steel. Wall anchor bolts shall not be less than 5/8 inch and constructed of corrosion resistant metal.

**F. Additional Work:** Additional items of construction such as cleanouts, terminal lamp holes, special manholes and other items necessary for the complete installation of the system shall conform to specific details on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these specifications.**3.4 FIELD QUALITY CONTROL****A. Tests, Inspections and Acceptance of Materials and Workmanship:**

1. **Workmanship:** It is imperative that all sewers and appurtenances be built practically watertight and the installation adhere rigidly to the specifications for materials and workmanship. All of the sewage must be pumped for disposal and special care and attention must be paid to securing watertight construction. Upon completion, the sewers, or sections thereof, will be tested and gauged, and if leakage is above the allowable limits specified, the sewer will be rejected.
2. **Inspection:**
  - a. On completion of each block or section of sewer, or such other times as the Architect may direct, the block or section of sewer shall be cleaned, tested and inspected. Each section of the sewer shall show, on examination from either end, a full circle of light between manholes.
  - b. Each manhole or other appurtenance to the system shall be of the specified size and form, be watertight, neatly and substantially constructed with the top set permanently to exact position and grade. All repairs shown necessary by the inspection shall be made; broken or cracked pipe replaced; all deposits removed and the sewer left true to line and grade, entirely clean, and ready for use.

**B. Limits of Infiltration, Exfiltration and Testing:**

1. The allowable limits of infiltration or leakage for the entire system or any portion thereof, including house service lines, shall not exceed a rate of 0.1 gallon per foot of pipe per 24 hours for all sizes of pipe throughout the system. The allowable limits of infiltration of manholes shall not exceed a rate of four (4) gallons per manhole per 24 hours.
2. Infiltration, if taken between any two (2) adjacent manholes, shall not exceed 0.1 gallon per 24 hours per foot of sewer for all sizes and all locations. This testing of lines between adjacent manholes will not be required except to localize the position of a leak in a portion of the system that exceeds the allowable leakage limit, or as directed by the Architect.
3. Any part or all of the system may be tested for infiltration or exfiltration, as directed by the Architect. Prior to testing for infiltration, the system shall be pumped out so that normal infiltration conditions exist at the time of testing. The amounts of infiltration or exfiltration shall be determined by pumping into or out of calibrated drums, or by other approved methods.

**Specifications**

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4. The exfiltration test will be conducted by filling the portion of the system being tested with water to a level which will provide: a minimum head on a service lateral connected to the test portion of two (2) feet; or in the event there are no service laterals in the test portion, a minimum difference in elevation of five (5) feet between the crown of the highest portion of the sewer and the test level.
  5. Tests shall be conducted on portions of the system not exceeding three (3) manhole runs or more than 1,000 feet of main sewer, or as otherwise directed by the Architect. Tests shall run continuously for three (3) hours. Where infiltration or exfiltration exceeds the allowable limits also specified herein, the defective pipe, joints, or other faulty construction shall be located and repaired by the Installer. If the defective portions cannot be located, the Installer shall remove and reconstruct as much of the work as is necessary in order to conform to the specified allowable limits. Testing shall be performed as the job progresses and shall be started after 3,000 feet of pipe are laid.
  6. The Installer shall provide all labor, equipment and materials and shall conduct all testing required, under the direction of the Architect. No separate payment will be made for this work and the cost for this work shall be included in the price quoted in the proposal for the applicable item of work.
- C. Specifications for Television Tape Report of Sanitary Sewer System
1. All visual television inspections shall be approved by the Architecting Division prior to the installation of any asphalt.
  2. A County Architecting inspector must be present to witness the video taping, line must be flushed with clean water. The Architecting Division shall be notified in advance to schedule an inspection.
  3. Video Tape Specifications and Contents
    - a. Standard VHS color format tape with data view and accurate footages displayed
    - b. All pertinent data recorded in audio on the tape including:
      - 1) Date of video
      - 2) Subdivision name and phase number
      - 3) Manhole numbers (these numbers must coincide with those on "as built" drawings)
      - 4) Size and material of pipe
      - 5) Service laterals must have size and connection angle indicated
      - 6) Locations of observed pipe deficiencies (i.e. bad joints, breaks, leaks, infiltration, etc.)
    - c. PVC pipe installations shall have a deflection test using a 7.5 % ("go-no-go") test mandrel of appropriate size which must be visible at all times.
      - 1) The installer shall provide a written report that must accompany the videotape submittal.
    - d. The written report must include:
      - 1) Manhole numbers (these numbers must coincide with those on "as built" drawings)
      - 2) Service connection locations indicated as "right" or "left"
      - 3) Identify service connection locations out of manholes
      - 4) Locations of observed deficiencies (i.e., bad joints, breaks, leaks, infiltration, etc.)
      - 5) Pipe ponding in excess of ¾" identified by location
      - 6) Actual measured distance (on ground) between manholes



### Specifications

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- e. Video tapes must clearly show details of structural defects, misalignments and infiltration. All known or indicated breaks shall be repaired, regardless of the test allowances. Faulty sections of sewer lines or manholes rejected by the City shall be removed and replaced.
- f. All manhole inverts must be completed and road base material must be compacted prior to video taping.

#### 3.5 PROTECTION

- A. Protect pipe and backfill or cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 22 13 13





**Specifications**

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**22 13 16 - SANITARY WASTE AND VENT PIPING**

1.1 MATERIALS

- A. Underground - Solid-wall PVC pipe with PVC socket fittings.
- B. Above ground - Hubless, cast-iron soil pipe and CISPI, heavy-duty hubless piping couplings.
- C. DWV copper tube with solder-joint drainage fittings.
- D. PE-film encasement for underground metal piping.

END OF SECTION 22 13 16







## Specifications

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### 22 13 23 - SANITARY WASTE INTERCEPTORS

#### 1.1 PRODUCTS

##### A. Grease Interceptors: Plastic.

1. Resilient pipe connectors.
2. Reinforced-concrete grade rings.
3. Manhole frames and covers.

##### B. Oil Interceptors: Plastic.

1. Resilient pipe connectors.
2. Reinforced-concrete grade rings.
3. Manhole frames and covers.
4. Shroud extending from top of interceptor to grade.

##### C. Precast-concrete manhole risers.

1. Reinforced-concrete grade rings.
2. Manhole frames and covers.

END OF SECTION 22 13 23





**Specifications**

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**22 14 13 - FACILITY STORM DRAINAGE PIPING**

1.1 MATERIALS

- A. Underground - Solid-wall PVC pipe with PVC socket fittings.
- B. Aboveground - Hubless, cast-iron soil pipe and CISPI, heavy-duty, hubless piping couplings.
- C. PE-film encasement for underground metal piping.

END OF SECTION 22 14 13





## Specifications

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### 22 15 13 - GENERAL-SERVICE COMPRESSED-AIR PIPING

#### 1.1 SUMMARY

- A. Piping and related specialties for systems operating at 200 psig or less.

#### 1.2 QUALITY ASSURANCE

- A. Quality Standard for High-Pressure Compressed-Air Piping: ASME B31.1.
- B. Quality Standard for Low-Pressure Compressed-Air Piping: ASME B31.9.
- C. Quality Standard for Brazing: ASME Boiler and Pressure Vessel Code: Section IX or AWS B2.2.
- D. Quality Standard for Welding: ASME Boiler and Pressure Vessel Code: Section IX.

#### 1.3 PRODUCTS

- A. Dielectric Fittings:
  - 1. Dielectric Unions: 250-psig minimum working pressure at 180 deg F.
  - 2. Dielectric Flanges: 150- or 300-psig minimum working pressure.
  - 3. Dielectric-flange kits.
- B. Flexible Pipe Connectors: Stainless steel.
- C. Quick Couplings: Automatic shutoff.

#### 1.4 PIPING APPLICATIONS

- A. Low-Pressure Distribution Piping:
  - 1. NPS 2 and Smaller: Steel pipe with threaded joints.
- B. Drain Piping: Copper tube with brazed or soldered joints.

END OF SECTION 22 15 13





## Specifications

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### 22 15 19 - GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

#### 1.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design compressed-air equipment mounting.

#### 1.2 QUALITY ASSURANCE

- A. Quality Standard for Receiver Tanks: ASME Boiler and Pressure Vessel Code.

#### 1.3 MANUFACTURED UNITS

- A. Oil-Free, Reciprocating Air Compressors:
  - 1. Compressor(s): Simplex; single stage.
  - 2. Mounting: Tank mounted.
  - 3. Receiver: Vertical, steel tank.
  - 4. Control Panels: Automatic control station with load control and protection functions.
- B. Inlet-Air Filters: Combination inlet-air filter-silencer for each air compressor(s).
- C. Compressed-Air Dryers: Refrigerant type.

#### 1.4 INSTALLATION

- A. Equipment Mounting: Air compressor(s) on concrete base with vibration isolation devices, Aftercoolers and dryers mounted separately on concrete base without vibration isolation devices.

END OF SECTION 22 15 19







## Specifications

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### 22 35 00 - DOMESTIC-WATER HEAT EXCHANGERS

#### 1.1 QUALITY ASSURANCE

- A. Performance Efficiency: ASHRAE/IESNA 90.1 and ASHRAE 90.2.
- B. ASME Compliance: ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. NSF Compliance: NSF 61, "Drinking Water System Components - Health Effects."

#### 1.2 WARRANTY

- A. Materials and Workmanship:
  - 1. Shell-and-Tube, Domestic-Water Heat Exchangers: One year.
  - 2. Circulating, Storage, Domestic-Water Heat Exchangers: Five years.
  - 3. Compression Tanks: One year(s).

#### 1.3 CIRCULATING, DOMESTIC-WATER HEAT EXCHANGERS

- A. Circulating, Storage, Domestic-Water Heat Exchangers:
  - 1. Heating Fluid: Heating hot water (Primary) and Steam (Secondary).
  - 2. Storage-Tank Construction: ASME code steel.
  - 3. Pressure Rating: 150 psig.
  - 4. Configuration: Vertical.

#### 1.4 DOMESTIC-WATER, HEAT-EXCHANGER ACCESSORIES

- A. Domestic-Water Compression Tanks: Steel tank with welded joints and butyl-rubber diaphragm; 150-psig pressure rating.
  - 1. Piping-type heat traps.
  - 2. Heat-Trap Fittings: ASHRAE 90.2.
  - 3. Combination temperature-and-pressure relief valves.
  - 4. Pressure relief valves.
  - 5. Vacuum relief valves.

END OF SECTION 22 35 00





**Specifications**

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**22 45 00 - EMERGENCY PLUMBING FIXTURES**

1.1 QUALITY ASSURANCE

- A. Quality Standard: ANSI Z358.1.

1.2 MANUFACTURED UNITS

- A. Combination Units: Accessible, plumbed, emergency shower with eye/face wash.
- B. Water-Tempering Equipment: Hot and cold water.

END OF SECTION 22 45 00



**Specifications**

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**23 00 00 - GENERAL HVAC****1.1 GENERAL**

- A. All applicable codes, laws and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the contractor who shall inform the owner, prior to submitting a proposal, of any work or materials which violate any of the above laws and regulations. Any work done by the contractor causing such violation shall be corrected by the contractor.
- B. All ductwork and piping is shown diagrammatically and does not show all offsets, drops and rises of runs. The contractor shall allow in his price for routing of ductwork and piping to avoid obstructions. Exact locations are subject to approval of the Architect.
- C. Support all ductwork and piping from building structure and/or framing in an approved manner. Where overhead construction does not permit fastening of supports for equipment, furnish additional framing.
- D. Install work so as to be readily accessible for operation, maintenance and repair. Minor deviations from drawings may be made to accomplish this, but changes which involve extra cost shall not be made without approval.
- E. Seal openings around ducts and piping through partitions, walls and floors (not in shafts) with mineral wool or other noncombustible material, in accordance with UL listings.
- F. Provide all necessary flashing and counter flashing to maintain the waterproofing integrity of this building as required by the installation of pipes, ducts, conduit, and equipment. Provide equipment curbs and dunnage steel as required.
- G. All material and equipment to be new unless otherwise noted.

**1.2 All systems will be designed to meet the requirements of the following codes:**

- A. Florida Building Code
- B. Florida Mechanical Code
- C. Florida Fire Code
- D. Florida Gas Code
- E. NFPA-13, Standard for the Installation of Sprinkler Systems)
- F. NFPA-14, (Standard for the Installation of Standpipe and Hose Systems, except 2-7 shall be Omitted)
- G. NFPA-20, (Standard for the Installation of Stationary Pumps for Fire Protection)
- H. NFPA-30, (Flammable and Combustible Liquids)

**Specifications**

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- I. NFPA-70, (National Electrical Code)
  - J. NFPA-90A, (Standard for Installation of Air Conditioning and Ventilating Systems)
  - K. NFPA-96, (Standard for Ventilation Control & Fire Protection of Commercial Cooking Equipment)
  - L. NFPA-101, (Life Safety Code)
  - M. Americans with Disability Act (ADA)
  - N. SMACNA HVAC Duct Construction Standards, First Edition
  - O. Florida Energy Efficiency Code for Building Construction
- 1.3 Products shall be listed by Underwriters Laboratory, or other industry-approved testing agency.
- 1.4 Scope of Work
- A. The work under contract includes all labor, materials and appliances necessary for the furnishing, installing and testing, complete and ready for safe operation of the systems. Work shall be installed in a neat, workmanlike manner.
  - B. Permits: The contractor shall give necessary notice, file drawings and specifications with the authority having jurisdiction (AHJ), obtain permits or licenses necessary to carry out this work and pay all fees therefor. The contractor shall arrange for inspection and tests of any or all parts of the work if so required by authorities and pay all charges for same. The contractor shall pay all costs for, and furnish to the owner before final billing, all certificates necessary as evidence that the work installed conforms with all regulations where they apply to this work.
  - C. Warranty: The contractor shall furnish a written guarantee to replace or repair promptly and assume responsibility for all expenses incurred for any workmanship and equipment in which defects develop within one year from the date of final certificate for payment and/or from date of actual use of equipment or occupancy of spaces, by owner, included under the various parts of the work, whichever date is earlier. This work shall be done as directed by the owner. This guarantee shall also provide that where defects occur, the contractor will assume responsibility for all expenses incurred in repairing and replacing work of other trades affected by defects, repairs or replacements in equipment supplied by the contractor.
- 1.5 Shop Drawings:
- A. Indicate on each submission:
    - 1. Project name and location
    - 2. Architect and Engineer
    - 3. Item identification
    - 4. Approval stamp of prime contractor, with submittal log #.



## Specifications

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B. Submissions:

1. Submissions 11 in. x 17 in. or smaller: If the submission is a catalog cut, then the contractor shall submit one original and two copies. Otherwise, he shall submit three copies. The Architect will forward the original and one copy (two copies when no original is received) to the engineer. All catalog cuts shall be complete.
2. Submissions larger than 11 in. x 17 in.: Submit two prints and one paper sepia to the Architect. The owner will return the sepia only.

C. Submit shop drawings for following:

1. Ductwork layout and sheet metal details
2. Grilles, registers and diffusers
3. Air balance report
4. Air handling units and fan coil units
5. Fans
6. Piping layout
7. Operating sequences
8. Vibration isolation
9. Electric damper motors
10. Controls devices
11. Water cooled chillers, cooling towers, and pumps, etc.
12. Boilers, flues, pumps, etc.
13. Split DX systems

END OF SECTION 23 00 00





**23 05 13 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT****1.1 MATERIALS****A. Polyphase Motors: Design B, medium induction motors.**

1. Efficiency: Energy efficient.
2. Service Factor: 1.15.
3. Multispeed Motors: Variable torque.
4. Rotor: Random-wound, squirrel cage.
5. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
6. Temperature Rise: Match insulation rating.
7. Insulation: Class F.
8. Code Letter Designation:
  - a. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - b. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.
9. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

**B. Polyphase Motors with Additional Requirements:**

1. Motors used with reduced-voltage and multispeed controllers.
2. Energy- and premium-efficient and Inverter-duty motors used with variable frequency controllers.
3. Severe-duty motors.

**C. Single-Phase Motors:**

1. Motors Larger than 1/20 HP: Permanent-split capacitor; split phase; capacitor start, inductor run; or capacitor start, capacitor run to suit starting torque and requirements of specific motor application.
2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 HP and Smaller: Shaded-pole type.
5. Internal thermal protection.

END OF SECTION 23 05 13



## **23 05 16 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING**

### **1.1 PRODUCTS**

#### **A. Packed Expansion Joints:**

1. Flexible, Ball-Joint, Packed Expansion Joints: Carbon steel with asbestos-free composition packing.
2. Slip-Joint Packed Expansion Joints: Carbon steel with asbestos-free PTFE packing.

#### **B. Packless Expansion Joints:**

1. Metal, Expansion-Compensator Packless Expansion Joints:
  - a. Configuration for Copper Tubing: Two-ply, phosphor-bronze bellows with copper pipe ends.
  - b. Configuration for Steel Piping: Two-ply, stainless-steel bellows; steel-pipe ends; and carbon-steel shroud.
2. Rubber, Expansion-Compensator Packless Expansion Joints: Twin reinforced-rubber spheres with external restraining cables.
3. Flexible-Hose Packless Expansion Joints:
  - a. Expansion Joints for Copper Tubing NPS 2 and Smaller: Copper-alloy fittings with solder-joint end connections.
  - b. Expansion Joints for Copper Tubing NPS 2-1/2 to NPS 4: Copper-alloy fittings with threaded end connections.
  - c. Expansion Joints for Steel Piping NPS 2 and Smaller: Carbon-steel fittings with threaded end connections.
  - d. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6: Carbon-steel fittings with flanged end connections.
  - e. Expansion Joints for Steel Piping NPS 8 to NPS 12: Carbon-steel fittings with flanged end connections.
  - f. Expansion Joints for Steel Piping NPS 14 and Larger: Carbon-steel fittings with flanged end connections.
4. Metal-Bellows Packless Expansion Joints:
  - a. Type: Circular, corrugated bellows with external tie rods.
  - b. Configuration: Single joint, Single joint with base, and double joint with base class(es) unless otherwise indicated.
  - c. Expansion Joints for Copper Tubing: Single- or multi-ply phosphor-bronze bellows, copper pipe ends, and brass shrouds.
  - d. Expansion Joints for Steel Piping: Single- or multiply stainless-steel bellows, steel pipe ends, and carbon-steel shroud.
5. Rubber Packless Expansion Joints:
  - a. Material: Fabric-reinforced rubber complying with FSA-NMEJ-703.



## Specifications

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- b. Arch Type: Single or multiple arches with external control rods.
  - c. Spherical Type: Single or multiple spheres with external control rods.
  - d. Material for Fluids Containing Gas, Hydrocarbons, or Oil: Buna-N or CR.
  - e. Material for Water: [BR] [Buna-N] [CR] [CSM] [EPDM] [NR].
  - f. End Connections: Full-faced, integral steel flanges with steel retaining rings.
- C. Grooved-Joint Expansion Joints: Factory-assembled; made of several grooved-end pipe nipples, couplings, and grooved joints.
  - 1. Nipples: Galvanized, ASTM A 53/A 53M, Schedule 40, Type E or S, steel pipe.
  - 2. Couplings: Five, Seven, 10, flexible type. Include ferrous housing sections, and bolts and nuts.
- D. Alignment Guides and Anchors:
  - 1. Alignment Guides: Steel, factory fabricated.
  - 2. Anchor Materials:
    - a. Steel shapes, plates, bolts, nuts, and washers.
    - b. Mechanical fasteners.

END OF SECTION 23 05 16



## Specifications

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### 23 05 17 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

#### 1.1 SLEEVE-SEAL SYSTEMS

- A. Field-assembled, modular sealing-element unit for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM rubber or NBR.
  - 2. Pressure Plates: Carbon steel or Stainless steel.
  - 3. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel.

#### 1.2 SLEEVE-SEAL FITTINGS

- A. Manufactured plastic, sleeve-type, plastic or rubber waterstop assembly made for imbedding in concrete slab or wall.

#### 1.3 GROUT

- A. Nonshrink, factory packaged.

#### 1.4 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Exterior Concrete Walls above Grade:
  - 1. Piping NPS 6 and Larger: Cast-iron wall sleeves, Galvanized-steel wall sleeves, Galvanized-steel-pipe sleeves.
- B. Concrete Slabs above Grade:
  - 1. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves, PVC-pipe sleeves, Stack-sleeve fittings, Sleeve-seal fittings, Molded-PVC sleeves.
  - 2. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves, PVC-pipe sleeves, Stack-sleeve fittings.
- C. Interior Partitions:
  - 1. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves or PVC-pipe sleeves.
  - 2. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 23 05 17





## Specifications

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### 23 05 18 - ESCUTCHEONS FOR HVAC PIPING

#### 1.1 PRODUCTS

##### A. Escutcheons for New Piping:

1. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
2. Chrome-Plated Piping: One-piece, cast-brass or Split-casting brass type; chrome plated.
3. Insulated Piping: One-piece, stamped-steel type, Split-plate, stamped-steel type with concealed hinge, Split-plate, stamped-steel type with exposed-rivet hinge.
4. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type; chrome plated, Split-casting brass type, chrome plated, One-piece, stamped-steel type, Split-plate, stamped-steel type with concealed hinge, Split-plate, stamped-steel type with exposed-rivet hinge.
5. Bare Piping in Equipment Rooms: One-piece, cast-brass type; chrome plated, Split-casting brass type, chrome plated, One-piece, cast-brass type; rough-brass finish, Split-casting brass type, rough-brass finish, One-piece, stamped-steel type, Split-plate, stamped-steel type with concealed hinge, Split-plate, stamped-steel type with exposed-rivet hinge.

##### B. Floor Plates for New Piping: One-piece type.

##### C. Floor Plates for Existing Piping: Split-casting type.

END OF SECTION 23 05 18





## **23 05 19 - METERS AND GAGES FOR HVAC PIPING**

### **1.1 PRODUCTS**

#### **A. Bimetallic-Actuated Thermometers:**

1. Case: Liquid-filled and sealed type(s); stainless steel; 5-inch diameter.
2. Dial: Nonreflective aluminum with etched scale in deg F.
3. Connector Type(s): Union joint, adjustable angle.
4. Window: Plain glass or plastic.

#### **B. Filled-System Thermometers:**

##### **1. Direct-Mounted, Metal-Case, Vapor-Actuated Thermometers:**

- a. Case: Sealed type, cast aluminum or drawn steel, 5-inch diameter.
- b. Movement: Mechanical.
- c. Dial: Nonreflective aluminum with etched scale in deg F.
- d. Window: Glass or plastic.
- e. Ring: Metal.
- f. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

##### **2. Direct-Mounted, Plastic-Case, Vapor-Actuated Thermometers:**

- a. Case: Sealed type, plastic; 5-inch diameter.
- b. Dial: Nonreflective aluminum with etched scale in deg F.
- c. Window: Glass or plastic.
- d. Ring: Metal or plastic.
- e. Connector Type(s): Union joint, adjustable, 180 degrees in vertical plane, 360 degrees in horizontal plane, with locking device.

#### **C. Liquid-In-Glass Thermometers:**

##### **1. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:**

- a. Case: Cast aluminum; 6-inch size.
- b. Case Form: Back angle or Straight.
- c. Tube: Glass with magnifying lens and blue or red organic liquid.
- d. Tube Background: Nonreflective aluminum with etched scale in deg F.

##### **2. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:**

- a. Case: Plastic; 6-inch size.
- b. Case Form: Back angle or Straight.
- c. Tube: Glass with magnifying lens and blue or red organic liquid.
- d. Tube Background: Nonreflective with etched scale in deg F.

## Specifications

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3. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
    - a. Case: Cast aluminum; 7-inch size unless otherwise indicated.
    - b. Case Form: Adjustable angle unless otherwise indicated.
    - c. Tube: Glass with magnifying lens and blue or red organic liquid.
    - d. Tube Background: Nonreflective aluminum with etched scale in deg F.
    - e. Window: Glass or plastic.
    - f. Stem: Aluminum.
  4. Plastic-Case, Industrial-Style, Liquid-in-Glass Thermometers:
    - a. Case: Plastic; 7-inch size unless otherwise indicated.
    - b. Case Form: Adjustable angle unless otherwise indicated.
    - c. Tube: Glass with magnifying lens and blue or red organic liquid.
    - d. Tube Background: Nonreflective aluminum with etched scale in deg F.
    - e. Window: Glass or plastic.
    - f. Stem: Aluminum.
- D. Duct-Thermometer Mounting Brackets: Flanged bracket, for attachment to air duct.
- E. Thermowells:
1. Material for Use with Copper Tubing: CNR or CUNI
  2. Material for Use with Steel Piping: CRES or CSA.
  3. Type: Stepped shank unless straight or tapered shank is indicated.
  4. Heat-Transfer Medium: Mixture of graphite and glycerin.
- F. Pressure Gages:
1. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
    - a. Case: Liquid-filled, Sealed, Open-front, pressure relief, or Solid-front, pressure relief type(s); cast aluminum or drawn steel; 6-inch diameter.
    - b. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
    - c. Pressure Connection: Brass, with NPS 1/4, NPS 1/4 or NPS 1/2, NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
    - d. Dial: Nonreflective aluminum with etched scale in psi.
    - e. Window: Glass or plastic.
    - f. Ring: Metal.
    - g. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
  2. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
    - a. Case: Sealed type; plastic; 6-inch diameter.
    - b. Pressure Connection: Brass, with NPS 1/4[NPS 1/4 or NPS 1/2NPS 1/2 ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
    - c. Dial: Nonreflective aluminum with etched scale in psi.
    - d. Window: Glass or plastic.
    - e. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

**Specifications**

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**G. Gage Attachments:**

1. Snubbers: Brass; with NPS 1/4NPS 1/4 or NPS 1/2NPS 1/2, and piston or porous-metal-type surge-dampening device. Include extension for use on insulated piping.
2. Siphons: Loop-shaped section of brass or steel pipe with NPS 1/4, NPS 1/4 or NPS 1/2, NPS 1/2 pipe threads.

**H. Test Plugs: Test-station fitting made for insertion into piping tee fitting.****I. Test-Plug Kits: Furnish one test-plug kit(s) containing one thermometer(s), one pressure gage and adapter, and carrying case.****J. Sight Flow Indicators:**

1. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator.
2. Minimum Pressure Rating: 125 psig.
3. Minimum Temperature Rating: 200 deg F.

**K. Flowmeters:****1. Orifice Flowmeters:**

- a. Minimum Pressure Rating: 300 psig.
- b. Minimum Temperature Rating: 250 deg F.
- c. Permanent Indicators: Meter suitable for wall or bracket mounting.

1) Scale: Gallons per minute.

- d. Portable Indicators: Hand-held, differential-pressure type, calibrated for connected sensor and having two 12-foot hoses, with carrying case.

1) Scale: Gallons per minute.

- e. Display: Shows rate of flow, with register to indicate total volume in gallons.

**2. Pitot-Tube Flowmeters:**

- a. Sensor: Insertion type; for inserting probe into piping and measuring flow directly in gallons per minute.

1) Minimum Pressure Rating: 150 psig.

2) Minimum Temperature Rating: 250 deg F.

- b. Display: Shows rate of flow, with register to indicate total volume in gallons].

## Specifications

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3. Turbine Flowmeters:
  - a. Sensor: Impeller turbine; for inserting into pipe fitting or for installing in piping and measuring flow directly in gallons per minute.
    - 1) Minimum Pressure Rating: 150 psig.
    - 2) Minimum Temperature Rating: 180 deg F.
  - b. Display: Shows rate of flow, with register to indicate total volume in gallons.
4. Venturi Flowmeters:
  - a. Sensor:
    - 1) Minimum Pressure Rating: 250 psig.
    - 2) Minimum Temperature Rating: 250 deg F.
  - b. Permanent Indicators:
    - 1) Scale: Gallons per minute.
  - c. Portable Indicators:
    - 1) Scale: Gallons per minute.
    - 2) Display: Shows rate of flow, with register to indicate total volume in gallons.
5. Vortex-Shedding Flowmeters:
  - a. Sensor: Inline type; for installing between pipe flanges and measuring flow directly in gallons per minute.
    - 1) Minimum Pressure Rating: 1000 psig.
    - 2) Minimum Temperature Rating: 500 deg F
  - b. Indicator:
    - 1) Display: Shows rate of flow, with register to indicate total volume in gallons.
- L. Thermal-Energy Meters:
  1. Impeller-Turbine, Thermal-Energy Meters:
    - a. Flow Sensor:
      - 1) Minimum Pressure Rating: 150 psig.
      - 2) Minimum Temperature Range: 40 to 250 deg F.
    - b. Indicator: Solid-state, integrating-type meter with integral battery pack; for wall mounting.
    - c. Display: Visually indicates total fluid volume in gallons and thermal-energy flow in kilowatts per hour or British thermal units.



## Specifications

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2. Ultrasonic, Thermal-Energy Meters:
  - a. Indicator: Solid-state, integrating-type meter with integral battery pack.
  - b. Display: Visually indicates total fluid volume in gallons and thermal-energy flow in kilowatts per hour or British thermal units.

END OF SECTION 23 05 19



## **23 05 23 - GENERAL-DUTY VALVES FOR HVAC PIPING**

### **1.1 CHILLED-WATER VALVES**

#### **A. Pipe NPS 2 and Smaller:**

1. Bronze Angle Valves: Class 150, bronze, nonmetallic disc.
2. Ball Valves: One, Two, Three piece, full, regular, reduced port, brass or bronze with brass, bronze or stainless-steel trim.
3. Bronze Swing Check Valves: Class 150, bronze or nonmetallic disc.
4. Bronze Gate Valves: Class 150, NRS or RS, bronze.
5. Bronze Globe Valves: Class 150, bronze or nonmetallic disc.

#### **B. Pipe NPS 2-1/2 and Larger:**

1. Iron Ball Valves: Class 150.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, aluminum-bronze, ductile-iron, stainless-steel disc.
3. Iron, Grooved-End Butterfly Valves: 175 CWP.
4. High-Performance Butterfly Valves: Class 150, single flange.
5. Iron Swing Check Valves: Class 125, Class 250, metal, nonmetallic-to-metal seats.
6. Iron Swing Check Valves with Closure Control: Class 125, lever and spring, weight.
7. Iron, Grooved-End Check Valves: 300 CWP.
8. Iron, Center-Guided Check Valves: Class 125, Class 150, Class 250, Class 300, compact-wafer, globe, metal, resilient seat.
9. Iron, Plate-Type Check Valves: Class 125, Class 150, Class 250, Class 300; single, dual plate; metal, resilient seat.
10. Iron Gate Valves: Class 125, Class 250, NRS, OS&Y.
11. Iron Globe Valves: Class 125, Class 250.
12. Lubricated Plug Valves: Class 125 or Class 250, regular gland, cylindrical, threaded, flanged.
13. Eccentric Plug Valves: 175 CWP, resilient seating.

### **1.2 CONDENSER-WATER VALVES**

#### **A. Pipe NPS 2 and Smaller:**

1. Bronze Angle Valves: Class 150, bronze disc.
2. Ball Valves: One, Two, Three piece, full, regular, reduced port, brass or bronze with brass, bronze trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150, NRS, RS.
5. Bronze Globe Valves: Class 150, bronze disc.

#### **B. Pipe NPS 2-1/2 and Larger:**

1. Iron Ball Valves: Class 150.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, ductile-iron, stainless-steel disc.
3. Iron, Grooved-End Butterfly Valves: 175, 300 CWP.

## Specifications

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4. High-Performance Butterfly Valves: Class 150, Class 300, single flange.
5. Iron Swing Check Valves: Class 125, Class 250, metal seats.
6. Iron Swing Check Valves with Closure Control: Class 125, lever and spring, weight.
7. Iron, Grooved-End Check Valves: 300 CWP.
8. Iron, Center-Guided Check Valves: Class 125, Class 150, Class 250, Class 300, metal seat.
9. Iron, Plate-Type Check Valves: Class 125, Class 150, Class 250, Class 300; single, dual plate; metal seat.
10. Iron Gate Valves: Class 125, Class 250, NRS, OS&Y.
11. Iron Globe Valves: Class 125, Class 250.
12. Lubricated Plug Valves: Class 125, Class 250, regular gland, cylindrical, threaded, flanged.

### 1.3 HEATING-WATER VALVES

#### A. Pipe NPS 2 and Smaller:

1. Bronze Angle Valves: Class 150, bronze disc.
2. Ball Valves: One, Two, Three piece, full, regular, reduced port, brass or bronze with brass, bronze trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150, NRS, RS.
5. Bronze Globe Valves: Class 150, bronze disc.

#### B. Pipe NPS 2-1/2 and Larger:

1. Iron Ball Valves: Class 150.
2. Iron, Single-Flange Butterfly Valves: 200 CWP, aluminum-bronze, ductile-iron disc.
3. Iron, Grooved-End Butterfly Valves: 175, 300 CWP.
4. High-Performance Butterfly Valves: Class 150, Class 300, single flange.
5. Iron Swing Check Valves: Class 125, Class 250, metal seats.
6. Iron Swing Check Valves with Closure Control: Class 125, lever and spring, weight.
7. Iron, Grooved-End Check Valves: 300 CWP.
8. Iron, Center-Guided Check Valves: Class 125, Class 150, Class 250, Class 300, compact-wafer, globe, metal seat.
9. Iron, Plate-Type Check Valves: Class 125, Class 150, Class 250, Class 300; single, dual plate; metal seat.
10. Iron Gate Valves: Class 125, Class 250.
11. Iron Globe Valves: Class 125, Class 250.

### 1.4 LOW-PRESSURE STEAM VALVES (15 PSIG OR LESS)

#### A. Pipe NPS 2 and Smaller:

1. Bronze Angle Valves: Class 125, Class 150, bronze disc.
2. Ball Valves: One, Two] [Three] piece, full port, brass or bronze with brass, bronze trim.
3. Bronze Swing Check Valves: Class 125, Class 150, bronze disc.
4. Bronze Gate Valves: Class 125, Class 150.
5. Bronze Globe Valves: Class 125, Class 150, bronze disc.

#### B. Pipe NPS 2-1/2 and Larger:





## Specifications

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1. Iron Ball Valves: Class 150.
2. High-Performance Butterfly Valves: Class 150, Class 300, single flange.
3. Iron Swing Check Valves: Class 125, Class 250, metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring, weight.
5. Iron Gate Valves: Class 125, Class 250.
6. Iron Globe Valves: Class 125, Class 250.

### 1.5 HIGH-PRESSURE STEAM VALVES (MORE THAN 15 PSIG)

#### A. Pipe NPS 2 and Smaller:

1. Bronze Angle Valves: Class 150, bronze disc.
2. Ball Valves: One, Two, Three piece, fullport, bronze with bronze trim.
3. Bronze Swing Check Valves: Class 150, bronze disc.
4. Bronze Gate Valves: Class 150, bronze.
5. Globe Valves: Class 150, bronze, bronze disc.

#### B. Pipe Sizes NPS 2-1/2 and Larger:

1. Ball Valves: Class 150, iron.
2. High-Performance Butterfly Valves: Class 300, single flange.
3. Iron Swing Check Valves: Class 250, metal seats.
4. Iron Swing Check Valves with Closure Control: Class 125, lever and spring, weight.
5. Iron Gate Valves: Class 250.
6. Iron Globe Valves: Class 250.

END OF SECTION 23 05 23



**23 05 29 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT****1.1 PERFORMANCE REQUIREMENTS**

- A. Pipe hangers and equipment supports designed by Contractor.
- B. Seismic-restraint hangers and supports designed by Contractor and approval obtained from authorities having jurisdiction.

**1.2 SUBMITTALS**

- A. Shop Drawings

**1.3 QUALITY ASSURANCE**

- A. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. ASME Boiler and Pressure Vessel Code.

**1.4 COMPONENTS**

- A. Metal Pipe Hangers and Supports: Carbon steel, stainless steel, and copper.
- B. Trapeze pipe hangers.
- C. Fiberglass pipe hangers.
- D. Metal Framing Systems: MFMA manufacturer.
- E. Fiberglass strut systems.
- F. Thermal-hanger shield inserts.
- G. Fastener Systems: Powder-actuated fasteners and mechanical-expansion anchors.
- H. Pipe Stands: Compact, Low type, single pipe, High type, single pipe, High type, multiple pipes, Curb-mounted type.
- I. Equipment supports.

END OF SECTION 23 05 29



**23 05 48 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT****1.1 PERFORMANCE REQUIREMENTS****1.2 COMPONENTS****A. Vibration Isolators:**

1. Isolator Pads: Neoprene.
2. Mounts: Double-deflection type.
3. Restrained Mounts: All directional mountings with seismic restraint; cast-ductile-iron housing.
4. Spring Isolators: Freestanding, laterally stable, open-spring type.
5. Restrained Spring Isolators: Freestanding, steel, open-spring type with seismic restraint.
6. Housed Spring Mounts: Ductile-iron or steel housing, with integral, vertically adjustable seismic snubbers.
7. Elastomeric Hangers: Double-deflection type.
8. Spring Hangers: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression.
9. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hangers with spring and insert in compression and with vertical-limit stop.
10. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor.
11. Resilient pipe guides.

**B. Air-Mounting Systems:**

1. Air Mounts: Freestanding, single or multiple, compressed-air bellows.
2. Restrained Air Mounts: Housed compressed-air bellows.

**C. Restrained Vibration Isolation Roof-Curb Rails: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail; with spring isolators mounted on elastomeric isolation pads, and snubber bushings.****D. Vibration Isolation Equipment Bases:**

1. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.
2. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.

**E. Seismic-Restraint Devices:**

1. Snubbers: Welded structural-steel shapes and replaceable resilient isolation washers and bushings.
2. Channel Support System: MFMA-3 slotted steel channels.
3. Restraint Cables: Stainless-steel cables.
4. Anchor Bolts: Mechanical type, seismic rated.
5. Resilient Isolation Washers and Bushings: Molded neoprene.



**Specifications**

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1.3 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged agency.

END OF SECTION 23 05 48



## Specifications

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### 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

#### 1.1 QUALITY ASSURANCE

- A. Quality Standard for Piping Identification: ASME A13.1.

#### 1.2 PRODUCTS

- A. Equipment Labels: Plastic.
- B. Warning Signs and Labels: 1/8 inch thick with adhesive.
- C. Pipe Labels: Self-adhesive.
- D. Duct Labels: 1/8 inch thick with adhesive.
- E. Stencils: Aluminum.
- F. Valve Tags: Brass, 0.032-inch minimum thickness.
- G. Warning Tags: Approximately 4 by 7 inches; reinforced grommet and wire or string fasteners.

END OF SECTION 23 05 53







## Specifications

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### 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

#### 1.1 SUMMARY

A. Testing, adjusting, and balancing for the following:

1. Air Systems: Constant-volume and variable-air-volume systems.
2. Hydronic Systems: Constant-flow, variable-flow and primary-secondary systems.
3. Steam systems.
4. Heat exchangers.
5. Motors.
6. Chillers.
7. Cooling towers.
8. Condensing units.
9. Boilers.
10. Heat-transfer coils.

#### 1.2 QUALITY ASSURANCE

A. Testing, Adjusting, and Balancing Agent Qualifications: AABC, NEBB, or TABB certified.

#### 1.3 EXECUTION

- A. Tolerances: Plus or minus 10 percent of design values.
- B. Inspections: Random checks by Owner/Architect to verify final testing, adjusting, and balancing report.
- C. Additional Tests: Random tests within 90 days of completing TAB to verify balance conditions and seasonal tests.

END OF SECTION 23 05 93



**Specifications**

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**23 07 13 - DUCT INSULATION****1.1 QUALITY ASSURANCE**

- A. Surface-Burning Characteristics: Flame-spread index of 25, and smoke-developed index of 50 for insulation installed indoors; according to ASTM E 84.
- B. Mockup of each type of duct insulation and finish.

**1.2 FIELD QUALITY CONTROL**

- A. Field Inspections: By Owner-engaged agency.

**1.3 DUCT INSULATION SCHEDULE, GENERAL**

- A. Plenums and Ducts Requiring Insulation:
  - 1. Indoor, concealed supply and outdoor air.
  - 2. Indoor, exposed supply and outdoor air.
  - 3. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
  - 4. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
  - 5. Indoor, concealed oven and warewash exhaust.
  - 6. Indoor, exposed oven and warewash exhaust.
  - 7. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
  - 8. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. Items Not Insulated:
  - 1. Fibrous-glass ducts.
  - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
  - 3. Factory-insulated flexible ducts.
  - 4. Factory-insulated plenums and casings.
  - 5. Flexible connectors.
  - 6. Vibration-control devices.
  - 7. Factory-insulated access panels and doors.

**1.4 INDOOR DUCT AND PLENUM INSULATION SCHEDULE**

- A. Concealed, Round and Flat-Oval, Supply-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board or polyolefin.
- B. Concealed, Round and Flat-Oval, Return-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board, or polyolefin.

**Specifications**

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- C. Concealed, Round and Flat-Oval, Outdoor-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board or polyolefin.
- D. Concealed, Round and Flat-Oval, Exhaust-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board, or polyolefin.
- E. Concealed, Rectangular, Supply-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board, or polyolefin.
- F. Concealed, Rectangular, Return-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board, or polyolefin.
- G. Concealed, Rectangular, Outdoor-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board or polyolefin.
- H. Concealed, Rectangular, Exhaust-Air Duct Insulation between Isolation Damper and Penetration of Building Exterior: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board or polyolefin.
- I. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve 2-hour fire rating.
- J. Concealed, Supply-Air Plenum Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board, or polyolefin.
- K. Concealed, Return-Air Plenum Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board or polyolefin.
- L. Concealed, Outdoor-Air Plenum Insulation: Mineral-fiber blanket.
- M. Concealed, Exhaust-Air Plenum Insulation: Mineral-fiber blanket.
- N. Exposed, Round and Flat-Oval, Supply-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board or polyolefin.
- O. Exposed, Round and Flat-Oval, Return-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board or polyolefin.
- P. Exposed, Round and Flat-Oval, Outdoor-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board or polyolefin.
- Q. Exposed, Round and Flat-Oval, Exhaust-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board or polyolefin.
- R. Exposed, Rectangular, Supply-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket or polyolefin.
- S. Exposed, Rectangular, Return-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket or polyolefin.
- T. Exposed, Rectangular, Outdoor-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket or polyolefin.



## Specifications

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- U. Exposed, Rectangular, Exhaust-Air Duct Insulation: Flexible elastomeric, mineral-fiber blanket or polyolefin.
  - V. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve 2-hour fire rating.
  - W. Exposed, Supply-Air Plenum Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board or polyolefin.
  - X. Exposed, Return-Air Plenum Insulation: Flexible elastomeric, mineral-fiber blanket, mineral-fiber board or polyolefin.
  - Y. Exposed, Outdoor-Air Plenum Insulation: Mineral-fiber blanket.
  - Z. Exposed, Exhaust-Air Plenum Insulation: Mineral-fiber blanket.
- 1.5 INDOOR, FIELD-APPLIED JACKET SCHEDULE
- A. Ducts and Plenums, Concealed: Aluminum.
  - B. Ducts and Plenums, Exposed: Aluminum.

END OF SECTION 23 07 13



**Specifications**

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**23 07 16 - HVAC EQUIPMENT INSULATION****1.1 QUALITY ASSURANCE**

- A. Surface-Burning Characteristics: Flame-spread index of 25, and smoke-developed index of 50 for insulation installed indoors and 75, and smoke-developed index of 150 for insulation installed outdoors; according to ASTM E 84.
- B. Mockup of each type of equipment insulation and finish.

**1.2 FIELD QUALITY CONTROL**

- A. Field Inspections: By Owner-engaged agency.

**1.3 EQUIPMENT INSULATION SCHEDULE**

- A. Chillers: flexible elastomeric, polyisocyanurate or polyolefin.
- B. Heat-Exchanger (Water-to-Water for Cooling Service) Insulation: flexible elastomeric, polyisocyanurate or polyolefin.
- C. Heat-Exchanger (Water-to-Water for Heating Service) Insulation: Calcium silicate, cellular glass, mineral-fiber board.
- D. Steam-to-Hot-Water Converter Insulation: Calcium silicate, cellular glass.
- E. Chilled-Water Pump Insulation: Cellular glass, mineral-fiber board or phenolic.
- F. Condenser-Water Pump Insulation: Cellular glass, mineral-fiber board or phenolic.
- G. Heating-Hot-Water Pump Insulation: Calcium silicate, cellular glass or mineral-fiber board.
- H. Steam Condensate Pump and Boiler Feedwater Pump Insulation: Calcium silicate or cellular glass.
- I. Chilled-Water Expansion/Compression Tank Insulation: Cellular glass, flexible elastomeric.
- J. Condenser-Water Expansion/Compression Tank Insulation: Cellular glass or flexible elastomeric.
- K. Heating-Hot-Water Expansion/Compression Tank Insulation: Calcium silicate OR cellular glass.
- L. Chilled-Water Air-Separator Insulation: Cellular glass or flexible elastomeric.
- M. Condenser-Water Air-Separator Insulation: Cellular glass or flexible elastomeric.
- N. Heating-Hot-Water Air-Separator Insulation: \Calcium silicate or cellular glass.
- O. Steam Condensate Tank and Receiver Insulation: Calcium silicate or cellular glass.



## Specifications

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- P. Steam Flash-Tank, Flash-Separator, and Blow-Off-Tank Insulation: Calcium silicate or cellular glass.
- Q. Outdoor, Aboveground, Heated, Fuel-Oil Storage Tank Insulation: Cellular glass, mineral-fiber board, mineral-fiber pipe and tank or polyisocyanurate.

### 1.4 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Equipment, Concealed: Aluminum, Painted aluminum.
- B. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches: Aluminum, Painted aluminum.
- C. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches: Aluminum, Painted aluminum.

### 1.5 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Equipment, Concealed: Aluminum, Painted aluminum, Stainless steel.
- B. Equipment, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches: Aluminum, Painted aluminum, Stainless steel.
- C. Equipment, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches: \Aluminum, Painted aluminum, Stainless steel.

END OF SECTION 23 07 16



**Specifications**

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**23 07 19 - HVAC PIPING INSULATION****1.1 QUALITY ASSURANCE**

- A. Surface-Burning Characteristics: Flame-spread index of 25, and smoke-developed index of 50 for insulation installed indoors and 75, and smoke-developed index of 150 for insulation installed outdoors]; according to ASTM E 84.
- B. Mockup of each type of pipe insulation and finish.

**1.2 FIELD QUALITY CONTROL**

- A. Field Inspections: By Owner-engaged agency.

**1.3 PIPING INSULATION SCHEDULE, GENERAL**

- A. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Underground piping.

**1.4 INDOOR PIPING INSULATION SCHEDULE**

- A. Condensate and Equipment Drain Water below 60 Deg F: Armaflex.
- B. Chilled Water and Brine, above 40 Deg F: Foam glass.
- C. Condenser-Water Supply and Return: Fiberglass.
- D. Heating-Hot-Water Supply and Return, 200 Deg F and Below: Cellular glass, mineral-fiber, preformed pipe, Type I.
- E. Steam and Steam Condensate, 350 Deg F and Below: Calcium silicate, cellular glass, mineral-fiber pipe insulation, Type I or II.
- F. Steam and Steam Condensate, above 350 Deg F: Calcium silicate, cellular glass, mineral-fiber, preformed pipe, Type I or II.
- G. Refrigerant Suction and Hot-Gas Piping: Cellular glass, flexible elastomeric, mineral-fiber, preformed pipe, Type I.
- H. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric.



## Specifications

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### 1.5 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Chilled Water and Brine: Cellular glass, flexible elastomeric, mineral-fiber, preformed pipe insulation, Type I.
- B. Condenser-Water Supply and Return: Cellular glass, flexible elastomeric, mineral-fiber, preformed pipe insulation, Type I.
- C. Refrigerant Suction and Hot-Gas Piping: Cellular glass, flexible elastomeric, mineral-fiber, preformed pipe insulation, Type I.
- D. Refrigerant Suction and Hot-Gas Flexible Tubing: Flexible elastomeric.
- E. Fuel Oil Piping, Heated: Cellular glass or mineral-fiber, preformed pipe insulation, Type I.

### 1.6 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

- A. Loose-fill insulation, for belowground piping, is specified in Division 33 piping distribution Sections.
- B. Chilled Water: Cellular glass.
- C. Fuel Oil Piping, Heated: Cellular glass.

### 1.7 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Piping, Concealed: Aluminum, Painted aluminum.
- B. Piping, Exposed: Aluminum, Painted aluminum.

### 1.8 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Piping, Concealed: Aluminum, Painted aluminum, Stainless steel.
- B. Piping, Exposed: Aluminum, Painted aluminum, Stainless steel.

### 1.9 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 23 07 19

**23 08 00 - COMMISSIONING OF HVAC****1.1 SUMMARY**

- A. Requirements for commissioning HVAC&R systems, assemblies, and equipment.
- B. Allowances for labor, instrumentation, tools, and equipment costs for technicians for performance of commissioning testing.
- C. Unit prices for adjusting allowances.
- D. Contractor's Responsibilities:
  - 1. Perform commissioning tests at the direction of the CxA.
  - 2. Attend construction phase controls coordination meeting.
  - 3. Attend testing, adjusting, and balancing review and coordination meeting.
  - 4. Participate in HVAC&R systems, assemblies, equipment, and component maintenance orientation and inspection.
  - 5. Provide information to CxA for final commissioning documentation.
  - 6. Provide measuring instruments and logging devices to record test data, and provide data acquisition equipment to record data.
- E. CxA's Responsibilities:
  - 1. Provide Project-specific construction checklists and commissioning process test procedures for actual HVAC&R systems, assemblies, equipment, and components.
  - 2. Direct commissioning testing.
  - 3. Verify testing, adjusting, and balancing of Work are complete.
  - 4. Provide test data, inspection reports, and certificates in Systems Manual.
- F. Commissioning Documentation:
  - 1. Submittals delivery and review plan.
  - 2. Identification of installed systems, assemblies, equipment, and components.
  - 3. Construction checklists.
  - 4. Certificate of completion.
  - 5. Certificate of readiness.
  - 6. Test and inspection reports and certificates.
  - 7. Corrective action documents.
  - 8. Verification of testing, adjusting, and balancing reports.
- G. Submittals:
  - 1. Certificates of readiness.
  - 2. Certificates of completion.



## Specifications

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### 1.2 EXECUTION

- A. Testing Preparation: Certification and verification that systems, subsystems, and equipment are ready for testing.
- B. Testing and Balance Verification:
  - 1. CxA witnesses testing and balance Work.
  - 2. Verification of final testing and balance report.
- C. Scope of Testing:
  - 1. Provide testing technicians, instrumentation, and tools.
  - 2. Entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each conditioned space.
  - 3. All modes of operation.
  - 4. Assist in preparation of testing procedures.
  - 5. Simulation of conditions when required.
  - 6. Boiler testing and acceptance procedures.
  - 7. HVAC&R instrumentation and control system testing.
  - 8. Pipe system cleaning, flushing, hydrostatic tests, and chemical treatment.
  - 9. Energy supply system testing.
  - 10. Refrigeration system testing.
  - 11. HVAC&R distribution system testing.
  - 12. Vibration and sound tests.

END OF SECTION 23 08 00

## **23 09 00 - INSTRUMENTATION AND CONTROL FOR HVAC**

### **1.1 SUMMARY**

- A. Control equipment for HVAC systems and components.

### **1.2 QUALITY ASSURANCE**

- A. Quality Standard: Comply with ASHRAE 135 for DDC system components.

### **1.3 CONTROL SYSTEM**

- A. System to control mechanical systems including the following:
  - 1. Building intrusion detection system.
  - 2. Building clock control system.
  - 3. Building lighting control system.

### **1.4 COMPONENTS**

- A. DDC Equipment:
  - 1. Operator Workstation: One microcomputer(s) with printer.
  - 2. Printer: Color, ink-jet type.
  - 3. Application Software: With dynamic color graphic displays, alarm and event processing, automatic restart, and data collection.
  - 4. Diagnostic Terminal Unit: Portable notebook-style microcomputer.
  - 5. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
  - 6. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
  - 7. Hardwired I/O interface.
  - 8. Power supplies.
  - 9. Power line filtering.
- B. Unitary Controllers: Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
- C. Alarm Panels: Unitized cabinet with suitable brackets for wall or floor mounting. Indicating light for each alarm point, single horn, acknowledge switch, and test switch, mounted on hinged cover.
- D. Time Clocks: Solid-state, programmable time control with separate programs.
- E. Electronic Sensors: Wall, immersion, or duct mounting.

## Specifications

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1. Thermistor temperature sensors and transmitters.
  2. RTDs and transmitters.
  3. Humidity sensors.
  4. Pressure transmitters/transducers.
- F. Status Sensors:
1. Status inputs for fans.
  2. Status inputs for pumps.
  3. Status inputs for electric motors.
  4. Voltage transmitters (100- to 600-V ac).
  5. Power monitors.
  6. Current switches.
  7. Electronic valve/damper position indicators.
  8. Water-flow switches.
- G. Gas Detection Equipment:
1. Carbon monoxide detectors.
  2. Carbon dioxide sensor and transmitters.
  3. Oxygen sensor and transmitters.
  4. Occupancy sensors.
- H. Duct airflow station.
- I. Thermostats:
1. Combination thermostat and fan switches.
  2. Electric, solid-state, microcomputer-based room thermostats.
  3. Low-voltage, on-off thermostats.
  4. Line-voltage, on-off thermostats.
  5. Remote-bulb thermostats.
  6. Fire-protection thermostats.
  7. Pneumatic room thermostats.
  8. Immersion thermostats.
  9. Airstream thermostats.
  10. Electric, low-limit duct thermostats.
  11. Electric, high-limit duct thermostats.
  12. Heating/cooling valve-top thermostats.
- J. Humidistats: Wall mounted type.
- K. Actuators:
1. Electric motors.
  2. Electronic actuators.
  3. Pneumatic valve and damper operators.
- L. Control Valves:
1. Globe Valves: Bronze body for NPS 2 and smaller; iron body for NPS 2-1/2 and larger.

**Specifications**

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2. Butterfly Valves: Cast-iron or ductile-iron body.
  3. Terminal Unit Control Valves: Bronze body.
  4. Self-Contained Control Valves: Bronze body.
- M. Dampers: AMCA-rated, parallel, opposed-blade design, for standard-pressure and low-leak applications.
- N. Air Supply:
1. Control and Instrumentation Tubing: Copper, Polyethylene, flame retardant, nonmetallic.
  2. Tank: ASME storage tank.
  3. Air Compressor: scroll type.
  4. Refrigerated air dryers.
  5. Desiccant dryers.
  6. Pressure gages.
  7. Instrument pressure gages.
  8. Diaphragm control and instrument valves.
  9. Gage cocks.
  10. Relays.
  11. Switches.
  12. Pressure regulators.
  13. Particle filters.
  14. Combination filter/regulators.
  15. Airborne oil filters.
  16. Pressure relief valves.
- O. Pressure-reducing stations.

END OF SECTION 23 09 00





## **23 09 93 - SEQUENCE OF OPERATIONS FOR HVAC CONTROLS**

### **1.1 SUMMARY**

- A. Control sequences for HVAC systems, subsystems, and equipment.

### **1.2 CONTROL SEQUENCES**

- A. Heating Control Sequences:

1. Heating-Water Supply Temperature Control: Thermostat modulates control valve to maintain heating-water supply temperature.
2. Heating-Water Supply Temperature Reset: Outdoor-air sensor resets heating-water supply temperature in straight-line relationship with outdoor-air temperature.
3. Control Primary Circulating Pump(s): DDC system energizes pump(s) at outdoor-air temperature set point.

- B. Central Refrigeration Equipment Sequences:

1. Start and Stop Condenser-Water Pump(s):
  - a. Enable condenser-water pumps when the following three conditions are met:
    - 1) Water pressure transducer confirms water in cooling-tower sump.
    - 2) DDC system outdoor-air temperature confirms outdoor-air temperature conditions are met.
    - 3) DDC system confirms cooling demand from ventilation system(s).
  - b. DDC system time schedule initiates pump.
2. Start and Stop Chilled-Water Pump(s): Flow switch in condenser-water circuit energizes pump(s) through DDC system command to starter relay.
3. Start and Stop Cooling-Tower Fans(s): Flow switch in condenser-water circuit energizes fan(s) through DDC system command to starter relay.
4. Start and Stop Refrigeration Machine(s): Flow switch in condenser-water circuit and flow switch in chilled-water circuit energize(s) refrigeration machine internal control circuit through DDC system command to refrigeration machine terminal strip.
5. Start and Stop Chiller(s): Flow switches in condenser-water and chilled-water circuit energize chiller internal control circuit through DDC system command to chiller terminal strip.
6. Alternate Chiller(s): DDC system software operates chiller(s) on lead-lag, alternating each startup, and adding and dropping chiller(s) through DDC system command to chiller terminal strip.
7. Alarm Chiller(s) Start Failure: Chiller software signals alarm through DDC system alarm.
8. Chilled-Water Level: Expansion tank liquid sensor signals alarm through DDC system alarm.
9. Chilled-Water Supply Temperature: Temperature sensor in common chilled-water supply piping maintains constant leaving chilled-water temperature reset according to highest cooling demand through DDC system signal to chiller control panel.

## Specifications

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10. Condenser-Water Temperature: Temperature sensor in cooling-tower sump modulates control valve through DDC system command to cooling-tower fan starter relay so valve is open to cooling tower and closed to bypass, and cycles tower fan(s) on and off to maintain sump temperature.

C. Air-Handling-Unit Control Sequences:

1. Start and Stop Supply Fan(s):
  - a. Enable supply fan(s) when the following conditions are met:
    - 1) Duct temperature is above 37 deg F.
    - 2) Duct temperature is below 300 deg F
    - 3) Duct is free of products of combustion.
  - b. Occupied Time Schedule: DDC system time schedule energizes fan(s) through time clock to motor starter.
  - c. Unoccupied Time Schedule: Room thermostat energizes fan(s) through room thermostat to motor starter.
  - d. Unoccupied Ventilation: DDC system time schedule and output cycle fan(s) during unoccupied periods through DDC system to motor starter.
2. Supply Fan(s) Variable-Volume Control:
  - a. Occupied Time Schedule: DDC system time schedule enables control through binary output.
  - b. Volume Control: Differential-pressure switch sensing supply-duct static pressure referenced to conditioned-space static pressure maintains constant supply-duct static pressure through DDC system to motor speed controller. Variable-speed drive is set to minimum speed when fan is stopped.
  - c. High Pressure: Static-pressure transmitter sensing supply-duct static pressure referenced to static pressure outside the duct stops fan(s) and signals alarm when static pressure rises above excessive-static-pressure set point through DDC system binary output to [alarm panel and motor starter.
3. Preheat Coil:
  - a. Freeze Protection: Duct-mounted averaging element thermostat, located after preheat coil and hard wired through motor starter; DDC system alarm allows fan to start if duct temperature is above 33 deg F.
  - b. Occupied Time Schedule: DDC system time schedule energizes coil circulating pump(s) through binary output to motor starter.
  - c. Discharge-Air Temperature: DDC system time schedule and electronic temperature sensor maintain air temperature set point by modulating control valve.
  - d. Unoccupied Time Schedule: DDC system time schedule and outdoor-air temperature energize coil circulating pump(s) when outdoor-air temperature falls below set point through binary output to motor starter.
4. Filters: During occupied periods when fan is running and differential-air-pressure transmitters exist, differential-pressure switch signals alarm on low- and high-pressure conditions.
5. Hydronic Cooling Coil:

**Specifications**

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- a. Occupied Time Schedule: DDC system time schedule enables control through binary output.
  - b. Supply-Air Temperature Electronic temperature sensor maintains supply-air temperature set point by modulating normally open control valve.
  - c. Temperature Reset: Electronic temperature sensor in return air resets supply-air temperature set point through DDC system in straight-line relationship with return-air temperature.
  - d. Temperature Reset: DDC system, with input from room temperature sensors, resets supply-air temperature in response to greatest heating demand through DDC system.
  - e. Unoccupied Time Schedule: DDC system time schedule disables control through binary output.
6. VAV, Terminal Air Units with Electric Coils: Room thermostat modulates damper to maintain different temperatures for occupied and unoccupied periods.
- D. Ventilation Sequences:
1. Combustion-Air, Makeup Unit Control, Electric: Start fan when served appliance burner starts; room thermostat sequences stages of heating.
  2. Combustion-Air, Makeup Unit Control, Steam: Start fan when served appliance burner starts; room thermostat modulates control valve.
  3. Exhaust Fan: Room thermostat cycles fan.
- E. Kitchen Exhaust Fan: Occupancy sensor starts fan and energizes makeup air unit.

END OF SECTION 23 09 93



**23 11 23 - FACILITY NATURAL-GAS PIPING****1.1 SUMMARY**

- A. Natural-gas piping within the building and distribution on the Project site.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Minimum Operating-Pressure Ratings:

- 1. Piping and Valves: 100 psig.
- 2. Service Regulators: 65 psig.
- 3. Service Meters: 5 psig.

- B. Natural-Gas System Pressures within Buildings:

- 1. Single Pressure: More than 2 psig but not more than 5 psig.
- 2. Two Pressure Ranges: More than 0.5 psig but not more than 2 psig, and 0.5 psig or less.
- 3. Two Pressure Ranges: More than 2 psig but not more than 5 psig, and more than 0.5 psig but not more than 2 psig.
- 4. Three Pressure Ranges: More than 2 psig but not more than 5 psig, more than 0.5 psig but not more than 2 psig, and 0.5 psig or less.

**1.3 MATERIALS**

- A. Piping Specialties:

- 1. Appliance flexible connectors.
- 2. Quick-disconnect devices.
- 3. Y-Pattern, Basket and T-pattern strainers.
- 4. Weatherproof vent cap.

- B. Manual Gas Shutoff Valves:

- 1. One- and two-piece ball valves.
- 2. Two-piece, full-port bronze ball valves with bronze trim.
- 3. Bronze plug valves.
- 4. Cast-iron, nonlubricated and lubricated plug valves.
- 5. PE ball valves.
- 6. Valve boxes.

- C. Electrically operated motorized gas valves.

- D. Earthquake Valves: Cast-aluminum body with nickel-plated chrome steel internal parts.

**Specifications**

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## E. Pressure Regulators:

1. Service pressure regulators.
2. Line pressure regulators.
3. Appliance pressure regulators.

## F. Service Meters:

1. Furnished by natural-gas supplier.
2. Diaphragm type.
3. Rotary type.
4. Turbine.
5. Service-meter bars.
6. Service-meter bypass fittings.

## G. Dielectric Fittings: Dielectric unions, dielectric flanges and dielectric-flange kits.

## H. Detectable warning tape for underground piping.

## 1.4 OUTDOOR PIPING SCHEDULE

- A. Underground Piping: Steel pipe with welded joints, Annealed-temper copper tube with brazed joints, Drawn-temper copper tube with brazed joints.
- B. Aboveground Piping: Steel pipe with threaded joints, Steel pipe with welded joints, Annealed-temper copper tube with brazed joints, Drawn-temper copper tube with brazed joints.
- C. Branch Piping in Cast-in-Place Concrete: Annealed-temper copper tube with brazed, flared joints.
- D. Containment Conduit: Steel pipe with welded joints.

## 1.5 INDOOR PIPING SCHEDULE FOR PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground Branch Piping NPS 1 and Smaller: Corrugated stainless-steel tubing with mechanical fittings, Annealed-temper, tin-lined copper tube with flared joints, Annealed-temper copper tube with brazed joints, Annealed-temper copper tube with flared joints, Steel pipe with threaded joints.
- B. Aboveground Distribution Piping: Steel pipe with threaded joints, Steel pipe with welded joints, Drawn-temper copper tube with brazed joints.
- C. Underground Piping: Steel pipe with threaded joints, Steel pipe with welded joints.
- D. Containment Conduit and Vent Piping: Steel pipe with welded joints.



## Specifications

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- 1.6 INDOOR PIPING SCHEDULE FOR PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG
- A. Aboveground Branch Piping NPS 1 and Smaller: [Corrugated stainless-steel tubing with mechanical fittings, Annealed-temper, tin-lined copper tube with flared joints, Annealed-temper copper tube with brazed joints, Annealed-temper copper tube with flared joints, Steel pipe with threaded joints.
  - B. Aboveground Distribution Piping: Steel pipe with threaded joints, Steel pipe with welded joints, Drawn-temper copper tube with brazed joints.
  - C. Underground Piping: Steel pipe with threaded joints, Steel pipe with welded joints.
  - D. Containment Conduit and Vent Piping: Steel pipe with welded joints.
- 1.7 INDOOR PIPING SCHEDULE FOR PRESSURES MORE THAN 5 PSIG
- A. Aboveground Branch Piping: Steel pipe with welded joints.
  - B. Aboveground Distribution Piping: Steel pipe with welded joints, Drawn-temper copper tube with brazed joints.
  - C. Underground Piping: Steel pipe with threaded joints, Steel pipe with welded joints.
  - D. Containment Conduit and Vent Piping: Steel pipe with welded joints.

END OF SECTION 23 11 23





**23 21 13 - HYDRONIC PIPING****1.1 SUMMARY**

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
1. Hot-water heating piping.
  2. Chilled-water piping.
  3. Condenser-water piping.
  4. Makeup-water piping.
  5. Condensate-drain piping.
  6. Blowdown-drain piping.
  7. Air-vent piping.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressures and Temperatures:
1. Hot-Water Heating Piping: 125 psig at 200 deg F
  2. Chilled-Water Piping: 125 psig at 200 deg F.
  3. Condenser-Water Piping: 125 psig at 150 deg F.
  4. Makeup-Water Piping: 80 psig at 150 deg F.
  5. Condensate-Drain Piping: 150 deg F.
  6. Blowdown-Drain Piping: 200 deg F.
  7. Air-Vent Piping: 200 deg F.
  8. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

**1.3 QUALITY ASSURANCE**

- A. Quality Standard: ASME B31.9.

**1.4 PRODUCTS**

- A. Valves:
1. Plastic Ball Valves: CPVC or PVC.
  2. Plastic Butterfly Valves: PVC or CPVC.
  3. Plastic Check Valves: PVC or CPVC.
  4. Bronze, Calibrated-Orifice, Balancing Valves: Ball or plug type.
  5. Cast-Iron or Steel, Calibrated-Orifice, Balancing Valves: Ball, plug, or globe pattern.
  6. Pressure-Reducing Valves: Bronze or brass.
  7. Safety Valves: Bronze or brass.

**Specifications**

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- 8. Automatic Flow-Control Valves: Brass or ferrous metal body; stainless-steel or corrosion-resistant piston and spring assembly; combination assemblies include bronze or brass-alloy ball valve.
- B. Air Control Devices:
  - 1. Air Vents: Manual and automatic.
  - 2. Expansion Tanks: ASME labeled with bladder or diaphragm.
  - 3. Air Separators: In-line or Air purgers.
- C. Bypass chemical feeder and chemicals for first year of operation.
- D. Hydronic Piping Specialties:
  - 1. Strainers: Y-pattern, basket, and T-pattern.
  - 2. Flexible Connectors: Stainless-steel bellows with woven-wire jacket or Fiber-reinforced, rubber spherical body.

**1.5 PIPING APPLICATIONS**

- A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be any of the following:
  - 1. Steel pipe, cast-iron fittings, and threaded joints.
  - 2. Steel pipe; steel, pressure-seal couplings and fittings; and pressure-seal joints.
- B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
  - 1. Steel pipe and welded and flanged joints.
  - 2. Steel pipe and grooved, mechanical joints.
- C. Hot-water heating piping installed belowground and within slabs shall be either of the following:
  - 1. Copper tubing and [soldered] [brazed] joints. Use the fewest possible joints.
  - 2. RTRP and RTRF with adhesive or flanged joints.
- D. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
  - 1. Steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
  - 2. Steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- E. Condenser-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
  - 1. Steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
  - 2. Steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- F. Makeup-water piping installed aboveground shall be either of the following:
  - 1. Copper tubing, wrought-copper fittings, and soldered, brazed joints.
- G. Makeup-Water Piping Installed Belowground and within Slabs: Annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.

**Specifications**

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- H. Condensate-Drain Piping: Copper tubing, wrought-copper fittings, and soldered joints.
- I. Blowdown-Drain Piping: Same materials and joining methods as for piping specified for the service in which blowdown drain is installed.
- J. Air-Vent Piping:
  - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
  - 2. Outlet: Copper tubing with soldered or flared joints.
- K. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

**1.6 VALVE APPLICATIONS**

- A. Shutoff-duty valves are for each installation in branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Calibrated-orifice, balancing valves are for installation in each branch connection to return main.
- C. Calibrated-orifice, balancing valves are for installation in return pipe of each heating or cooling terminal.
- D. Check valves are for installation in each pump discharge and elsewhere as required to control flow direction.
- E. Safety valves are for installation in hot-water generators.
- F. Pressure-reducing valves are for installation in makeup-water connection to regulate system fill pressure.

**1.7 CHEMICAL TREATMENT**

- A. Chemical Treatment: Water analysis by Contractor.

END OF SECTION 23 21 13



**Specifications**

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**23 21 13.13 - UNDERGROUND HYDRONIC PIPING****1.1 PIPING APPLICATION****A. Chilled-Water Piping:**

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered, brazed, pressure-seal joints.
2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded or welded and flanged joints.
3. Schedule 5 steel pipe; steel, pressure-seal couplings and fittings; and pressure-seal joints.
4. Mechanical-joint, ductile-iron pipe; standard- or compact- pattern mechanical-joint fittings; and mechanical joints.
5. RTRP and RTRF with adhesive or flanged joints.
6. Loose-Fill Insulation: Granular or Powder.
7. Conduit Piping: Schedule 40 steel carrier pipe, with mineral-wool or calcium silicate carrier-pipe insulation and with coated and insulated conduit.
8. Cased piping with polyurethane carrier-pipe insulation.

**B. Condenser-Water Piping:**

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered, brazed, pressure-seal joints.
2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded or welded and flanged joints.
3. Schedule 5 steel pipe; steel, pressure-seal couplings and fittings; and pressure-seal joints.
4. Mechanical-joint, ductile-iron pipe; standard- or compact- pattern mechanical-joint fittings; and mechanical joints.
5. RTRP and RTRF with adhesive or flanged joints.
6. Loose-Fill Insulation: Granular or Powder.
7. Conduit Piping: Schedule 40 steel carrier pipe, with mineral-wool or calcium silicate carrier-pipe insulation and with coated and insulated conduit.
8. Cased piping with polyurethane carrier-pipe insulation.

END OF SECTION 23 21 13.13



**Specifications**

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**23 21 23 - HYDRONIC PUMPS****1.1 PRODUCTS****A. Close-Coupled, In-Line Centrifugal Pumps:**

1. Casing: Radially split, cast iron.
2. Impeller: Cast bronze.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Seal: Mechanical.
5. Pump Bearings: Permanently lubricated ball bearings or Oil lubricated; bronze-journal or thrust type.

**B. Close-Coupled, End-Suction Centrifugal Pumps:**

1. Casing: Radially split, cast iron.
2. Impeller: Cast bronze.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Seal: Mechanical.
5. Pump Bearings: Permanently lubricated ball bearings or Oil lubricated; bronze-journal or thrust type.

**C. Separately Coupled, Horizontally Mounted, In-Line Centrifugal Pumps:**

1. Casing: Radially split, cast iron.
2. Impeller: Cast bronze.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Seal: Mechanical.
5. Pump Bearings: Permanently lubricated ball bearings or Oil lubricated; bronze-journal or thrust type.
6. Shaft Coupling: Molded-rubber insert with interlocking spider or Interlocking frame with interconnecting springs.
7. Motor: Resiliently mounted.

**D. Separately Coupled, Vertically Mounted, In-Line Centrifugal Pumps:**

1. Casing: Radially split, cast iron.
2. Impeller: Cast bronze.
3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
4. Seal: Mechanical.
5. Pump Bearings: Permanently lubricated ball bearings or Oil lubricated; bronze-journal or thrust type.
6. Shaft Coupling: Axially split spacer coupling.

**E. Separately Coupled, Base-Mounted, End-Suction Centrifugal Pumps:**

1. Casing: Radially split, cast iron. Integral mount on volute to support the casing and attached piping.
2. Impeller: Cast bronze.

## Specifications

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3. Pump Shaft: Steel, with copper-alloy shaft sleeve.
  4. Seal: Mechanical.
  5. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing.
  6. Shaft Coupling: molded-rubber insert and interlocking spider with EPDM coupling sleeve for variable-speed applications.
  7. Coupling Guard: Dual rated, steel, removable, attached to mounting frame.
  8. Mounting Frame: Welded-steel frame and cross members.
- F. Separately Coupled, Base-Mounted, Double-Suction Centrifugal Pumps:
1. Casing: Horizontally split, cast iron. Casing supports to allow removal and replacement of impeller without disconnecting piping.
  2. Impeller: Cast bronze.
  3. Pump Shaft: Stainless steel.
  4. Seal: Mechanical.
  5. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing.
  6. Shaft Coupling: molded-rubber insert and interlocking spider with EPDM coupling sleeve for variable-speed applications]
  7. Coupling Guard: Dual rated, steel, removable, attached to mounting frame.
  8. Mounting Frame: Welded-steel frame and cross members.
- G. Separately Coupled, Vertically Mounted, Double-Suction Centrifugal Pumps:
1. Casing: Radially split, cast iron.
  2. Impeller: Cast bronze.
  3. Pump Shaft: Stainless steel.
  4. Seal: Mechanical.
  5. Pump Bearings: Grease-lubricated ball bearings in cast-iron housing.
  6. Shaft Coupling: Molded-rubber insert and interlocking spider.
- H. Separately Coupled, Vertically Mounted, Turbine Centrifugal Pumps:
1. Single stage.
  2. Pump Bowl: Cast iron, with replaceable bronze wear ring, basket strainer, and suction bell.
  3. Impeller: Cast bronze.
  4. Pump Shaft: Carbon or Stainless steel.
  5. Pump Bearings: Water-lubricated sleeve bearings.
  6. Pump Column: Steel pipe.
  7. Seal: Mechanical.
  8. Shaft Coupling: Keyed with locking collets.
  9. Discharge Head: Class 125 discharge flange.
  10. Drive Ratchet: Nonreversing ratchet.
- I. Automatic Condensate Pump Units: Package units with corrosion-resistant pump, plastic tank with cover, and automatic controls.
- J. Specialty Fittings:
1. Suction diffuser.
  2. Triple-duty valves.





**Specifications**

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1.2 STARTUP SERVICES

- A. Startup service by a factory-authorized service representative.

1.3 DEMONSTRATION

- A. By factory-authorized service representative.

END OF SECTION 23 21 23



**23 22 13 - STEAM AND CONDENSATE HEATING PIPING****1.1 SUMMARY**

- A. LP and HP steam and condensate piping for systems inside the building.

**1.2 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressures and temperatures:
  - 1. HP Steam Piping: 250 psig.
  - 2. LP Steam Piping: 125 psig.
  - 3. Condensate Piping: 250 psig.
  - 4. Makeup-Water Piping: 80 psig at 150 deg F.
  - 5. Blowdown-Drain Piping: Equal to pressure of the piping system to which it is attached.
  - 6. Air-Vent and Vacuum-Breaker Piping: Equal to pressure of the piping system to which it is attached.
  - 7. Safety-Valve-Inlet and -Outlet Piping: Equal to pressure of the piping system to which it is attached.

**1.3 QUALITY ASSURANCE**

- A. Quality Standard: ASME B31.1, "Power Piping" and ASME B31.9, "Building Services Piping."

**1.4 PRODUCTS**

- A. Dielectric Fittings:
  - 1. Dielectric unions.
  - 2. Dielectric flanges.
  - 3. Dielectric-flange kits.
- B. Strainers:
  - 1. Y-pattern.
  - 2. Basket.
- C. Flash Tanks: Fabricated according to ASME Boiler and Pressure Vessel Code.
- D. Safety Valves: ASME labeled; brass, bronze and cast iron.
- E. Pressure-Reducing Valves: Cast iron; pilot operated; diaphragm type.

## Specifications

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- F. Steam Traps:
  - 1. Thermostatic.
  - 2. Thermodynamic.
  - 3. Float and thermostatic.
  - 4. Inverted bucket.
- G. Thermostatic air vents.
- H. Vacuum breakers.
- I. Steam Meters: Venturi, Vortex, Variable-area flowmeter.
- J. Condensate Meters: Turbine type.

### 1.5 PIPING APPLICATIONS

#### A. LP Steam Piping Applications:

- 1. LP Steam Piping, NPS 2 and Smaller: Steel pipe, cast-iron fittings, and threaded joints.
- 2. LP Steam Piping, NPS 2-1/2 through NPS 12: Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- 3. LP Steam Piping, NPS 14 through NPS 18: Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- 4. LP Steam Piping, NPS 20 and Larger: Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- 5. Condensate Piping above Grade, NPS 2 and Smaller:
  - a. Steel pipe, cast-iron fittings, and threaded joints.
- 6. Condensate Piping above Grade, NPS 2-1/2 and Larger:
  - a. Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.

#### B. HP Steam Piping Applications:

- 1. HP Steam Piping, NPS 2 and Smaller: Steel pipe, cast-iron fittings, and threaded joints.
- 2. HP Steam Piping, NPS 2-1/2 through NPS 12: Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- 3. HP Steam Piping, NPS 14 through NPS 18: Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- 4. HP Steam Piping, NPS 20 and Larger: Steel pipe; wrought-steel fittings, flanges, and flange fittings; and welded and flanged joints.
- 5. Condensate Piping above Grade, NPS 2 and Smaller:
  - a. Steel pipe, cast-iron fittings, and threaded joints.

END OF SECTION 23 22 13



## Specifications

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### 23 22 23 - STEAM CONDENSATE PUMPS

#### 1.1 PRODUCTS

##### A. Single-Stage, Centrifugal Pumps with Floor-Mounted Receivers:

1. Configuration: Duplex floor-mounted pump with receiver and float switches; rated to pump 200 deg F steam condensate.
2. Receiver: Welded steel.
3. Pumps: Bronze fitted with mechanical seals; pumps mounted on receivers.
4. Controls: Factory wired between pumps and float switches for single external electrical connection.

#### 1.2 STARTUP SERVICE

- ##### A. Startup service by a factory-authorized service representative.

#### 1.3 DEMONSTRATION

- ##### A. By a factory-authorized service representative.

END OF SECTION 23 22 23





## Specifications

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### 23 23 00 - REFRIGERANT PIPING

#### 1.1 QUALITY ASSURANCE

- A. Quality Standards: ASHRAE 15 and ASME B31.5.

#### 1.2 PRODUCTS

- A. Valves and Specialties:
  - 1. Diaphragm packless valves.
  - 2. Packed-angle valves.
  - 3. Check valves.
  - 4. Service valves.
  - 5. Solenoid Valves: 24-V ac.
  - 6. Safety relief valves.
  - 7. Thermostatic expansion valves for 40 deg F suction temperature; adjustable superheat.
  - 8. Hot-gas bypass valves
  - 9. Straight-type strainers.
  - 10. Angle-type strainers.
  - 11. Moisture/liquid indicators.
  - 12. Mufflers.
  - 13. Receivers.
  - 14. Liquid accumulators.

#### 1.3 PIPING APPLICATIONS

- A. Piping Applications for Refrigerant R-410A: Maximum NPS 4.
  - 1. Suction Lines for Conventional Air-Conditioning Applications: Copper.
  - 2. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications:
    - a. NPS 2 and Smaller: Copper with brazed or soldered joints.
    - b. NPS 2-1/2 and Larger: Schedule 40, black steel with welded joints.
  - 3. Safety-Relief-Valve Discharge Piping:
    - a. NPS 2 and Smaller: Copper with brazed or soldered joints.
    - b. NPS 2-1/2 and Larger: Schedule 40, black steel with welded joints.
    - c. Schedule 40, black steel with welded joints.

END OF SECTION 23 23 00





**23 25 00 - HVAC WATER TREATMENT****1.1 SUMMARY**

- A. This Section includes the following HVAC water-treatment systems:

1. Bypass chemical-feed equipment and controls.
2. Biocide chemical-feed equipment and controls.
3. Ozone-generator biocide equipment and controls.
4. UV-irradiation unit, biocide equipment, and controls.
5. Chemical treatment test equipment.
6. HVAC water-treatment chemicals.
7. Makeup water softeners.
8. RO equipment for HVAC makeup water.
9. Water filtration units for HVAC makeup water.

**1.2 MAINTENANCE**

- A. Chemical and Service Program: For one year following date of Substantial Completion.

**1.3 PRODUCTS**

- A. Manual Chemical-Feed Equipment: Bypass feeders.

- B. Automatic Chemical-Feed Equipment:

1. Water Meters: Oscillating-piston, magnetic-drive or Turbine-type totalization meters.
2. Inhibitor injection timers.
3. pH controllers.
4. TDS controllers.
5. Biocide feeder timers.
6. Polyethylene chemical solution tanks.
7. Polyethylene chemical solution tubing.
8. Positive-displacement chemical solution injection pumps.
9. Injection assembly.

- C. Ozone-generator biocide equipment with stainless-steel piping and self-contained breathing apparatus.

- D. UV biocide equipment.

- E. Chemical treatment test equipment with the following components:

1. Test kit.
2. Sample cooler.
3. Corrosion test-coupon assembly.



## Specifications

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- F. HVAC Makeup Water Softener: Twin mineral tanks and one brine tank, factory mounted on skid; with water test kit.
- G. RO Equipment for HVAC Makeup Water: RO membrane elements in housings, high-pressure pumps and motors, controls, valves, and prefilter; mounted on skid; with water test kit.
- H. Filtration Equipment:
  - 1. Multimedia filters.
  - 2. Self-cleaning strainers.
  - 3. Bag or Cartridge-type filters.
  - 4. Centrifugal separators.

### 1.4 WATER ANALYSIS

- A. Water Analysis: By Contractor.

END OF SECTION 23 25 00

**23 31 13 - METAL DUCTS****1.1 QUALITY ASSURANCE**

- A. Mockups for system static-pressure classifications higher than 3-inch wg.

**1.2 MATERIALS**

- A. Single-wall rectangular ducts and fittings.
- B. Double-wall rectangular ducts and fittings.
  - 1. Fibrous-glass or Flexible elastomeric duct liner for interstitial insulation.
  - 2. Perforated or Solid inner duct.
- C. Single-wall round ducts and fittings.
- D. Double-wall round ducts and fittings.
  - 1. Fibrous-glass or Flexible elastomeric duct liner for interstitial insulation.
  - 2. Perforated or Solid inner duct.
- E. Sheet Metal Materials:
  - 1. Galvanized sheet steel.
  - 2. PVC-coated, galvanized sheet steel.
  - 3. Carbon-steel sheets.
  - 4. Stainless-steel sheets.
  - 5. Aluminum sheets.
  - 6. Factory-applied antimicrobial coating.
- F. Duct Liner:
  - 1. Fibrous glass, Type I, flexible; Type II, rigid.
    - a. With antimicrobial erosion-resistant coating.
  - 2. Flexible elastomeric.
  - 3. Natural fiber.
- G. Sealant Materials:
  - 1. Two-part tape sealing system.
  - 2. Water-based joint and seam sealant.
  - 3. Solvent-based joint and seam sealant.
  - 4. Flanged joint sealant.
  - 5. Flange gaskets.
  - 6. Round duct joint O-ring seals.



## Specifications

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### 1.3 SEISMIC-RESTRAINT DEVICES

- A. Channel support system.
- B. Galvanized-steel restraint cables.
- C. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections or Reinforcing steel angle clamped to hanger rod.

### 1.4 DUCT CLEANING

- A. Clean new duct system(s) before testing, adjusting, and balancing.
- B. Clean the following items:
  - 1. Air outlets and inlets.
  - 2. Supply, return, and exhaust fans.
  - 3. Air-handling units.
  - 4. Coils and related components.
  - 5. Return-air ducts, dampers, actuators, and turning vanes.
  - 6. Supply-air ducts, dampers, actuators, and turning vanes.
  - 7. Dedicated exhaust and ventilation components and makeup air systems.

### 1.5 DUCT SCHEDULE

- A. All ducts shall be galvanized steel except as follows:
  - 1. Commercial Kitchen Hood Exhaust Ducts:
    - a. Exposed to View: Type 304, stainless-steel sheet finish.
    - b. Concealed: Type 304, stainless-steel sheet.
    - c. Welded seams and joints.
  - 2. Dishwasher Hood Exhaust Ducts:
    - a. Type 304, stainless-steel sheet.
    - b. Exposed to View: No. 4, No. 3 finish.
    - c. Concealed: No. 2D finish.
    - d. Welded seams and flanged joints with watertight EPDM gaskets.
  - 3. Moist Environment Duct Material: Aluminum.

END OF SECTION 23 31 13



## Specifications

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### 23 33 00 - AIR DUCT ACCESSORIES

#### 1.1 QUALITY ASSURANCE

- A. Installation Standards: NFPA 90A and NFPA 90B.

#### 1.2 PRODUCTS

- A. Backdraft and Pressure Relief Dampers: Multiple, center-pivoted blade, parallel action, gravity balanced.
- B. Barometric Relief Dampers: Horizontal or vertical mounting.
- C. Manual Volume Dampers: Low-leakage steel, Low-leakage aluminum, multiple or single blade, parallel- or opposed-blade design, with linkage outside airstream.
- D. Control Dampers: Parallel, Opposed-blade design.
- E. Fire Dampers: Static and dynamic heat-responsive device.
- F. Flange connectors.
- G. Duct Silencers: Factory fabricated and tested, round or rectangular.
- H. Turning Vanes: Double-blade, galvanized sheet steel.
- I. Remote damper operators.
- J. Duct-Mounted Access Doors: Double wall, rectangular, galvanized sheet steel with insulation.
- K. Pressure Relief Access Doors: Double wall with insulation fill.
- L. Flexible Connectors: Indoor.
- M. Flexible Ducts: Insulated.
- N. Duct security bars.
- O. Duct accessory hardware.

END OF SECTION 23 33 00





## Specifications

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### 23 34 13 - AXIAL HVAC FANS

#### 1.1 TUBEAXIAL FANS

- A. Housings: Steel, Galvanized steel, Aluminum.
- B. Wheel Assemblies: Cast or extruded aluminum with airfoil-shaped blades mounted on cast-iron wheel keyed to shaft.
- C. Coatings: Color-match enamel, PTFE, Hot-dip galvanized, Powder; applied to housings.

#### 1.2 VANEAXIAL FANS

- A. Housings: [Steel] [Galvanized steel] [Aluminum] [Fiberglass-reinforced plastic] [Stainless steel].
- B. Wheel Assemblies: Cast aluminum with airfoil-shaped blades mounted on cast-iron wheel keyed to shaft.
  - 1. Variable-Pitch Fans: Internally mounted actuator.
- C. Coatings: Color-match enamel, Hot-dip galvanized, Powder coating; applied to housings.

#### 1.3 DUCT SILENCERS

- A. Description: Tubular with center cone silencers consisting of a shell with fill material.
- B. Housings: Steel, Galvanized steel, Aluminum with flanged inlet and outlet connections matching fan or cone sizes.

END OF SECTION 23 34 13





**23 34 23 - HVAC POWER VENTILATORS****1.1 QUALITY ASSURANCE**

- A. AMCA-Certified Ratings Seal.

**1.2 CENTRIFUGAL ROOF VENTILATORS**

- A. Direct-drive or belt-driven centrifugal type, with spun-aluminum, extruded-aluminum, galvanized-steel housing.
  - 1. Variable-speed controller.
  - 2. Disconnect switch inside fan housing.
  - 3. Bird screens.
  - 4. Backdraft dampers.
  - 5. Motorized dampers.
  - 6. Galvanized-steel roof curbs with built-in raised cant and mounting flange.

**1.3 AXIAL ROOF VENTILATORS**

- A. Direct-drive or belt-driven axial type, with removable, spun-aluminum housing.
  - 1. Aluminum or Steel fan wheel.
  - 2. Disconnect switch inside fan housing.
  - 3. Bird screens.
  - 4. Backdraft dampers.
  - 5. Motorized dampers.
  - 6. Galvanized-steel roof curbs with built-in raised cant and mounting flange.

**1.4 CENTRIFUGAL WALL VENTILATORS**

- A. Direct-drive or belt-driven centrifugal type, with spun-aluminum housing.
  - 1. Variable-speed controller.
  - 2. Disconnect switch.
  - 3. Bird screens.
  - 4. Wall grille.
  - 5. Backdraft dampers.
  - 6. Motorized dampers.

**1.5 IN-LINE CENTRIFUGAL FANS**

- A. In-line, direct-drive centrifugal type, with split, spun-aluminum housing, wheel, and outlet guide vanes.
  - 1. Variable-speed controller.



## Specifications

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2. Volume-control damper.
3. Companion flanges.
4. Fan guards.
5. Motor and drive cover (belt guard).

### 1.6 PROPELLER FANS

#### A. Direct-drive or belt-driven propeller type, with galvanized-steel housing and orifice ring.

1. Fan Wheels: Steel, Cast aluminum, Extruded aluminum.
2. Gravity shutters.
3. Motor-side back guard.
4. Wall sleeve.
5. Weathershield hood.
6. Weathershield front guard.
7. Variable-speed controller.
8. Disconnect switch.

END OF SECTION 23 34 23



## Specifications

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### 23 36 00 - AIR TERMINAL UNITS

#### 1.1 QUALITY ASSURANCE

- A. Installation Standard: ASHRAE 62.1 and NFPA 70.

#### 1.2 PRODUCTS

- A. Shutoff, Single-Duct Air Terminal Units:

1. Configuration: Volume-damper assembly inside unit casing.
2. Casing: Steel or Aluminum, double wall with removable access panels.
  - a. Casing Lining: 1-inch- thick, fibrous-glass duct liner or polyurethane foam insulation.
3. Regulator Assembly: System-air-powered bellows.
4. Volume Damper: Normally open, galvanized steel with maximum airflow leakage of 2 percent at 3-inch wg inlet static pressure.
5. Attenuator Section: Steel or Aluminum, internally insulated.
  - a. Lining: 1-inch- thick, fibrous-glass duct liner or polyurethane foam insulation.
6. Multioutlet Attenuator Section: With collars, each with locking balancing damper.
7. Hydronic Coils: Copper tube and aluminum fins.
8. Electric-Resistance Heating Coils: Slip-in-type, open-coil design with factory-installed controls.
9. Factory-mounted and -wired, DDC microprocessor-based controls.

- B. Hangers and supports.

- C. Seismic restraints.

#### 1.3 SOURCE QUALITY CONTROL

- A. Air terminal units rated according to ARI 880.

#### 1.4 FIELD QUALITY CONTROL

- A. Contractor-engaged testing agency.

END OF SECTION 23 36 00





## **23 37 13 - DIFFUSERS, REGISTERS, AND GRILLES**

### **1.1 PRODUCTS**

#### **A. Diffusers:**

1. Round ceiling diffusers, fully adjustable and two position.
2. Rectangular and square ceiling diffusers, [adjustable.
3. Perforated diffusers, surface-mounted.
4. Perforated diffusers, panel-mounted.
5. Louver face diffusers.
6. Linear bar diffusers with narrow core spacing arrangement.
7. Linear slot diffusers.

#### **B. Registers and Grilles:**

1. Modular core supply grilles with one, two, three, and four grilles per unit.
2. Adjustable bar registers and grilles.
3. Security registers and grilles.
4. Fixed face registers and grilles.
5. Linear bar grilles with grid face arrangement.

END OF SECTION 23 37 13



## **23 37 23 - HVAC GRAVITY VENTILATORS**

### **1.1 PRODUCTS**

- A. Louvered-Penthouse Ventilators: 4 or 6-inch-deep louvers and aluminum or galvanized-steel sheet roof.
  - 1. Frame and Blade Material: Extruded aluminum and Galvanized steel with mitered corners.
    - a. AMCA seal.
    - b. Exterior Corners: Mitered and welded blades and Mitered blades with concealed close-fitting splices and fully recessed and semirecessed mullions at corners.
  - 2. Roof Curbs: Specified in Division 07 Section "Roof Accessories."
  - 3. Roof Curbs: Galvanized steel, built-in raised cant and mounting flange.
    - a. Overall Height: Per FBC..
  - 4. Bird Screening: Galvanized-steel, square mesh or Aluminum, square mesh.
  - 5. Insect Screening: Aluminum.
  - 6. Galvanized-Steel Sheet Finish: Baked enamel.
- B. Roof Hoods: Galvanized-steel or Aluminum sheet.
  - 1. Roof Curbs: Specified in Division 07 Section "Roof Accessories."
  - 2. Roof Curbs: Shop fabricated, galvanized steel, built-in raised cant and mounting flange.
    - a. Overall Height: Per FBC.
  - 3. Bird Screening: Galvanized-steel, square mesh or Aluminum, square mesh.
  - 4. Insect Screening: Aluminum.
  - 5. Galvanized-Steel Sheet Finish: Baked enamel.
- C. Goosenecks: Galvanized-steel sheet.
  - 1. Roof Curbs: Specified in Division 07 Section "Roof Accessories."
  - 2. Roof Curbs: Shop fabricated, galvanized steel, built-in raised cant and mounting flange.
    - a. Overall Height: Per FBC.
  - 3. Bird Screening: Galvanized-steel, square mesh or Aluminum, square mesh.
  - 4. Insect Screening: Aluminum.
  - 5. Galvanized-Steel Sheet Finish: Baked enamel.

END OF SECTION 23 37 23







## Specifications

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### 23 55 23 - GAS-FIRED RADIANT HEATERS

#### 1.1 WARRANTY

- A. Materials and Workmanship 10 years.

#### 1.2 MANUFACTURED UNITS

##### A. Tubular Infrared Heaters:

1. Type of Gas: Natural.
2. Combustion Tubing: Stainless or Aluminized steel.
3. Tubing Connections: Stainless steel.
4. Reflector: Polished aluminum with reflector extension shields.
5. Burner safety controls.
6. Gravity-Vented Power Burner: Vent-pipe connection or Concentric vent for combustion air and flue gas.
  - a. Balancing dampers.
  - b. Outdoor-air duct connection.
7. Vacuum-Vented, Condensing Burner: With multiple atmospheric burners and vacuum fan.
  - a. Balancing dampers.
  - b. Outdoor-air duct connection.

##### B. High-Intensity Infrared Heaters:

1. Type of Gas: Natural.
2. Burner: Aluminized-steel plenum chamber.
3. Reflector: Polished aluminum.
4. Accessories:
  - a. Parabolic reflector.
  - b. Wire grid.
  - c. Protective screen.
  - d. Heat-deflector shield.
  - e. Stainless-steel flexible connector with manual valve.
  - f. Hanger chain.
  - g. Preassembled chain suspension kit.

##### C. Controls: Two-stage, wall-mounting thermostat.

END OF SECTION 23 55 23





**Specifications**

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**23 57 00 - HEAT EXCHANGERS FOR HVAC**

1.1 QUALITY ASSURANCE

- A. Quality Standard: ASME Boiler and Pressure Vessel Code, Section VIII, "Pressure Vessels," Division 1.

1.2 PRODUCTS

A. Shell-and-Tube Heat Exchangers:

1. Configuration: U-tube with removable bundle.
2. Shell Material: Steel.
3. Head Material: Cast iron, Cast stainless steel, Fabricated steel, Fabricated steel with removable cover.
4. Tube Material: Seamless copper or Steel.
5. Tubesheet Material: Steel.
6. Baffle Material: Steel.
7. Support Saddles: Fabricated of material similar to shell. Foot mount with provision for anchoring to support.

END OF SECTION 23 57 00



## **23 64 13.16 - INDIRECT-FIRED ABSORPTION WATER CHILLERS**

### **1.1 QUALITY ASSURANCE**

- A. Performance Rating: ARI 560.
- B. Compliance: ASHRAE 15, ASHRAE/IESNA 90.1-2004, ASME, NFPA 70, UL.

### **1.2 MANUFACTURED UNIT**

- A. Packaged, water-cooled, single or double-effect absorption chiller.
- B. Absorbent and Refrigerant:
  - 1. Absorbent: Lithium bromide solution with corrosion inhibitor.
  - 2. Refrigerant: Deionized or distilled water.
  - 3. Performance Enhancer: Heat and mass transfer enhancer.

### **1.3 PUMPS**

- A. Hermetically sealed, self-lubricating, and fitted with self-adjusting, spring-loaded, wear-compensating tapered carbon bearings.
- B. Designed to operate for not less than 25,000 hours between inspections.
- C. Separate and dedicated pumps for absorbent solution and refrigerant.
- D. Purge System: To automatically remove noncondensable vapors; and motor with an open dripproof or totally enclosed enclosure.

### **1.4 HEAT EXCHANGERS**

- A. Absorber:
  - 1. Tube Material: Copper-nickel alloy.
  - 2. Minimum Tube Wall Thickness: 0.035 inch.
  - 3. Water Box: Standard and removable.
  - 4. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange, Welded, ASME B16.5, raised-face flange, Grooved for mechanical-joint coupling, Grooved with mechanical-joint coupling and flange adapter.
  - 5. Additional corrosion protection.
  - 6. Absorber/Condenser Crossover Piping: Factory installed.
- B. Evaporator:
  - 1. Nozzle or dispersion tray.

## Specifications

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2. Refrigerant Holding Pan: stainless steel.
3. Tube Material: Copper-nickel alloy.
4. Minimum Tube Wall Thickness: 0.035 inch.
5. Water Box: Standard and removable.
6. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange, Welded, ASME B16.5, raised-face flange, Grooved for mechanical-joint coupling, Grooved with mechanical-joint coupling and flange adapter.

C. Condenser:

1. Refrigerant Holding Pan: stainless steel.
2. Tube Material: Copper-nickel alloy.
3. Minimum Tube Wall Thickness: 0.035 inch.
4. Water Box: Standard and removable.
5. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange, Welded, ASME B16.5, raised-face flange, Grooved for mechanical-joint coupling, Grooved with mechanical-joint coupling and flange adapter.
6. Additional corrosion protection.

D. First-Stage Generator for Double-Effect Chillers:

1. Tube Material: 70/30 copper-nickel alloy.
2. Minimum Tube Wall Thickness: 0.035 inch.
3. Water Box: Standard.
4. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange, Welded, ASME B16.5, raised-face flange, Grooved for mechanical-joint coupling, Grooved with mechanical-joint coupling and flange adapter.
5. Additional corrosion protection.

E. Second-Stage Generator for Double-Effect Chillers:

1. Tube Material Copper.
2. Minimum Tube Wall Thickness: 0.025 inch.
3. Water Box: Standard.
4. Nozzle Pipe Connections: Welded, ASME B16.5, flat-face flange, Welded, ASME B16.5, raised-face flange, Grooved for mechanical-joint coupling, Grooved with mechanical-joint coupling and flange adapter.
5. Additional corrosion protection.

F. Solution Heat Exchanger: Shell and tube or brazed plate.

G. Steam Condensate Drain Cooler: Copper-nickel alloy or stainless steel.

### 1.5 INSULATION

- A. Cold Surfaces: Closed-cell, flexible elastomeric, 1-1/2 inches thick.
- B. Hot Surfaces: Mineral-fiber board, 2 inchesthick, with metal jacket.



## Specifications

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### 1.6 ELECTRICAL

- A. Single-point, field-power connection to fused disconnect switch; minimum withstand rating not less than 65,000 A.
  - 1. Branch power circuit to each motor, dedicated electrical load, and controls with disconnect switch or circuit breaker.
- B. Terminal blocks with numbered and color-coded wiring.

### 1.7 CONTROLS

- A. Microprocessor based.
- B. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, digital display.
- C. BAS Interface: Communication interface.
- D. Modulating control valve on heat source.

### 1.8 ACCESSORIES

- A. Sight glasses.
- B. Flow switches.
- C. Vibration isolation.
- D. Lithium bromide filter.

### 1.9 HEAT-EXCHANGER, BRUSH-CLEANING SYSTEM

- A. For Each Chiller Condenser: Brushes in individual tubes, four-way automatic, flow-diverting valve, and control panel.

### 1.10 SOURCE QUALITY CONTROL

- A. Factory run tested.
- B. Factory witness performance tested.
- C. Factory witness sound tested.

END OF SECTION 23 64 13.16





## Specifications

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### 23 64 16 - CENTRIFUGAL WATER CHILLERS

#### 1.1 QUALITY ASSURANCE

- A. Certification: ARI 550.
- B. Compliance: ASHRAE 15 and 147, ASHRAE/IESNA 90.1, ASME, NFPA 70, UL.
- C. Performance Rating: ARI 550/590.
- D. Sound Rating: ARI 575.

#### 1.2 COMPONENTS

- A. Compressor-Drive Assembly: Variable displacement with open or hermetic, direct or gear drive.
  - 1. Capacity Control: Variable-inlet, guide-vane assembly combined with hot-gas bypass, if necessary, to achieve performance indicated.
  - 2. Oil Lubrication System: Consisting of pump, filtration, heater, cooler, factory-wired power connection, and controls.
- B. Refrigeration:
  - 1. Refrigerant : R-134a.
  - 2. For Chillers Using R-134a: ASME-rated, spring-loaded, pressure relief valve.
- C. Evaporator: Shell-and-tube design with carbon steel shell and individually replaceable tubes with enhanced or smooth internal finish and standard or marine water box.
- D. Condenser: Shell-and-tube design with carbon steel shell and individually replaceable tubes with enhanced or smooth internal finish and standard marine water box.
- E. Insulation for Cold Surfaces: Closed cell, flexible elastomeric.
- F. Electrical: Single-point, field-power connection to fused disconnect switch.
- G. Motor Controllers: Variable frequency controller.
  - 1. Accessories:
    - a. Push-button stations.
    - b. Time-delay relays.
    - c. Elapsed-time meters.
    - d. Panel-type meters.
    - e. Multifunction digital-metering monitor.
    - f. Phase-failure and undervoltage relays.
- H. Controls: Microprocessor based.



## Specifications

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1. Operator Interface: Keypad or pressure-sensitive touch screen. Multiple-character, digital display.
2. BAS Interface: Communication interface.

I. Accessories:

1. Flow switch: Pressure differential type.
2. Vibration Isolation: Neoprene pads and Spring isolator.
3. Sound Barrier: Removable and reusable sound-barrier covers over the compressor housing, hermetic motor, compressor suction and discharge piping, and condenser shell.

1.3 SOURCE QUALITY CONTROL

- A. Factory run tested.
- B. Factory witness performance tested.
- C. Factory witness sound tested.
- D. Evaporator and Condensers: Factory tested and inspected according to ASME Boiler and Pressure Vessel Code.

END OF SECTION 23 64 16

## **23 65 00 - COOLING TOWERS**

### **1.1 QUALITY ASSURANCE**

- A. ASHRAE/IESNA 90.1 for energy efficiency.
- B. ASME Compliance: ASME Boiler and Pressure Vessel Code: Section VIII, Division 1 for heat-exchanger coils.
- C. CTI Certification: CTI STD 201 for thermal performance.

### **1.2 WARRANTY**

- A. Materials and Workmanship: Five years.

### **1.3 PRODUCTS**

#### **A. Open-Circuit, Induced-Draft, Counterflow Cooling Towers:**

- 1. Casing: Stainless steel.
- 2. Collection Basin: Stainless steel.
- 3. Collection Basin Water-Level Control: Mechanical float assembly and valve.
- 4. Gravity Water Distribution Basin: Stainless steel with[single-inlet, field-piping connection to each cell.
- 5. Fill: PVC, 15 mils thick before forming.
- 6. Drift Eliminator: FRP or PVC.
- 7. Air-Intake Louvers: Matching casing.
- 8. Air-Intake Screens: Stainless-steel wire mesh.
- 9. Fan: Axial; aluminum blades with field-adjustable blade pitch.
- 10. Fan Drive: Gear.
- 11. Fan Motor: Totally enclosed fan cooled (TEFC) [; NEMA Premium Efficient.
- 12. Fan Discharge Stack: Manufacturer's standard design.
- 13. Vibration Switch: For each fan drive with manual-reset button.
- 14. Gear Drive, Oil-Level Switch: Low-oil-level warning switch for connection to BMS.
- 15. Capacity Control Dampers: Stainless-steel dampers, with integral controls.
- 16. Controls: Factory installed and wired, and functionally tested at factory before shipment.
- 17. Personnel Access Components: Ladders and cages, platforms, and handrails, constructed of stainless steel.

#### **B. Open-Circuit, Induced-Draft, Crossflow Cooling Towers:**

- 1. Casing: Stainless steel.
- 2. Collection Basin: Stainless steel.
- 3. Collection Basin Water-Level Control: Mechanical float assembly and valve.
- 4. Gravity Water Distribution Basin: Stainless steel with[single-inlet, field-piping connection to each cell.
- 5. Fill: PVC, 15 mils thick before forming.



## Specifications

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6. Drift Eliminator: FRP or PVC.
7. Air-Intake Louvers: Matching casing.
8. Air-Intake Screens: Stainless-steel wire mesh.
9. Fan: Axial; aluminum blades with field-adjustable blade pitch.
10. Fan Drive: Gear.
11. Fan Motor: Totally enclosed fan cooled (TEFC) [; NEMA Premium Efficient.
12. Fan Discharge Stack: Manufacturer's standard design.
13. Vibration Switch: For each fan drive with manual-reset button.
14. Gear Drive, Oil-Level Switch: Low-oil-level warning switch for connection to BMS.
15. Capacity Control Dampers: Stainless-steel dampers, with integral controls.
16. Controls: Factory installed and wired, and functionally tested at factory before shipment.
17. Personnel Access Components: Ladders and cages, platforms, and handrails, constructed of stainless steel.

### 1.4 SOURCE QUALITY CONTROL

- A. Cooling Towers: Tested and certified according to CTI STD 201.

### 1.5 FIELD QUALITY CONTROL

- A. Testing: By Owner-engaged agency.
- B. Testing Procedures: ASME PTC 23, "ASME Performance Test Codes - Code on Atmospheric Water Cooling Equipment and CTI ATC 105, "Acceptance Test Code for Water Cooling Towers]."

END OF SECTION 23 65 00



## Specifications

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### 23 72 00 - AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

#### 1.1 QUALITY ASSURANCE

- A. Quality Standard: ARI 1060, ASHRAE 62.1, ASHRAE 84, UL 1812, UL 1815, and UL 1995.

#### 1.2 PRODUCTS

- A. Heat Wheels: Steel casing with integral purge section, aluminum rotor, and motor drive.
  - 1. Controls: Factory mounted.
  - 2. Filters: Disposable panel.
- B. Heat-Pipe Heat Exchangers: Copper tubes and integral-aluminum fins.
  - 1. Refrigerant: ASHRAE 15, Group 1.
  - 2. Coating: Epoxy, Synthetic resin.
  - 3. Control: Face and bypass.
- C. Fixed-Plate Total Heat Exchangers: Galvanized-steel casing.
  - 1. Plates: Chemically treated paper.
  - 2. Filters: Disposable panel.
- D. Controls:
  - 1. Time clock.
  - 2. Motion (occupancy) sensor.
  - 3. Carbon monoxide sensor.
  - 4. Humidistat.
  - 5. Wall-mounted, space-temperature sensor with DDC temperature adjustment.

END OF SECTION 23 72 00





## Specifications

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### 23 74 13 - PACKAGED, OUTDOOR, CENTRAL-STATION AIR-HANDLING UNITS

#### 1.1 MANUFACTURED UNITS

##### A. Casing:

1. Galvanized steel painted with baked enamel.
2. Double Wall construction.
3. Stainless-steel liner.
4. Insulated with fiberglass.
5. Stainless-steel drain pan with drain connection on both sides.

##### B. Supply-Air Fan: Direct driven, double width, forward curved, centrifugal.

##### C. Supply-Air Fan: Belt driven, forward curved, centrifugal.

##### D. Condenser-Coil Fan: Direct-driven propeller.

##### E. Relief-Air Fan: Forward curved.

##### F. Coils:

1. Coil Sections: Common or individual, insulated, galvanized-steel casings.
2. Preheat Coil: Hot water.
3. Heating Coil: Hot water or Electric resistance.
4. Cooling Coil: Chilled water.
5. Water Coils: Continuous circuit, Self-draining, Cleanable.
  - a. Tubes: Copper.
  - b. Fins: Aluminum.
  - c. Frames: Galvanized steel.
6. Electric Heating Coils: Coiled resistance wire.
  - a. Control Panel: Remote mounted.

##### G. Prefilters:

1. Disposable panel.
2. Extended-surface, disposable panel.
3. Extended-surface, nonsupported media.
4. Automatic roll.
5. Activated-carbon panel.
6. Activated carbon.
7. HEPA.

##### H. Filters:

1. Disposable panel.

**Specifications**

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2. Extended-surface, disposable panel.
  3. Extended surface, nonsupported media.
  4. Automatic roll.
  5. Activated-carbon panel.
  6. Activated carbon.
- I. Outdoor-Air Damper: 0 to 25 percent, with motorized damper and hood.
- J. Outdoor- and Return-Air Mixing Dampers: 0 to 100 percent economizer with motorized dampers and hood.
- K. Electrical Power Connection: Single with unit-mounted disconnect.
- L. Basic Unit Controls:
1. Wall-mounted thermostat or sensor.
  2. Wall-mounted humidistat or sensor with concealed set point and concealed indication.
- M. DDC Controllers:
1. Safety controls.
  2. Scheduled controls.
  3. Unoccupied period controls.
  4. Supply fan controls.
  5. Electric-heating-coil controls.
  6. Fixed minimum outdoor-air controls.
  7. Economizer enthalpy-based controls.
  8. Carbon dioxide sensor.
  9. VVT relays.
  10. Interface with HVAC instrumentation and control system.
- N. Accessories:
1. Gas burner compartment heater.
  2. Duplex electrical outlet.
  3. Low-ambient kit.
  4. Filter differential pressure switch.
  5. Coil Hail guards.
  6. Concentric diffuser.
- O. Roof Curb:
1. Vibration isolators.
  2. Wind restraints.

END OF SECTION 23 74 13



## **23 82 19 - FAN COIL UNITS**

### **1.1 SUMMARY**

- A. Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.
- B. Horizontal Fan-Coil Units: Hydronic cooling coil and hot-water or electric heating coil.
- C. Horizontal Ducted Fan-Coil Units: Hydronic cooling coil and hot-water or electric heating coil.

### **1.2 MANUFACTURED UNITS**

#### **A. Fan-Coil Units:**

- 1. Insulation: 1-inch matte-finish, closed-cell foam.
- 2. Drain Pans: Insulated galvanized steel with plastic liner.
- 3. Chassis: Galvanized steel where exposed to moisture.
- 4. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color as selected by Architect.
- 5. Outdoor-Air Wall Box: Aluminum, rain-resistant horizontal; steel louver with integral eliminators and bird screen.
- 6. Outdoor-air damper with digital controls.
- 7. Filters: Pleated cotton-polyester media.
- 8. Hydronic Coils: Copper tube with aluminum fins.
- 9. Electric-Resistance Heating Coils: Nickel-chromium wire, with high-temperature safety.
- 10. Fan and Motor Board: Removable.
  - a. Fan: Double width, forward curved, centrifugal.
  - b. Motor: Permanently lubricated, multispeed.
- 11. Hydronic Piping Package:
  - a. Three-way, modulating coil control valves.
  - b. Two-piece ball valves, automatic flow-control valves, Y-pattern strainers, wrought copper unions, and risers for stacked units.
- 12. Unit Control: BAS interface.

#### **B. Ducted Fan-Coil Units:**

- 1. Insulation: 1-inchcoated glass fiber.
- 2. Drain Pans: Insulated galvanized steel with plastic liner.
- 3. Chassis: Galvanized steel where exposed to moisture.
- 4. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color.
- 5. Mixing Plenum: Outdoor- and return-air dampers with digital controls.
- 6. Filters: Pleated cotton-polyester media.
- 7. Hydronic Coils: Copper tube with aluminum fins.
- 8. Steam Coils: Copper tube with aluminum fins.



## Specifications

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9. Indoor Refrigerant Coils: Copper tube with aluminum fins.
10. Electric-Resistance Heating Coils: Nickel-chromium wire, with high-temperature safety.
11. Direct-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, multispeed motor resiliently mounted in the fan inlet.
12. Belt-Driven Fans: Double width, forward curved, centrifugal; with permanently lubricated, single-speed motor installed on an adjustable, resiliently mounted fan base.
13. Hydronic Piping Package:
  - a. Three-way, modulating coil control valves.
  - b. Two-piece ball valves, automatic flow-control valves, Y-pattern strainers, wrought copper unions, and risers for stacked units.
14. Unit Control: BAS interface.

END OF SECTION 23 82 19



## Specifications

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### 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

#### 1.1 SUMMARY

- A. Building wires, cables, connectors, splices, and terminations for wiring systems rated 600 V and less.

#### 1.2 QUALITY ASSURANCE

- A. Quality Standard: NFPA 70.

#### 1.3 MATERIALS

- A. Conductors and Cables:
  - 1. Conductors: Copper.
  - 2. Conductor Insulation: Types THHN-THWN, XHHW.
  - 3. Multi-conductor Cable: Type MC with ground wire.
- B. Connectors and Splices: Factory fabricated.

#### 1.4 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

#### 1.5 CONDUCTOR AND INSULATION APPLICATIONS

- A. Service Entrance: THHN-THWN, single conductors in raceway..
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway, Type MC cable.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: THHN-THWN, single conductors in raceway.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.



## Specifications

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- G. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- H. Class 2 Control Circuits: Power-limited cable, concealed in building finishes and Power-limited tray cable, in cable tray.

### 1.6 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged independent testing agency (NETA).
- B. Infrared Scanning: For each splice in cables and conductors No. 3 AWG and larger.

END OF SECTION 26 05 19



## **26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

### **1.1 QUALITY ASSURANCE**

- A. Quality Standard for Grounding Materials and Equipment: UL 467.

### **1.2 PRODUCTS**

- A. Insulated Conductors: Copper or tinned copper wire or cable.
- B. Bare Copper Conductors:
  - 1. Solid conductors.
  - 2. Stranded conductors.
  - 3. Tinned conductors.
  - 4. Stranded bonding conductors.
  - 5. Copper tape, braided bonding jumpers.
  - 6. Tinned-copper tape, braided bonding jumpers.
- C. Grounding Bus: Predrilled rectangular copper bars with stand-off insulators.
- D. Connectors: Bolted and exothermic-welded type.
- E. Grounding Electrodes:
  - 1. Ground Rods: Copper-clad sectional type.

### **1.3 FIELD QUALITY CONTROL**

- A. Ground-Resistance Testing: By Contractor-engaged testing agency.

END OF SECTION 26 05 26





## **26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

### **1.1 PERFORMANCE REQUIREMENTS**

- A. Rated Strength: Minimum structural safety factor of five times the applied force.

### **1.2 PRODUCTS**

- A. Support, Anchorage, and Attachment Components:
  - 1. Steel slotted support systems with metallic coatings.
  - 2. Raceway and cable supports.
  - 3. Steel conduit and cable hangers, clamps, and associated accessories.
  - 4. Support for non-armored conductors and cables in vertical conduit risers.
  - 5. Structural steel for fabricated supports and restraints.
  - 6. Mounting, Anchoring, and Attachment Components:
    - a. Powder-actuated fasteners.
    - b. Mechanical-expansion anchors.
    - c. Concrete inserts.
    - d. Clamps for attachment to steel structural elements.
    - e. All steel, springhead toggle bolts.
    - f. Threaded hanger rods.
- B. Fabricated Metal Equipment Support Assemblies: Welded or bolted steel shapes.
- C. Concrete Bases: 3000-psi , 28-day compressive-strength concrete.

END OF SECTION 26 05 29





**26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS****1.1 MATERIALS****A. Metal Conduits, Tubing, and Fittings:**

1. GRC.
2. ARC.
3. PVC-coated rigid steel conduit.
4. EMT.
5. Fittings:
  - a. Conduit fittings for hazardous (classified) locations.
  - b. EMT: Steel compression type.
  - c. Expansion fittings.
  - d. PVC coated.

**B. Nonmetallic Conduits, Tubing, and Fittings:**

1. ENT.
2. Fittings: Match conduit.

**C. Metal Wireways and Auxiliary Gutters: Sheet metal with screw covers.****D. Boxes, Enclosures, and Cabinets:**

1. Metal Outlet and Device Boxes: Aluminum.
2. Metal Floor Boxes: Cast metal, fully adjustable.
3. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb .
4. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing 70 lb .
5. Small sheet metal pull and junction boxes.
6. Cast-metal access, pull, and junction boxes.
7. Box extensions.
8. Gangable boxes are allowed.
9. Hinged-Cover Enclosures: Metal.
10. Cabinets: Galvanized steel.

**E. Handholes and Boxes for Exterior Underground Wiring: [Polymer concrete with polymer-concrete frame and cover, prototype tested for compliance with SCTE 77.**

1. Configuration: Open bottom.
2. Weatherproof cover.
3. Cover Legend: "ELECTRIC."



## Specifications

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### 1.2 RACEWAY APPLICATION

#### A. Outdoors:

1. Exposed: GRC.
2. Concealed, Aboveground: EMT.
3. Underground: RNC, Type EPC-80-PVC.
4. Boxes and Enclosures, Aboveground: Type 3R.

#### B. Indoors:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed and Subject to Severe Damage: GRC.
3. Concealed: EMT.
4. Damp or Wet Locations: GRC.
5. Boxes and Enclosures: Type 1, except Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

#### C. Minimum Raceway Size: 3/4-inch trade size.

#### D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid Conduit: Threaded rigid steel conduit fittings.
2. PVC Externally Coated, Rigid Steel Conduits: Fittings listed for use with this type of conduit.
3. EMT: compression fittings.
4. Flexible Conduit: Fittings listed for use with flexible conduit.

END OF SECTION 26 05 33

**26 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS****1.1 SUMMARY**

- A. Conduits, ducts, and duct accessories for direct-buried and concrete-encased duct banks.
- B. Handholes and boxes.
- C. Manholes.

**1.2 QUALITY ASSURANCE**

- A. Quality Standard: ANSI C2.

**1.3 COMPONENTS**

- A. Conduit:
  - 1. Rigid steel conduit.
  - 2. Rigid nonmetallic conduit (RNC).
- B. Nonmetallic Ducts:
  - 1. Underground plastic utilities duct, Type EB-20-PVC.
  - 2. Underground plastic utilities duct, Type DB-80-PVC.
- C. Precast concrete handholes and boxes.
- D. Handholes and Boxes Other Than Precast Concrete:
  - 1. Polymer concrete handholes and boxes with polymer concrete cover.
  - 2. Fiberglass handholes and boxes with polymer concrete frame and cover.
  - 3. Fiberglass handholes and boxes with covers of polymer concrete.
- E. Manholes: Precast concrete.
- F. Manhole Accessories:
  - 1. Iron frames and covers.
  - 2. Sump frame and grate.
  - 3. Bolting inserts for concrete utility structure cable racks and other attachments.
  - 4. Cable rack assemblies.
  - 5. Fixed ladders.



**Specifications**

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1.4 SOURCE QUALITY CONTROL

- A. Prototype testing by manufacturer.

1.5 INSTALLATION

- A. Waterproofing exterior surfaces of manholes and handholes.

END OF SECTION 26 05 43



## Specifications

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### 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

#### 1.1 MATERIALS

##### A. Sleeves:

1. Schedule 40 steel pipe.
2. Cast-iron pipe.
3. Galvanized-steel sheet for conduits penetrating non-fire-rated gypsum-board assemblies.
4. Schedule 40 PVC pipe.
5. Galvanized-steel sheet for rectangular openings.

##### B. Sleeve-Seals:

1. EPDM rubber sealing elements.
2. Plastic Stainless-steel pressure plates.
3. Stainless-steel connecting bolts and nuts.

##### C. Hydraulic-cement grout.

##### D. Silicone Sealants:

1. Single-component, silicone-based, neutral-curing elastomeric sealant.
2. Multicomponent, silicone-based liquid elastomeric nonshrinking foam.

END OF SECTION 26 05 44





## Specifications

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### 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

#### 1.1 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and IEEE C2.

#### 1.2 PRODUCTS

- A. Power Raceway Identification: Self-adhesive vinyl labels.
- B. Armored and Metal-Clad Cable Identification: Self-adhesive vinyl labels.
- C. Power and Control Cable Identification: Self-adhesive vinyl labels and color-coding bands.
- D. Conductor Identification: Color-coding conductor tape
- E. Underground-Line Warning Tape: Detectable three-layer laminate.
- F. Warning Labels and Signs: Baked-enamel warning signs.
- G. Instruction Signs: Engraved, laminated acrylic or melamine plastic.
- H. Equipment Identification Labels: Engraved, laminated acrylic or melamine plastic.

END OF SECTION 26 05 53







## Specifications

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### 26 05 73 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

#### 1.1 SUMMARY

- A. Contractor shall provide with successful manufacturer a computer-based, fault-current and overcurrent protective device coordination studies. Series-rated devices will be used.

#### 1.2 QUALITY ASSURANCE

- A. Quality Standards: IEEE 399 and IEEE 242.

#### 1.3 COMPONENTS

- A. Computer software program for plotting and diagramming time-current-characteristic curves and for reporting settings and ratings of all overcurrent protective devices.
- B. Optional Computer Program Features:
  - 1. Arcing faults.
  - 2. Simultaneous faults.
  - 3. Explicit negative sequence.
  - 4. Mutual coupling in zero sequence.

#### 1.4 EXECUTION

- A. Fault-Current Study: Electrical distribution system from normal and alternate power sources.
- B. Coordination study includes the following:
  - 1. Transformer primary overcurrent protective devices.
  - 2. Motors served by voltages more than 600 V.
- C. Conductor protection.

END OF SECTION 26 05 73



**26 09 13 - ELECTRICAL POWER MONITORING AND CONTROL****1.1 SUMMARY**

- A. Monitoring of electrical power circuits through PC-based workstation(s) and software.
- B. Monitoring of electrical power circuits through communication network and interface modules for data transport protocols.

**1.2 SOFTWARE SERVICE AGREEMENT**

- A. Technical support for two years.
- B. Upgrade service for two years.

**1.3 FUNCTIONAL DESCRIPTION**

- A. Monitor and record load profiles and chart energy consumption patterns for electricity, domestic water, natural gas, and
- B. Calculate allocation of utility costs.
- C. Identify power system anomalies and measure, display, and record trends and alarms.
- D. Preserve critical loads or avoid total shutdown due to unforeseen loss of power sources.
- E. Manage demand.
- F. Report equipment status and power system control.
- G. Operating System:
  - 1. Software: Configured to run on a portable laptop computer, a single PC, or a palm computer.
  - 2. Software: Configured to run on a single PC, with capability for accessing multiple devices simultaneously.
  - 3. Software: Configured for a server and multiple client PCs, each with capability for accessing multiple devices simultaneously.
  - 4. Software: Configured for a server and multiple client PCs, each with capability for accessing multiple devices simultaneously; includes interactive graphics client; Web enabled.
  - 5. Operating System: Based on 64 bit, Microsoft Windows workstation operating system.
  - 6. Peer computer control software to detect failure of workstation and associated server.
- H. Applications Software:
  - 1. Password protected to three levels.
  - 2. Automatic and encrypted backups for database and history; automatically stored on central control PC

## Specifications

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3. Operator audit trail.
4. Workstation server functions to support other client PCs on the LAN and WAN.
5. User-programmable export and import of data to and from commonly used Microsoft Windows spreadsheet, database, billing, and other applications.
6. Metered values displayed in real time.
7. Remote control display of circuit-breaker status and control; and user-defined schemes for load shedding automatically initiated and executed.
8. Interactive color-graphics platform.
9. User-defined monitoring, and event control.
10. Trending reports.
11. Alarm messages displayed and recorded.
12. Waveform data displayed and recorded.
13. Data sharing to third-party applications software.
14. Tenant or activity billing software.
15. Current alarm, supervisory, and trouble conditions reporting.

### 1.4 COMPONENTS

#### A. Power Monitors:

1. Environmental Conditions:
  - a. Indoor installation in non-air-conditioned spaces.
  - b. Ambient conditions of 0 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.
2. rms real-time measurements.
3. Demand current calculations, per phase, three-phase average and neutral.
4. Demand real power calculations, three-phase total.
5. Demand reactive power calculations, three-phase total.
6. Demand apparent power calculations, three-phase total.
7. Average power factor calculations, demand coincident, three-phase total.
8. Power analysis values.
9. Power demand calculations.
10. Current and voltage sampling.
11. Monthly minimum and maximum values recording.
12. Harmonic calculations display and recording.
13. Current and voltage ratings.
14. Waveform capture.
15. One digital input signal(s).
16. Onboard data logging.
17. Alarms.
18. Power monitoring communications permanently connected RS-485 Modbus TCP/IP.
19. Backlighted LCD display monitors with touch-screen selecting devices.

#### B. Standalone, Web-Enabled Monitoring and Control Instrument:

1. LAN connectivity: **[10 Base-T] [100 Base-T] [100 Base-FX]** LAN.
2. Factory-addressed and -tested communication devices within equipment.



## Specifications

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3. Server configurations for initial network parameters set using Web browser; factory-programmed network server with embedded HTML-formatted Web pages, password-protected login, and firewall-protected operating software.
4. Network accessible data.
5. Power monitoring communications permanently connected to RS-485 Modbus TCP/IP and local RS-232 access point.

C. Workstation Hardware: Standard unmodified PC.

D. RS-232 ASCII interface with pager and alarm system interface.

E. LAN Cables:

1. RS-485 cable.
2. Unshielded twisted pair cable: Category [5e] [6].

### 1.5 CABLING

A. Wiring Method: In raceways except in accessible ceiling spaces or gypsum board partitions.

### 1.6 FIELD QUALITY CONTROL

A. Testing: By Contractor-engaged agency

END OF SECTION 26 09 13





## Specifications

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### 26 09 23 - LIGHTING CONTROL DEVICES

#### 1.1 PRODUCTS

- A. Daylight-harvesting switching controls.
- B. Daylight-harvesting dimming controls.
- C. Indoor Occupancy Sensors: Dual-technology type, with separate, externally mounted relay unit.
- D. Switchbox-mounted occupancy sensors.
- E. Lighting Contactors: Electrically operated and mechanically held.
- F. Emergency Shunt Relay: Normally closed, electrically held, arranged for wiring in parallel with manual or automatic switching contacts.
- G. Control Cables:
  - 1. Power Cables: Not smaller than No. 12 AWG.
  - 2. Classes 2 and 3 Control Cables: Stranded-copper conductors, not smaller than No. 18 AWG.
  - 3. Class 1 Control Cables: Stranded-copper conductors, not smaller than No. 16 AWG.

END OF SECTION 26 09 23







## Specifications

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### 26 09 43 - NETWORK LIGHTING CONTROLS

#### 1.1 QUALITY ASSURANCE

- A. Quality Standard: 47 CFR, Subparts A and B, Class A; and IEC 60929, Annex E.

#### 1.2 WARRANTY

- A. Materials and Workmanship: 5 (Five) years.
- B. Replacement Parts for Transient Voltage Surge Failures: 5 (Five) years.
- C. Repair or Replace Electrically Held Relays: 5 (Five) years.
- D. Software Upgrades: Materials, workmanship, and programming for 2 (two) years.

#### 1.3 SOFTWARE SERVICE AGREEMENT

- A. Software technical support and upgrade services for 5 (five) years.

#### 1.4 PRODUCTS

- A. Expandability: Capable of increasing capacity by 25 percent of current capacity.
- B. Performance Requirements: Manual operation of switches signals relays through programmable control module.
- C. Performance Requirements: Manual operation, internal timing and control unit, or an external source signals relaysthrough programmable control module.
- D. Performance Requirements: Individually addressable devices communicating with data-entry and - retrieval devices using DALI protocol.
- E. Control Module: Programmable, PC-based control unit with keyboard and color LCD for separate graphic display(s) for programming lighting control DALI bus; interoperable with building automation system.
- F. Features:
  - 1. Interoperability: RS-485, LonWorks or BACnet, Web-based, DALI-compliant network.
  - 2. Nonvolatile system memory.
  - 3. Lighting control software.
  - 4. Automatic time adjustment.
  - 5. Astronomic control.
  - 6. Demand control.

**Specifications**

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7. On-off confirmation signal.
8. Remote communication capability.
9. Telephone override capability.
10. Local override capability.
11. Automatic control of local override.
12. Automatic battery backup.
13. Programmed time signal.
14. Daylight balancing dimming control.
15. Daylight compensating switch control.
16. Bilevel controls.
17. Flick warning.
18. Diagnostics.
19. Local data-entry devices: PCs, PDAs, hand-held IR devices, and wired or wireless Ethernet hubs.

G. Power Distribution Components: Modular relaypanel and line-voltage surge suppression.

H. DALI Materials: One full-rated network and lighting control software.

I. Manual Switches: Momentary contact, low-voltage push buttons and maintained contact, full- or low-voltage switches, with integral locator light; finish plates and legends.

J. Conductors and Cables:

1. No. 12 AWG power wiring to supply side of Class 2 power source.
2. Classes 2 and 3 Control Cable: Multiconductor cable with copper conductors.
3. Class 1 Control Cable: Multiconductor cable with copper conductors.
4. Digital and Multiplexed Signal Wire: Unshielded, Category [5e] [6] twisted-pair cable.
5. RS-485 Cables: Two pairs, No. 22 AWG with copper conductors.

## 1.5 INSTALLATION

A. Wiring Method: In raceways except in accessible ceiling space.

B. Field-mounting transient voltage suppressors for lighting control devices installed in Category A locations that do not have integral line-voltage surge protection.

C. Software installation and user-variable programming.

END OF SECTION 26 09 43



## **26 22 00 - LOW-VOLTAGE TRANSFORMERS**

### **1.1 SUMMARY**

- A. Dry-type, distribution transformers rated 600 V and less, with capacities up to 500 kVA.

### **1.2 QUALITY ASSURANCE**

- A. Quality Standard: IEEE C57.12.91.

### **1.3 PRODUCTS**

- A. General Transformer Requirements:

- 1. Factory assembled and tested; air cooled.
- 2. Cores: Grain-oriented, non-aging silicon steel.
- 3. Coils: Aluminum, continuous windings without splices except for taps.

- B. Distribution Transformers: NEMA ST 20.

- 1. Core: One leg per phase.
- 2. Enclosure:
  - a. Ventilated.
  - b. NEMA 250, Type 2.
- 3. Custom Finish: Gray.
- 4. Taps for Transformers Smaller Than 3 kVA: None.
- 5. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- 6. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- 7. Insulation Class: 220 deg C, with maximum 150 deg C rise above 40 deg C.
- 8. Features:
  - a. Energy efficient for transformers larger than 15 kVA.
  - b. K-factor rating.
  - c. Electrostatic shielding.
  - d. Wall brackets.
  - e. Fungus proofing.
  - f. Low sound level.

- C. Buck-Boost Transformers: Self-cooled, two-winding dry type with ventilated enclosure.

- 1. Finish: Gray.



**Specifications**

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1.4 SOURCE QUALITY CONTROL

- A. Transformers: Tested and inspected according to IEEE C57.12.91.

1.5 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged independent agency.
- B. Test Procedure:
  - 1. Visual and mechanical inspections and electrical tests.
  - 2. Infrared scanning.

END OF SECTION 26 22 00

**26 23 00 - LOW-VOLTAGE SWITCHGEAR****1.1 SUMMARY**

- A. Metal-enclosed, low-voltage, power circuit-breaker switchgear rated 1000 V and less for use in ac systems. Generator and main breakers shall have solid state, PLC based transfer control to enable parallel operation with the utility company. Switchgear shall be equipped with all utility grade metering and relaying as required by Duke Energy for co-generation connections.
- B. Basis of design as manufactured by Square D Company. All other manufacturers shall require Pinellas County approval prior to submission.

**1.2 PRODUCTS**

- A. Ratings:
  - 1. Nominal System Voltage: 480/277 V, 4 wire, 60 Hz.
  - 2. Main-Bus Continuous: 4000A.
- B. Fabrication: Factory assembled and tested and complying with IEEE C37.20.1 and UL 1558.
- C. Indoor Enclosure: Steel.
- D. Section barriers between main and tie circuit-breaker compartments.
- E. Bus isolation barriers.
- F. Individual Circuit-breaker compartments.
- G. Removable, hinged, rear cover panels.
- H. Auxiliary Compartments:
  - 1. Utility metering compartment.
  - 2. Bus transition sections.
  - 3. Incoming-line pull sections.
  - 4. Hinged front panels.
  - 5. Pull box on top of switchgear.
- I. Bus bars connect between vertical sections and between compartments.
  - 1. Neutral Bus: 100 percent of phase-bus ampacity.
  - 2. Phase and Neutral Bus: Copper.
  - 3. Copper ground bus.
  - 4. Bus-bar insulation.
  - 5. Isolated horizontal bus

**Specifications**

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**1.3 COMPONENTS**

- A. Instrument Transformers:
  - 1. Potential transformers.
  - 2. Current transformers.
- B. Instruments: Multifunction digital-metering monitor.
- C. Relays: Utility grade relays as approved by Duke Energy to enable parallel operation with the utility for co-generation.
- D. Surge arresters.
- E. Control Power Supply: Dry-type transformer, 120 V.
- F. Circuit Breakers:
  - 1. Operating Mechanism: Mechanically and electrically trip-free, stored-energy type.
    - a. Normal closing speed.
    - b. Slow closing speed.
    - c. Stored-Energy Mechanism: Electrically charged.
    - d. Operation counter.
  - 2. Solid-state trip devices with Long Time, Short Time, ground fault and instantaneous trip. Trip Units shall have full metering capabilities including harmonic content and be suitable for power monitoring network connections.
  - 3. Auxiliary contacts.
  - 4. Padlocking provisions.
  - 5. Operating handle.
  - 6. Electric close button.
  - 7. Mechanical interlocking.
  - 8. Key interlocks.
  - 9. Undervoltage Trip Devices: Adjustable.
  - 10. Shunt-trip devices.
  - 11. Drawout construction
  - 12. Indicating lights.
- G. Circuit-Breaker Removal Apparatus: Overhead device, track mounted.
- H. Spare-fuse cabinet.
- I. Identification: Mimic bus.

**Specifications**

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**1.4 FIELD QUALITY CONTROL**

- A. Prepare for acceptance tests as follows:
1. Test insulation resistance for each switchgear bus, component, connecting supply, feeder, and control circuit.
  2. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
1. Inspect switchgear installation, including wiring, components, connections, and equipment. Test and adjust components and equipment.
  2. Verify that electrical control wiring installation complies with manufacturer's submittal by means of point-to-point continuity testing. Verify that wiring installation complies with requirements in Division 26 Sections.
  3. Complete installation and startup checks according to manufacturer's written instructions.
  4. Assist in field testing of equipment including pretesting and adjusting of equipment and components.
  5. Report results in writing.
- C. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- D. Perform the following field tests and inspections and prepare test reports:
1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:
    - a. Switchgear.
    - b. Circuit breakers.
    - c. Protective relays.
    - d. Instrument transformers.
    - e. Metering and instrumentation.
    - f. Ground-fault systems.
    - g. Battery systems.
    - h. Surge arresters.
    - i. Capacitors.
  2. Remove and replace malfunctioning units and retest as specified above.
- E. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchgear. Remove front and rear panels so joints and connections are accessible to portable scanner.
1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchgear 11 months after date of Substantial Completion.
  2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.



### **Specifications**

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3. Record of Infrared Scanning: Prepare a certified report that identifies switchgear checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

END OF SECTION 26 23 00



## **26 24 13 - SWITCHBOARDS**

### **1.1 QUALITY ASSURANCE**

- A. Quality Standards: NEMA PB 2, NFPA 70, and UL 891.

### **1.2 PRODUCTS**

- A. Manufactured Units:

- 1. Front-connected, front-accessible switchboards.
    - a. Main Devices: Fixed, individually mounted.
    - b. Branch Devices: Panel mounted.
    - c. Sections front and rear aligned.
  - 2. Front- and side-accessible switchboards.
    - a. Main Devices: Fixed, individually mounted.
    - b. Branch Devices: Panel mounted.
    - c. Sections front and rear aligned.
  - 3. Front- and rear-accessible switchboards.
    - a. Main Devices: Fixed, individually mounted.
    - b. Branch Devices: Fixed, individually mounted.
    - c. Sections rear aligned.
  - 4. Nominal System Voltage: 480Y/277 V
  - 5. Main-Bus Continuous: See riser for amperage.
  - 6. Constructed to withstand seismic forces.
  - 7. Indoor Enclosures: Steel, NEMA 250, Type 1.
    - a. Finish: Standard gray.
  - 8. Basis of design is Square D Company. Other manufacturers shall be approved by Pinellas County prior to submission
- B. Disconnecting and Overcurrent Protective Devices:
    - 1. Molded-case circuit breaker (MCCB), with series-connected rating to meet available fault currents.
      - a. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and field-adjustable settings.
      - b. Accessories:
        - 1) Lugs: Compression style.
        - 2) Ground-Fault Protection: Integrally mounted.
        - 3) Communication Capability: Circuit-breaker-mounted communication module.

**Specifications**

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- 4) Shunt trip.
      - 5) Undervoltage trip.
      - 6) Auxiliary Contacts: Two SPDT switches.
      - 7) Key interlock kit.
    - 2. Insulated-Case Circuit Breaker (ICCB): 100 percent rated, fixed mounting.
      - a. Full-function microprocessor-based trip units.
      - b. Remote trip indication and control.
      - c. Communication capability.
      - d. Key interlock kit.
      - e. Control Voltage: 120-V ac.
  - C. Instrumentation:
    - 1. Instrument Transformers:
      - a. Potential transformers.
      - b. Current transformers.
      - c. Control-power transformers.
      - d. Current transformers for neutral and ground-fault current sensing.
    - 2. Multifunction digital-metering monitor.
    - 3. Ammeters, voltmeters, and power-factor meters.
    - 4. Instrument switches.
  - D. Control Power: 120-V ac with electrically interlocked main and tie circuit breakers.
  - E. Accessories:
    - 1. Accessory set including tools.
  - F. Identification:
    - 1. Mimic bus continuously integrated, factory applied to front of switchboard.
    - 2. Painted graphics.
    - 3. Service equipment label.
- 1.3 FIELD QUALITY CONTROL
- A. Testing: By Contractor-engaged agency.
  - B. Tests: Infrared scanning.

END OF SECTION 26 24 13

**26 24 16 - PANELBOARDS****1.1 QUALITY ASSURANCE**

- A. Quality Standards: NEMA PB 1 and NFPA 70.

**1.2 PRODUCTS**

A. General Requirements for Panelboards:

1. Constructed to withstand seismic forces.
2. Enclosures: Flush and surface mounted.
  - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
  - b. Outdoor Locations: NEMA 250, Type 3R.
  - c. Kitchen and Wash-Down Areas: NEMA 250, Type 4X , stainless steel.
  - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4X stainless steel.
  - e. Front: Hinged cover.
  - f. Directory card.
3. Incoming Mains Location: Top and bottom.
4. Phase, Neutral, and Ground Buses: Copper.
  - a. Optional Buses: Equipment ground, extra-capacity neutral.
5. Conductor Connectors: Compression -type main and neutral lugs.
  - a. Optional Features: Compression feed-through lugs, sub-feed lugs and extra-capacity neutral lugs.
6. Panelboard Short-Circuit Current Rating: Rated for NRTL labeled series-connected system with integral or remote upstream overcurrent protective devices.
7. Basis of Design is Square D Company. Other manufacturer's to be approved by Pinellas County prior to submission.

B. Distribution Panelboards:

1. Mains: Circuit breaker or Lugs only see design criteria.
2. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

C. Lighting and Appliance Branch-Circuit Panelboards:

1. Mains: Circuit breaker or lugs only.
2. Branch Overcurrent Protective Devices: Bolt-on circuit-breaker type.

D. Disconnecting and Overcurrent Protective Devices:

1. Molded-Case Circuit Breaker: Series-connected rating to meet available fault currents.



## Specifications

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- a. Circuit Breakers: Thermal-magnetic, adjustable instantaneous-trip, GFCI and AFCI types.
- b. Features and Accessories:
  - 1) Lugs: Mechanical style.
  - 2) Appropriate for Application: Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
  - 3) Ground-Fault Protection: Integrally mounted relay and trip unit.
  - 4) Shunt Trip: 24-Vtrip coil.
  - 5) Handle padlocking devices.

### 1.3 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged independent agency..
- B. Tests: Infrared scanning.

### 1.4 ADJUSTING

- A. Load balancing.

END OF SECTION 26 24 16



## Specifications

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### 26 27 26 - WIRING DEVICES

#### 1.1 PRODUCTS

- A. Receptacles: Duplex, 125 V, 20 A.
  - 1. Straight Blade: Specification grade.
  - 2. GFCI: Non-feed through, specification grade.
  - 3. Twist-locking type.
- B. Pendant cord-connector devices with external cable grip.
- C. Cord and plug sets.
- D. Snap Switches: 120/277 V, 20 A.
  - 1. Pilot light switches.
  - 2. Key-operated switches.
  - 3. Single-pole, double-throw, momentary contact, center-off switches.
  - 4. Key-operated, single-pole, double-throw, momentary contact, center-off switches.
- E. Wall-Box Dimmers:
  - 1. Modular, full-wave, solid-state units with slider control.
    - a. LED: Soft tap or other quiet switch; EMI/RFI filter to eliminate interference. Illuminated when "OFF."
    - b. Fluorescent: Trim potentiometer for low-end dimming.
- F. Occupancy Sensors:
  - 1. Long-Range Wall-Switch Sensors: Dual-technology type with adjustable time delay.
- G. Wall Plates:
  - 1. Material for Finished Spaces: Satin-finished stainless steel in secure spaces with tamperproof screws and Thermoplastic in non-secured public spaces.
  - 2. Material for Unfinished Spaces: Galvanized steel.
  - 3. Material for Damp and Wet Locations: Cast aluminum.
- H. Floor Service Fittings: Modular, dual service, with power receptacle and voice and data communication outlet.
  - 1. Type: Flush.
  - 2. Service Plate: Rectangular, brass.
- I. Poke-Through Assemblies: Below-floor junction box with multichanneled, through-floor raceway/firestop and detachable floor service outlet assembly.
  - 1. Service Outlet Assembly: Flush type.



## Specifications

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- 2. Size: 4 inch .
- J. Multioutlet Assemblies: Metalraceways.
- K. Finishes:
  - 1. Connected to Normal Power System: Per Architect.
  - 2. Connected to Emergency Power System: Red.

END OF SECTION 26 27 26



## Specifications

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### 26 28 13 - FUSES

#### 1.1 QUALITY ASSURANCE

- A. Quality Standards: NEMA FU 1 for cartridge fuses and UL 248-11 for plug fuses.

#### 1.2 PRODUCTS

- A. Cartridge Fuses: Nonrenewable.
- B. Plug Fuses: Nonrenewable.
- C. Plug-Fuse Adapters: For using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets.
- D. Spare-Fuse Cabinet: Wall-mounted steel unit with fuse pullers for each size of fuse.

#### 1.3 FUSE APPLICATIONS

- A. Cartridge Fuses:
  - 1. Motor Branch Circuits: Class RK1, time delay or as required by the manufacturer.
  - 2. Other Branch Circuits: Class J, time delay.
  - 3. Control Circuits: Class CC, time delay.

END OF SECTION 26 28 13







## Specifications

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### 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

#### 1.1 PRODUCTS

##### A. Fusible Switches:

1. Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, Type HD.
  - a. Equipment ground kit.
  - b. Neutral kit.
  - c. Class R fuse kit.
  - d. Auxiliary contact kit.
  - e. Hookstick handle.
  - f. Lugs: Mechanical.
  - g. Accessory control power.

##### B. Nonfusible Switches:

1. Heavy Duty, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, Type HD.
2. Accessories:
  - a. Equipment ground kit.
  - b. Neutral kit.
  - c. Auxiliary contact kit.
  - d. Hookstick handle.
  - e. Lugs: Mechanical.
  - f. Accessory control power.

##### C. Molded-Case Circuit Breakers:

1. Thermal-magnetic type.
2. Adjustable instantaneous-trip type.
3. Electronic-trip type.
4. GFCI type.
5. Features and Accessories:
  - a. Lugs: Mechanical.
  - b. Shunt trip.
  - c. Undervoltage Trip: 35 to 75 percent of rated voltage without intentional time delay.
  - d. Auxiliary Contacts: Two SPDT switches.
  - e. Accessory control power.

##### D. Enclosures:

1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
2. Outdoor Locations: NEMA 250, Type 3R.
3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4x, stainless steel.



**Specifications**

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1.2 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged independent agency.
- B. Tests: Infrared scanning.

1.3 Adjusting

- A. Set field-adjustable circuit-breaker trip ranges.

END OF SECTION 26 28 16



## Specifications

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### 26 32 13 - ENGINE GENERATORS

#### 1.1 SUMMARY

- A. Packaged gas-engine generator sets with size as indicated on the drawings and as outlined in project narrative.

#### 1.2 QUALITY ASSURANCE

- A. Quality Standard: NEMA MG 1 and NFPA 37.
- B. Emergency Power Supply System: NFPA 110, Level 2.
- C. Safety Standard: ASME B15.1.

#### 1.3 PROJECT CONDITIONS

- A. Environmental Conditions: 5 to 40 deg C and 1000 feet

#### 1.4 WARRANTY

- A. Materials and Workmanship: Five years from the date of substantial completion.

#### 1.5 MAINTENANCE SERVICE

- A. Full-Maintenance Service: 12 months from the date of substantial completion.

#### 1.6 ENGINE-GENERATOR SET

- A. Output Connections: Three-phase, four wire.
- B. Performance: Suitable for loads involving sensitive electronic equipment, adjustable frequency drives, or uninterruptible power supply systems.
- C. Fuel: Natural gas.
- D. Governor: Adjustable isochronous, with speed sensing.
- E. Engine Cooling System: Integral radiator. Refer to Mechanical Sections for additional information.
- F. Engine Exhaust System: Refer to Mechanical Sections
- G. Combustion-Air Intake: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element.

## Specifications

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- H. Starting System: Electric motor, 24 V, with battery and battery charger.
- I. Control and Monitoring: Automatic starting; with control devices grouped on panel mounted on generator sets.
  - 1. Connection to data link for building automation system or building monitoring and control system.
  - 2. Common remote audible alarm.
  - 3. Remote alarm annunciator.
  - 4. Remote emergency-stop switch.
- J. Generator Overcurrent and Fault Protection:
  - 1. Generator Circuit Breaker: Molded-case, electronic-trip type.
  - 2. Generator disconnect switch.
  - 3. Microprocessor-based generator protector.
  - 4. Ground-fault indication.
- K. Generator: Directly connected to engine shaft, with drip-proof enclosure and solid-state voltage regulator.

### 1.7 SOURCE QUALITY CONTROL

- A. Testing: Project specific at factory including factory witness test as required by Pinellas County
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- C. Perform tests and inspections and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
  - 1. Perform tests recommended by manufacturer and each electrical test and visual and mechanical inspection except those indicated to be optional for "AC Generators and for Emergency Systems" specified in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
  - 3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
    - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
    - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.

**Specifications**

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- c. Verify acceptance of charge for each element of the battery after discharge.
    - d. Verify that measurements are within manufacturer's specifications.
  - 4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
  - 5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
  - 6. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
  - 7. Exhaust Emissions Test: Comply with applicable government test criteria.
  - 8. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.
  - 9. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.
  - 10. Noise Level Tests: Measure A-weighted level of noise emanating from generator-set installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.
- E. Coordinate tests with tests for transfer switches and run them concurrently.
- F. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- G. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- J. Remove and replace malfunctioning units and reinspect as specified above.
- K. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.
- L. Report results of tests and inspections in writing within two weeks to Owner/Engineer. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.



## Specifications

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- M. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner. Infrared scan shall be conducted when unit is under load.
  - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
  - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 1.8 INSTALLATION

- A. Mounting: On concrete base with restrained-spring vibration isolators

### 1.9 FIELD QUALITY CONTROL

- A. Testing: By Contractor-independent engaged testing firm. .

END OF SECTION 26 32 13

**26 36 00 - TRANSFER SWITCHES****1.1 SUMMARY**

- A. Transfer switches rated 600 V and less.

**1.2 QUALITY ASSURANCE**

- A. Quality Standards: NEMA ICS 1, NFPA 70, **NFPA 110**, and UL 1008.

**1.3 PRODUCTS**

- A. General:

- 1. Solid-state controls.
- 2. Resistant to damage by voltage transients.
- 3. Solenoid or electric-motor operated.
- 4. Designed for continuous-duty, repetitive transfer of full-rated current.
- 5. **Neutral switched** for four-pole switches.
- 6. Neutral terminals for single-phase, three-wire or three-phase, four-wire systems without neutral switching.
- 7. Oversize neutrals.
- 8. Battery charger for generator starting batteries.
- 9. Annunciation, control, and programming interface components.
- 10. Enclosures: NEMA 250, Type 1.

- B. Automatic Transfer Switches: NFPA 110, Level 1.

- 1. Type: Double throw contactor type
- 2. Manual Switch Operation: Under load.
- 3. Signal-before-transfer contacts.
- 4. Digital communication interface.
- 5. Control Features: Automatic closed transition Features:
  - a. Undervoltage sensing for each phase of normal source.
  - b. Time delay for override of normal-source sensing.
  - c. Voltage/frequency lockout relay.
  - d. Time delay for retransfer to normal source.
  - e. Test switch.
  - f. Switch-position pilot lights.
  - g. Source-available indicating lights.
  - h. Unassigned auxiliary contacts.

- C. Bypass/Isolation Switches: NFPA 110, Level 1; manual type, arranged to connect either source of power directly to load, isolating transfer switch from load and from both power sources; factory-installed copper bus bars interconnected with automatic transfer switches.



**Specifications**

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1.4 FIELD QUALITY CONTROL

- A. Testing: By Contractor-engaged agency with Manufacturer's service representative.

END OF SECTION 26 36 00





## **26 41 13 - LIGHTNING PROTECTION FOR STRUCTURES**

### **1.1 SUMMARY**

- A. Lightning protection for structures, structure elements, building site components.

### **1.2 QUALITY ASSURANCE**

- A. Installer: Certified by LPI as a Master Installer/Designer.
- B. Quality Standards: UL 96 and NFPA 780.

### **1.3 COMPONENTS**

- A. Roof-Mounting Air Terminals: NFPA 780, aluminum.
- B. Ground Rods: Copper-clad steel.

### **1.4 INSTALLATION**

- A. Installation Standards: UL 96A and NFPA 780.
- B. Conductors to Be Concealed:
  - 1. Down conductors.
- C. Ground loop.
- D. Lightning protection components bonded with intermediate-level interconnection loop conductors at 60-foot intervals.

### **1.5 FIELD QUALITY CONTROL**

- A. Inspection: LPI System Certificate.

END OF SECTION 26 41 13





## **26 43 13 - TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS**

### **1.1 QUALITY ASSURANCE**

- A. Quality Standards: IEEE C62.41.2, IEEE C62.45, NFPA 70, NEMA LS 1, and UL 1449.

### **1.2 PRODUCTS**

- A. Service Entrance Suppressors:
  - 1. Modular design.
  - 2. Peak Single-Impulse Surge Current Rating: 320 kA per mode/640 kA per phase.
- B. Panelboard Suppressors:
  - 1. Modular design.
  - 2. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.

### **1.3 FIELD QUALITY CONTROL**

- A. Testing: By Contractor-engaged independent agency.

END OF SECTION 26 43 13



## Specifications

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### 26 51 00 - INTERIOR LIGHTING

#### 1.1 QUALITY ASSURANCE

- A. Quality Standard for Emergency Fluorescent Power Units: UL 924.

#### 1.2 WARRANTY

- A. Emergency Lighting Unit Batteries: 10 years.

#### 1.3 PRODUCTS

##### A. LED Light Fixtures

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant. LED drivers shall include the following features unless otherwise indicated:
  - a. Minimum efficiency: 85% at full load.
  - b. Minimum Operating Ambient Temperature: -20° C. (-4° F.)
  - c. Input Voltage: 120 – 277V ( $\pm 10\%$ ) at 60 Hz.
  - d. Integral short circuit, open circuit, and overload protection.
  - e. Power Factor:  $\geq 0.95$ .
  - f. Total Harmonic Distortion:  $\leq 20\%$ .
  - g. Comply with FCC 47 CFR Part 15.
2. LED modules shall include the following features unless otherwise indicated:
  - a. Comply with IES LM-79 and LM-80 requirements.
  - b. Minimum CRI 80 and color temperature 3000°K unless otherwise specified in fixture schedule.
  - c. Minimum Rated Life: 50,000 hours per IES L70.
  - d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.
  - e. Housing, LED driver, and LED module shall be products of the same manufacturer.
3. LED Troffers:
  - a. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling. Housing, LED driver, and LED module shall be products of the same.

##### B. Ballasts for Linear Fluorescent Lamps:

1. General Requirements for Electronic Ballasts:
  - a. Sound Rating: Class A ballasts.
  - b. Total Harmonic Distortion Rating: Less than 10 percent.
  - c. Transient Voltage Protection: Category A or better.
  - d. Lamp Current Crest Factor: 1.7 or less.
  - e. BF: 0.88 or higher.
  - f. Power Factor: 0.95 or higher.
  - g. Parallel Lamp Circuits: Multiple lamp ballasts connected to maintain full light output on surviving lamps if one or more lamps fail.

**Specifications**

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2. Electronic Programmed-Start Ballasts for T5, T8, T5 and T5HO Lamps:
    - a. Lamp end-of-life detection and shutdown circuit for T5 diameter lamps.
    - b. Automatic lamp starting after lamp replacement.
  3. Ballasts for Dimmer-Controlled Lighting Fixtures: Electronic type.
    - a. Dimming Range: 100 to 5 percent of rated lamp lumens.
    - b. Ballast Input Watts: Can be reduced to 20 percent of normal.
  4. Ballasts for Bi-Level and Controlled Lighting Fixtures: Electronic type.
    - a. High-Level Operation: 100 percent of rated lamp lumens.
    - b. Low-Level Operation: 30 percent of rated lamp lumens.
- C. Ballasts for Compact Fluorescent Lamps: Electronic.
1. Lamp end-of-life detection and shutdown circuit.
  2. Automatic lamp starting after lamp replacement.
  3. Sound Rating: Class A.
  4. Total Harmonic Distortion Rating: Less than 20 percent.
  5. Transient Voltage Protection: Category A or better.
  6. Operating Frequency: 20 kHz or higher.
  7. Lamp Current Crest Factor: 1.7 or less.
  8. BF: 0.95 or higher.
- D. Emergency Fluorescent Power Units:
1. Internal Type: Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture body and compatible with ballast; emergency connector operates one fluorescent lamp(s) continuously at an output of 1100 lumens each.
  2. External Type: Self-contained, modular, battery-inverter unit, suitable for powering one or more fluorescent lamps, remote mounted from lighting fixture.
- E. Ballasts for HID Lamps:
1. Electromagnetic Type for Metal-Halide Lamps: Constant-wattage autotransformer or regulating high-power-factor, low-noise type.
- F. Quartz Lamp Lighting Controller: For HID lighting units.
1. Switching Off: Automatically switches quartz lamp off when HID lamp strikes reaches approximately 60 percent light output.
- G. Exit Signs: Internally lighted.
1. Lamps for AC Operations: 50,000-hour light-emitting diodes.
  2. Self-Powered Exit Signs (Battery Type): Sealed, maintenance-free, nickel-cadmium battery with fully automatic, solid-state charger with sealed transfer relay.
- H. Emergency Lighting Units: Self-contained, with sealed, maintenance-free, lead-acid battery and fully automatic, solid-state charger, integral time-delay relay..



## Specifications

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- I. Fluorescent Lamps:
  - 1. T8 rapid-start lamps, rated 32 W maximum.
  - 2. T5 rapid-start lamps, rated 28 W maximum.
  - 3. T5HO rapid-start lamps, rated 54 W maximum.
  - 4. Compact Fluorescent Lamps: T4 double tube, rated 13, 18, 26, 32, 42W.
- J. HID Lamps:
  - 1. High-pressure sodium lamps.
  - 2. Metal-halide lamps.
  - 3. Pulse-start, metal-halide lamps.
  - 4. Ceramic, pulse-start, metal-halide lamps.
  - 5. Low-pressure sodium lamps.
- K. Lighting fixture support components.
- L. Retrofit kits for fluorescent lighting fixtures.

END OF SECTION 26 51 00







## Specifications

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### 26 56 00 - EXTERIOR LIGHTING

#### 1.1 PERFORMANCE REQUIREMENTS

- A. Pole Wind Load:
  - 1. Wind speed for poles 150 mph.

#### 1.2 QUALITY ASSURANCE

- A. Quality Standard: AASHTO LTS-4-M.

#### 1.3 WARRANTY

- A. Materials and Workmanship for Luminaires: Five years.
- B. Poles and Mast Arms Metal Corrosion: Five years.
- C. Poles and Mast Arms Color Retention: Five years.

#### 1.4 PRODUCTS

- A. Luminaire Finishes: Manufacturer's standard finish
  - 1. Steel Luminaires: Factory-painted, polyurethane enamel.
  - 2. Aluminum Luminaires: Natural satin or Class I, color anodic finish.
- B. HID Lamp Ballasts: Constant-wattage autotransformer or regulating high-power-factor type and suitable for low-temperature starting.
  - 1. Auxiliary, instant-on, quartz system.
- C. HID Lamps: Ceramic, pulse-start, metal-halide lamps.
- D. Aluminum Poles: See schedule.
- E. Pole Accessories:
  - 1. Breakaway supports.
  - 2. Duplex receptacle.
  - 3. Base covers.
  - 4. Transformer base.

END OF SECTION 26 56 00





## Specifications

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### 27 05 00 - COMMON WORK RESULTS FOR TELECOMMUNICATIONS

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION OF WORK

- A. Provide all labor, equipment, supplies and materials for the complete installation of fully functional Structured Cabling systems in accordance with the Contract Documents. Structured Cabling systems include but are not limited to:
  - 1. Telecommunications Grounding Network
  - 2. Horizontal cabling system
  - 3. Fiber optic riser system
- B. The work includes the following as well as work not listed below but described elsewhere as it applies to all Structured Cabling systems:
  - 1. Raceway and cable trays
  - 2. Telephone and data cabling terminations
  - 3. Optical fiber and terminations
  - 4. Telecommunications outlets
  - 5. Terminal blocks/cross-connect systems
  - 6. Equipment racks and cabinets
  - 7. Patch Panels
  - 8. Telecommunications grounding network
  - 9. Patch Cords and Telecommunications Outlet Cords
  - 10. Surge Protection
  - 11. Fire Stopping
  - 12. System testing
  - 13. Documentation and submissions
- C. Interpretation of Contract Documents
  - 1. The technologies that are specified by this document include telephone, data, and CATV cabling. See section 274100 for general provisions related to Audio/Visual Systems. See section 280500 for general provisions related to Security Electronics systems.
  - 2. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
  - 3. Mention in these specifications or indications and/or reasonable implications whereby articles, materials, operation or methods related to execution of the work are noted, specified, drawn or described, thereby requires execution of each such item of work and provision of all labor, materials, equipment and accessories required for execution thereof.
  - 4. No exclusions from, or limitations in, the language used in the specifications shall be interpreted as meaning that the accessories necessary to complete any required system or item of equipment are to be omitted.
  - 5. The use of words in the singular shall not be considered as limiting where other indications

## Specifications

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- denote that more than one item is referred to.
6. Furnish and install all materials for systems, resulting upon completion, in functioning systems in compliance with performance requirements specified. The omission of express reference to any parts necessary for, or reasonably incidental to, a complete installation shall not be construed as a release from furnishing such parts.
  7. Drawings are diagrammatic and indicate general arrangement of system and equipment, except when specifically dimensioned or detailed. They are to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement.
  8. Refer to dimensioned architectural/structural drawings for exact, locations of building elements.
  9. Field verification of measurements takes priority over dimensioned drawings.
  10. Dimensions indicated anywhere, are limiting dimensions.
  11. The Owner/User reserves the right to make any reasonable change in location of devices and equipment prior to rough installation without involving additional expense. All changes from the drawings as are necessary to make the work of the Contractor conform to the building as constructed shall be included and installed without extra cost.

### 1.2 SCOPE AND RESPONSIBILITY

- A. Provide full time on site field representation for Division 27 Structured Cable Systems scope of work for duration of installation and prior to turn over.
- B. Include detailed scheduling information for Structured Cabling System installation and testing in the construction schedule. Provide detailed GANTT chart construction schedule showing all tasks referenced in the project phasing plans. Include:
  1. Engineering
  2. Shop drawing preparation
  3. Shop Fabrication
  4. Equipment installation
  5. Electrical Work
  6. Testing, commissioning, and training.
- C. This schedule must be submitted fourteen (14) calendar days after receipt of contract. The duration of this schedule must also comply with the completion dates of the construction schedule contained in the contract documents.
- D. Provide coordination to ensure Telecommunication spaces are completed, cleaned and have conditioned air as early as possible to facilitate completion of Structured Cabling System wiring and terminations. **Space shall be free of air-borne particles prior to installation of any Structured Cable Equipment.** The Architect shall inspect and approve the condition of these rooms prior to the installation of any active or passive equipment.
- E. Conduct periodic coordination meetings between Contractors to make everyone aware of critical areas of construction. Distribute the meeting minutes and attendance to the Owner/User's Representative, the Architect and the Owner/User in a timely fashion.
- F. Contractor shall provide coordination of mechanical and electrical installation requirement with the General Contractor and the Electrical Contractor.



## Specifications

- G. Provide coordination of the Structured Cabling system installation.
- H. Provide coordination as required to complete the inspection described in paragraph 3.1 INSPECTION.
- I. Furnish and install a complete conduit raceway system including back boxes, junction boxes, mortar boxes, and cable tray for all structured cable systems. The conduit size shall allow for a maximum conductor fill of 40% in accordance with NEC guidelines. Unless noted otherwise on the drawings.
- J. Inspect conduit raceway system including back boxes, junction boxes, and mortar boxes for all Structured Cabling systems furnished by others. Notify the Architect of any discrepancies immediately.
- K. Conduit between telecommunications outlet and cable tray shall be continuous.
- L. Conduit from telecommunications outlets shall continue from box to location above accessible ceiling. J-hook shall be used to support cabling from conduit stub to cable tray. Maximum spacing of J-hooks shall not exceed 5'.
- M. Furnish and install all nonstandard back boxes.
- N. Furnish and install all equipment racks and cabinets.
- O. Furnish and install Telecommunications Grounding System as shown in the Project Documents. Provide connection of the Telecommunications Grounding System to the electrical ground system per NEC, and as shown in the Project Documents.
- P. Furnish all 120 volt AC wiring and connections for power panels and/or terminal strips in electrical panels, cabinets, enclosures, and or consoles, as indicated in the contract documents and approved shop drawings.
- Q. Furnish and install all devices, equipment, and appurtenances resulting in complete, functional, and fully operational systems as specified herein, indicated on the drawings and listed below;
  - 1. Section 270526 – Ground and Bonding for Telecommunications
  - 2. Section 271116 – Cabinets and Enclosures for Telecommunications
  - 3. Section 271120 – CATV Systems
  - 4. Section 271300 – Backbone Cabling for Telecommunications
  - 5. Section 271500 – Horizontal Cabling for Telecommunications
- R. Provide a detailed installation, which, is prepared and certified by an RCDD technician.
- S. Furnish and install the miscellaneous systems equipment and materials as required for a complete and fully functional Structured Cabling system as specified and or indicated on the drawings.
- T. Provide termination of all cabling for the Structured Cabling System.
- U. Prior to fabrication, coordinate exact location and installation of devices with other trades.
- V. Provide coordination to complete the inspection described in Paragraph 3.1 INSPECTION.



## Specifications

- W. Provide complete system test, Manufacturer's minimum 20-year performance certification and Owner/User training by the personnel responsible for the Structured Cabling System installation.
- X. Provide complete factory certified training to the Owner/User.
- Y. Coordinate the work of this Section with that of other Sections to ensure that the entire work of this project will be carried out in an orderly, complete and coordinated fashion.

### 1.3 RELATED DOCUMENTS

#### A. General

- 1. Drawings, specifications and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section. The Contractor and all subcontractors are responsible for locating information pertaining to required items of work specified or indicated elsewhere in the Contract Documents.

#### B. Related Work Specified Elsewhere

- 1. Division 00 - BIDDING REQUIREMENTS
- 2. Division 01 - GENERAL REQUIREMENTS
- 3. Division 26 - ELECTRICAL

#### C. Reference Specifications, Materials, and/or Codes

- 1. Submit all items necessary to obtain all required permits to the appropriate Regulatory Agencies obtain all required permits and pay all required fees.
- 2. All work shall conform to the National Electrical Code (NEC) and to applicable National Fire Protection Association (NFPA) codes.
- 3. All work shall conform to all Federal, State and local ordinances.
- 4. Where applicable, all fixtures, equipment and materials shall be as approved or listed by the following:
  - a) Factory Mutual Laboratories (FM).
  - b) Underwriters Laboratories, Inc. (UL).
  - c) National Electrical Manufacturers Association (NEMA).
- 5. References to the National Electrical Code and National Fire Protection Association (NFPA) are a minimum installation requirement standard. Design drawings and specification sections shall govern in those instances where requirements are greater than those specified in the NEC and NFPA.
- 6. All material and equipment shall be listed, labeled or certified by Underwriters' Laboratories, Inc. where such standards have been established. Equipment and material, which are not covered by UL Standard, will be accepted provided equipment and material are listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class, which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe will be considered, if inspected or tested in accordance with national industrial standards such as NEMA, ICEA or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings. NOTE: It is not required that the final



## Specifications

installed system be UL listed as a single product.

D. All work shall meet or exceed the standards and procedures of the following:

1. National Fire Protection Association (NFPA): NFPA 70, NFPA 72, NFPA 90A
2. National Electrical Code (NEC)
3. California Electrical Code (CEC)
4. American National Standards Institute (ANSI/EIA/TIA)
  - a) 568-C.0 Generic Telecommunications Cabling for Customer Premise
  - b) 568-C.1 Commercial Building Telecommunications Cabling Standard
  - c) 568-C.2 Balanced Twisted Pair Telecommunications Cabling and Component Standard
  - d) 568-C.3 Optical Fiber Cabling Components Standard.
  - e) 569-B Commercial Building Standard for Telecommunications Pathways and Spaces
  - f) 598-B Commercial Building Standard for Telecommunications Optical Fiber Cable Color Coding.
  - g) 606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings.
  - h) 607 Commercial Buildings Grounding (Earthing) and Bonding Requirements for Telecommunications
  - i) 758-A Customer Owned Outside Plant Telecommunications Cabling Standard.
  - j) TSB-67 Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems.
5. All work shall meet or exceed the standards and procedures of the following:
  - a) National Fire Protection Association (NFPA)
  - b) National Electrical Code (NEC)
  - c) American National Standards Institute (ANSI)
  - d) National Electrical Manufacturers Association (NEMA)
  - e) American Society of Testing Materials (ASTM)
  - f) Institute of Electronic & Electrical Engineers (IEEE)
  - g) Underwriters Laboratory (UL)
  - h) Americans With Disabilities Act (ADA)

E. Include all items of labor and material required to comply with such standards and codes. Where quantity, sizes or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specifications or drawings, respectively, shall govern.

F. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of the current local codes and any additional authorities having jurisdiction.

### 1.4 QUALITY ASSURANCE

A. General

1. Furnish and install only new equipment and materials required (less than 1 year from manufacture), unused without blemish or defect.
2. Each major component of equipment shall have the manufacturer's name, address, model

## Specifications

number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable. NEMA Code Ratings, UL label, or other data, which is die-stamped into the surface of the equipment, shall be stamped in a location easily visible. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases, equipment is oversized to allow for pickup loads which cannot be delineated under the minimum performance.

3. All equipment of the same type shall be the product of one manufacturer.
4. The original factory condition of manufactured equipment shall not be modified without the written approval of the Architect.

### B. Qualifications

1. The Contractor shall have been in existence for a minimum of 5 years.
2. The Contractor shall specialize in the installation of Structured Cabling systems of equal scope, quality, type, and complexity to that required herein.
3. The Contractor shall be a member in good standing in BICSI for at least 5 years prior to bid time. Provide verification of membership.
4. The Contractor will own, at time of bid, all required testing equipment called for in the specifications. Technicians responsible for operating testing equipment will have successfully completed all manufacturers approved training courses for the successful operation of the testing equipment.
5. The Contractor shall be an authorized dealer for the Structure Cabling solution for at least one year prior to bid time. This is to include fiber optic cable, copper unshielded twisted pair cable, and jacks and patch panels.
6. The principal members and key personnel to be assigned to the project shall each have a minimum of 10 years experience in completing projects of equal scope, quality, type, and complexity to that required herein.
7. Minimum of five Structured Cabling Systems, of similar size and scope, installed and operational for a minimum of one year.
8. Minimum of one BICSI Registered Communications Distribution Designer (RCDD) employed or contracted by the Contractor.
9. Project Lead Technician
  - a) Trained and certified by the Structured Cabling System solution manufacturer.
  - b) Minimum 5 years experience as Lead Technician on Structured Cabling System projects of similar size and scope.
  - c) BICSI Installer Level 2 certification.
10. Project Technicians
  - a) Trained and certified by the Structured Cabling System solution manufacturer.
  - b) Minimum 2 years experience on Structured Cabling System projects of similar size and scope.
  - c) BICSI level 1 or level 2 installer certification.
  - d) Local services facility within 100-mile radius of project location.

### C. Qualification Proposal Requirements





## Specifications

1. THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING DOCUMENTED PROOF THAT ALL QUALIFICATIONS HAVE BEEN MET. THE FOLLOWING DOCUMENTATION IS REQUIRED WITHIN 48 HOURS OF THE BID OPENING FOR THE APPARENT LOW BIDDER AND THE RUNNER UP. QUALIFICATION PROPOSAL SHALL INCLUDE THE FOLLOWING-
  - a) A history of the Contractor that reflects the length of time they have performed services similar to those required for this project.
  - b) Contractor Qualification Statement AIA-305A
  - c) Audited financial statement for the previous year.
  - d) Name, address, and telephone number of organization's current Bonding company and level of bonding capacity.
  - e) Resume's of the principal members and key personnel of the organization indicating a minimum of 10 years experience each in successfully completing projects of equal scope, quality, type and complexity to that required herein. Include resume(s) of personnel in the employ of the organization that have at least 5 years experience in the design, fabrication, and installation of comparable systems. Include a delineation of each individual's responsibilities on this project. Resumes must include information about the individual experience and systems integration capabilities.
  - f) Provide a description of installation capabilities and indicate:  
  
Name, registration number and resume of certifying BICSI RCDD.  
Name, Structured Cabling System solution manufacturer certification number and resume of Lead Technician.  
Name, Structured Cabling System solution manufacturer certification number and resume of Technician(s).  
Name and resume of the project manager that will be assigned the project.
  - g) List of at least 5 comparable, completed projects (of similar size and scope, on which work has been performed, that have been operational for minimum of 1 year. Include for each facility the following:  
  
Name and location of project.  
Date of occupancy.  
Name, address, and telephone number of Owner/User.  
Name, address, and telephone number of Architect.  
Name, address, and telephone number of organization's Bonding Company for the individual project.  
A description of the systems involved, the construction dates, and the contract amount for the equipment and services provided.
  - h) List of all projects, within the last 5 years, in which the Contractor has been involved in litigation with a City, County, State or Federal government agency. Include summary of final decisions and status of pending litigation.
  - i) The Contractor shall be an authorized dealer for at least 75% of the equipment specified for at least one year prior to bid time. Provide line list of all manufactures represented and period of time represented.
  - j) Complete list of all testing equipment and date of purchase. Include serial numbers for each piece of equipment.



## Specifications

- k) The technical proposal shall also indicate an understanding of the scope, quality, and technical aspects of the work and shall include the following:
  - a. A technical description of the Contractors approach to implementing each of the major systems included in the work. Interfaces with other contractor's work, if any, must be specifically addressed.
  - b. For each major system, a delineation of the tasks to be performed by the Contractor's staff and those tasks, if any, to be performed by subcontractors.
  - c. A list of major systems components, including the equipment manufacturer's product numbers, to be used on this project. Detailed technical specifications and catalog cut sheets must accompany any proposed substitutions for the specified equipment in accordance with Division 1 requirements.
  - d. A description of the overall system integration, which shall include a functional block diagram of the integrated system. For each functional unit shown on the diagram, the Contractor shall provide a description of the functional capabilities and characteristics of the unit, including the hardware and software systems associated with the functional unit.
  - e. A functional description of the software to be furnished. Software that is currently available and software that is to be developed by the Contractor shall be identified.
- l) Copy of manufacturer's certification indicating the capability to provide a minimum 20-year guaranteed system.
- m) THE ARCHITECT WILL EVALUATE ALL QUALIFICATION PROPOSALS. THE CONTRACTOR WILL BE REQUIRED TO MEET ALL QUALIFICATIONS LISTED PRIOR TO THE SUBMISSION OF THE SYSTEM SHOP DRAWING SUBMITTALS.

### 1.5 SUBMITTALS

- A. Refer to Section 013300 - Submittal Procedures
- B. Duplicate copies of the bidding documents are not acceptable and will be rejected.
- C. The Contractor will participate in a MANDATORY PRE-SUBMITTAL MEETING.
  - 1. Location: Project Job Site
  - 2. Time Line: Sixty (60 days after award of contract
  - 3. Participants:
    - a) Architect
    - b) General Contractor
    - c) Electrical Contractor
    - d) Telecom Subcontractor
    - Project Manager
    - Project Estimator
  - 4. The initial assembly of submittal materials as described herein shall be submitted for review.



## Specifications

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D. Bill of Materials

1. Provide complete bill of materials for all major components, accessories, and hardware to be provided in order to assemble a complete functioning system.
2. Bill of materials shall include-
  - a) Manufacturer Name
  - b) Model
  - c) Version
  - d) Quantity

E. All submittals provided must be certified by an RCDD employee.

F. Unless stated differently in the Bidding General Provisions, provide six (6) copies of submittals as called for below.

G. The formal submittal shall be transmitted 30 days after award of contract.

H. Product Submittal

1. Submittal must consist of a complete package, bound in a three ring binder, including, Product Data for each Section of the Division 27 Structured Cable Systems, and Shop Drawings as applicable. **PARTIAL OR INCOMPLETE SUBMITTALS ARE NOT ACCEPTABLE.** The Submittal shall include the following:
2. A Title Page complete with the following required information:
  - a) Project name.
  - b) Date.
  - c) Name and address of the Architect.
  - d) Name of Construction Manager
  - e) Name and address of the Electrical Contractor
  - f) Name and address of the General Contractor
  - g) Name and address of any Subcontractors.
3. An Index Page complete with the following required information:
  - a) Name of the Supplier.
  - b) Name of the Manufacturer.
  - c) Title, section and paragraph of the Specification Sections. (Example section 271500, paragraph 2.4)
  - d) Products in order as specified in PART II of the related specification.
4. Each Specification section shall be separated, collated in order, and complete with the following information:
  - a) Title sheet.
  - b) Descriptive purpose of the system, stating how each product is to function.
5. Each Data Sheet shall have the specific reference to the Specification it is to be used for, noting

## Specifications

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- the section and paragraph.
6. Product Data showing multiple products, models or options shall be clearly marked identifying the specific product, model and options, which are submitted for review. Unmarked submittals or facsimile copies shall not be acceptable.
  7. Submit product data for all equipment showing:
    - a) Original Data Sheets Only. Fax copies are not acceptable.
    - b) Product performance, mechanical and electrical specifications.
    - c) Manufacturer's installation instructions.
    - d) Certification from the submitted manufacturers that the Contractor's designated personnel are trained on the installation of the system. Include Contractor installer's name, experience and responsibility.
    - e) Product test compliance certificates if required.
- I. Shop Drawings
1. Submittals consisting of reproduced copies of the original bidding documents will be rejected. The contractor is required to develop a complete set of drawings specific to the final configuration of the system based on the manufacture and models of all components included. Shop drawings are to include all changes noted in addenda, as well as any changes included in architects special instructions or change orders issued prior to the submittal of the shop drawings.
  2. Shop drawings shall be submitted with product data.
  3. Electronics files of floor plans and reflected ceiling plans are available from the ARCHITECT at a cost of \$150.00 per sheet. Detail sheets, block diagrams, and riser sheets are not available.
  4. All drawings shall be created using an industry recognized computer aided design program. Recognized programs include AutoDesk Revit, AutoCAD, and Microstation. All drawings are to be made using the latest software release available.
  5. Submit shop drawings for all equipment showing:
    - a) Location and type of all field equipment on floor plans.
      - f. Telecommunications Outlets Of All Types
      - g. Wall Phone Outlets
      - h. Telecommunication Rooms
      - i. Equipment Rooms
    - b) Large scale (minimum 1/4"=1') floor plan and elevation view drawings of all telecommunications closets depicting all racks, consoles, cabinets, equipment, outlets, etc.
    - c) Size and spacing of all anchors, wall penetrations, joinery construction, etc., required for complete system installation.
    - d) Electrical riser diagrams identifying all signal, power, and ground circuitry.
    - e) Elevations of all equipment racks showing equipment mounting locations (front and rear if any equipment is rear mounted).
    - f) Wall elevations showing mounting of cabinets, and wall mount hardware and electronics.
    - g) Wire management details for the installation of cable harnesses inside racks, equipment cabinets and other areas of exposed cable.

## Specifications

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- h) Block diagrams depicting wire connectivity to all data closets.
- i) Wiring diagrams for all equipment and devices (active and passive).
  - j. Wiring diagrams are required to show point to point connection of all terminations for all devices.
  - k. Indicate wire type used for connection.
  - l. Indicated type of termination to be made.
- j) Equipment Room layout, Telecommunications Relay Rack elevations and fiber management panel layout drawings
- k) Telecommunication Room layout and Telecommunications Relay Rack elevations and fiber management panel layout drawings
- l) Telecommunication Backboard layouts
- m) Telecommunication Grounding system

### J. Samples

1. Provide samples as requested for review and approval of substitutions or as specified in Division 27 Structured Cable Systems specifications.

### K. Test Plan and Documentation

1. Submit a complete testing plan for all systems for approval within thirty (30) days of receipt of approved shop drawing/product data submittal.
2. Plan submitted must include shop and field testing of each and every field device and control function. Refer to standards for more detailed testing requirements for structured UTP and fiber optic cabling.
3. Plan submitted must include examples of testing documentation. Testing documentation must be submitted when requesting final Demonstration/Inspection (described below).
4. Detailed testing agenda and testing documentation forms for all systems. Detailed agenda outlining the "hands-on" training sessions to be provided to the Owner/User. The operation, programming/debugging, troubleshooting, repair and maintenance of all systems shall be covered.

### L. Training Plan and Documentation

1. Submit a complete training plan for all systems for approval.
2. As a minimum, the plan submitted must include individualized training paths for the following personnel on all aspects of the Structured Cabling system.
  - a) Administrators
  - b) Supervisors
  - c) Operators
  - d) Maintenance Personnel
3. As a minimum, the plan submitted must include the following:
  - a) Proposed classes or sessions.
  - b) Recommended attendees for each class or session.

## Specifications

- c) Proposed class or session objectives.
  - d) Proposed class or session agenda and duration.
  - e) Proposed supporting materials for each class or session.
  - f) Proposed testing procedure for evaluation purposes.
  - g) Proposed documentation of testing and evaluation.
- 4. Do not commence training until the plan has been approved.
  - 5. Plan submittal must include names of technical instructors. Contractor must provide engineer responsible for project as instructor. Contractor instructor shall submit evidence of factory training on system provided.

### M. Operating and Maintenance Data

- 1. Provide three (3) copies of each operating and maintenance manual for each Division 27 Structured Cable Systems. Manuals shall be bound in "D-ring" binders with a detailed table of contents.
- 2. The O & M manuals shall be cross-referenced to the Record Documents and contain the following information for all systems:
  - a) Product catalog cut sheets and specifications of all equipment.
  - b) "Hands-on" operational description of all equipment and performance features in each system using clear and understandable terminology.
  - c) Detailed programming instructions for all systems and all software programs.
  - d) Printed copy of all equipment settings. This is to include the final settings for all source level control, analog and digital processing, and amplification.
  - e) Copy of all software programs stored on floppy disc or CD. Provide one copy for each O & M Manual, and one copy that are to be left in the rear of the equipment rack.
  - f) Troubleshooting procedures to diagnose malfunctions in each system.
  - g) Repair procedures for all equipment.
  - h) Preventative maintenance procedures for all equipment.
  - i) Table listing the model numbers for all equipment in each system including the names and phone numbers of the manufacturer and their representative directly responsible for this project.

### N. Record Documents

- 1. Submit three (3) black line prints, and electronic copy of the "As-built" condition of all systems including:
  - a) A set of updated shop drawings showing all Contract changes.
  - b) A set of updated product data showing all Contract changes.
  - c) Hands on operational description of all equipment and performance features in each system using clear and understandable terminology.
  - d) Floor plan showing conduit raceway routing including all equipment rack, cabinet and pull box locations, and conduit sizes.
  - e) Complete point-to-point wiring diagrams showing **ALL** equipment, devices, wire and cable (Signal, power and ground). This document shall also include all terminal block designations, abbreviations and color-coding.
  - f) Electronic copy shall use the most recent version of the software platform used for



## Specifications

creating shop drawings.

2. Provide report showing results of all tests required and outlined in individual 270500 series specifications.
3. Two (2) copies of training session DVD.
4. Transmittal letter listing delivery of complete spare parts inventory.
5. Copy of warranty statement.
6. Procedures for addressing warranty/repair issues.

### 1.6 ADDITIONAL CONSTRUCTION ADMINISTRATION SERVICES BY THE ARCHITECT

- A. The Contractor shall be obligated to reimburse the Owner/User for reasonable costs for the following additional professional services for which the Owner/User will be required to compensate the Architect. Reimbursement shall be on an hourly basis at the Architects standard rates, plus reasonable reimbursable expenses billed at a rate of 1.1 times the actual cost to the Architect. A deductive change order to the Contractor's sum will be processed periodically for the cost of such services incurred by the Owner/User.
1. More than two reviews of the same submittal.
  2. Responding to multiple "Requests for Information" (RFI) for which the answer is readily obtainable in the Contract Documents.
  3. Preparation and follow up review of more than one "Punch List" for the same items of work.
  4. Construction administration services that extend more than 60 days past the initial date of Substantial Completion. These services include, but are not limited to, all work associated with the following: attending pay/progress meetings, on-site observation, and processing the Application and Certification for Payment.
- B. The Architect will endeavor to notify the Owner/User and the Contractor prior to performing any work that will result in the aforementioned additional services; and to review any proposed modifications to the contract. Contract modification shall not be contingent, however, upon issuance of any such notice or prior review.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. [\[Refer to Section 016000 - Product Requirements\]](#)
- B. Products that have been in manufacture for at least one year, unless otherwise specified by performance requirements.

### 2.2 SUBSTITUTIONS

- A. Submit substitutions in accordance with [\[Section 016000 – Product Requirements\]](#). No other method of substitution is acceptable.
- B. Deviations from specifications
1. Any deviations from the specifications must be approved 10 calendar days prior to the bid date.

**Specifications**

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- This includes changes to the scope of work, equipment substitutions, and changes to the general provision.
2. Changes to the scope of work in the bid proposal are not acceptable. Any proposed change is to be submitted to the Architect for review. Any approved changes will be listed by addendum prior to the bid opening.
  3. Any proposed equipment substitution must be submitted 10 calendar days prior to the bid date. Accompany the request, the Contractor must provide manufactures product specifications for the exact model be substituted. This literature must clearly state all specifications called for in the bidding documents, as well as performance characteristics not specified but inherent to the product listed in the specifications. Any items approved as a substitute will be listed by addendum prior to the bid opening. Substitutions after the award of bid will only be allowed in case of discontinued equipment, or if an item of equal or better quality is available and will not affect the contract cost of the system.
  4. Changes to the general provisions are not acceptable. Any proposed change is to be submitted to the Architect for review. Any approved changes will be listed by addendum prior to the bid opening.
  5. When a specified item is found to be discontinued or obsolete by the manufacturer, the contractor is required to substitute the manufacturer recommended equivalent for that product. If an equivalent is not available, the contractor is instructed to notify the Architect in writing prior to bid time.
- C. Where specific products are sole source specified, no substitutions will be allowed.
- 2.3 MANUFACTURED PRODUCTS
- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are readily available.
- B. Equipment Assemblies and Components
1. All components of an assembled unit need not be products of the same manufacturer; however, all components must be acceptable to the Architect.
  2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  3. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer.
  4. Components shall be compatible with each other and with the total assembly for the intended service.
  5. Constituent parts which are similar shall be the product of a single manufacturer.
- C. All factory wiring shall be identified on or provided with the equipment being furnished and on all wiring diagrams and included with O & M manuals.
- D. When factory testing is specified
1. The Architect shall have the option of witnessing factory tests. The Contractor shall notify the Architect a minimum of 15 working days prior to the manufacturers making the factory tests.
  2. Four copies of certified test reports containing all test data shall be furnished to the Architect prior to final inspection and not more than 90 days after completion of tests.





## Specifications

3. When equipment fails to meet factory test and reinspection is required, the Contractor shall be liable for all additional expenses.

### 2.4 EQUIPMENT IDENTIFICATION

- A. In addition to the requirements of the National Electrical Code, install an identification sign which will clearly indicate information required for use and maintenance of items such as cabinets, control devices and other significant equipment.
- B. Nameplates shall be laminated black phenolic resin with a white core and engraved lettering, a minimum of 1/4-inch high. Nameplates that are furnished by manufacturer, as a standard catalog item, or where other methods of identification are herein specified, are exceptions.
- C. All inputs and outputs are to be clearly labeled. Inputs to include the source location and signal type. Outputs should indicate location signal is sent to.
- D. All custom input plates labeling shall be engraved and paint filled or laser etched with a contrasting color as shown on the specification.
- E. Any and all user serviceable devices shall be clearly labeled

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Before installing equipment, carefully inspect the installed Work of all other Trades. Verify that all such Work is complete to the point where the installation of electronic equipment may properly commence. Verify that the telecommunications closets are free of airborne contaminants prior to the installation of electronic equipment.
- B. Verify that all equipment is installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.
- C. In the event of discrepancy, immediately notify the Architect.
- D. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.
- E. Return to original (preconstruction) condition any work disturbed during system installation.

### 3.2 INSTALLATION

- A. Install all equipment in strict accordance with the manufacturer's recommendations, reviewed shop drawings, BICSI TDM 12<sup>th</sup> edition, and EIA/TIA Standards for UTP and fiber optic cable.
- B. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.
- C. Secure equipment with fasteners suitable for the use, materials, and loads encountered. If requested,

**Specifications**

submit evidence proving suitability. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.

- D. National Electrical Code requirements are applicable to all work.
- E. Working spaces shall be not less than specified in the National Electrical Code for all voltages specified.
- F. Where the Architect determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Owner/User. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and duct work.

**3.3 WORK PERFORMANCE**

- A. Coordinate location of equipment with other trades to minimize interferences.
- B. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Architect as required by limited working space.
- C. Holes shall not affect structural sections such as ribs or beams.
- D. Holes shall be laid out in advance. The Architect shall be advised prior to drilling through structural sections for determination of proper layout.
- E. Any holes created in walls, floors, or ceilings by the Contractor are to be sealed with a fire rated caulking according to all national, state, and local codes.
- F. Hangers and other supports shall support only equipment and materials. Provide not less than a safety factor of 5, which shall conform to any specific requirements in the Construction Documents.
- G. The Contractor is responsible for repairing and or replacing any damage caused by their workforce at no additional cost to the Owner/User, or the Owner/User's representatives.

**3.4 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT**

- A. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.
- B. Prevent damage from rain, dirt, sun and ground water by storing equipment on elevated supports and covering all sides with securely fastened protective rigid or flexible waterproof coverings.
- C. Protect piping by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.
- D. During construction, cap the top of all conduits and raceway installed vertically.

## Specifications

- E. During installation, protect equipment against entry of foreign matter on the inside, and vacuum clean both inside and outside before testing and operating.
- F. Damaged equipment, as determined by the Architect, shall be replaced.
- G. Protect painted surfaces with removable heavy kraft paper, sheet vinyl or equal, installed at the factory and removed prior to final inspection.
- H. Repaint damaged "FINISH" paint on equipment and materials with painting equipment and finished with same quality of paint and workmanship as used by the original manufacturer so repaired areas are not obvious.
- I. Conduit back boxes, floor boxes, and poke thru's shall be vacuumed clean prior to the installation of cable.

### 3.5 IDENTIFICATION

- A. Nameplates shall be laminated black phenolic resin with white core and engraved lettering, a minimum of ¼ inch high. Nameplates that are furnished by manufacturer, as a standard catalog item, or where other methods of identification are herein specified, are exceptions.
- B. Uppercase letters of uniform height; centered on device, cover plate, or enclosure; engraved letters filled with a contrasting color; and all characters made clearly and distinctly.
- C. Use abbreviations defined in the contract documents whenever possible. Use plan designations for labeling unless indicated otherwise.

### 3.6 LABELING

- A. All cables shall be properly identified using a high quality thermal transfer labeling device such as the Kroy K4100 or equal.
- B. Cable
  - 1. Provide typewritten labels on both ends of all system cabling. Locate label within 6" of cable termination. Cover label with clear heat shrink tubing.
- C. Power Outlets
  - 1. Power outlet labels are to be mechanically generated.
  - 2. All power outlets designated for equipment shall be labeled on top.
  - 3. Provide a second label on the bottom of the outlet cover plate indicating service panel number and circuit breaker number.
  - 4. Text lettering to be 1/8" high.
- D. Rack Mounted Electronic Components
  - 1. Electronic component labels are to be mechanically generated.
  - 2. All inputs are to be labeled identifying source location of signal.



## Specifications

3. All outputs are to be labeled identifying signal destination.
4. Provide ¼" diameter indicator dot showing level setting for all rotary knobs, sliders, and pushbutton switches.
5. Power switches shall be clearly labeled indicating switch is to be left in the on position at all times.

### 3.7 CABLE TERMINATIONS AND DRESS

- A. Installation of communication conductors shall adhere to the following:
  1. Furnish and install cable supports as specified.
  2. All cables and/or conductors shall be terminated with approved cable termination connectors compatible with the specific termination.
  3. Label all cables on both ends and on all patch panel/termination points.
  4. Cables shall be neatly bundled using latch and hook type straps.

### 3.8 CLEANING

- A. Refer to [Section 017419 – Construction Waste Management and Disposal]
- B. Daily during construction and prior to Owner/User acceptance of the building, remove from the premises and dispose of all packing material and debris caused by work performed under Division 27 Structured Cable Systems specifications.
- C. Remove all dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.
- D. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

### 3.9 TESTING EQUIPMENT

- A. Copper Certification Tester
  1. Cable Types
    - a) Shielded and unshielded twisted pair LAN cabling
      - m. TIA Category 3, 4, 5, 5e, 6, and 6A: 100 ohm
      - n. ISO/IEC Class C and D: 100 ohm and 120 ohm
      - o. ISO/IEC Class E, 100 ohm ISO/IEC Class F, 100 ohm
      - p. Cat 6A/Class Ez permanent link adapters Plug type and lift: shielded and unshielded cable, TIA Cat 3, 4, 5, 5E, 6, and 6A and ISO/IEC Class C, D, E, and Ea permanent link
      - q. Cat 6A/Class Ea channel adapters Plug type and life: shielded and unshielded cable, TIA Cat 3, 4, 5, 5E, 6, and 6A and ISO/IEC Class C, D, E, and Ea channels.
  2. Test Standards



## Specifications

- a) TIA Category 3, 5E, 6 per ANSI/TIA-568-C.2.
- b) TIA Category 5 (1000BASE-T) per TIA TSB-95
- c) TIA Category 6 per TIA/EIA-568B.2-1
- d) TIA Category 6A per ANSI/TIA-568-C.2 (6A DTX-1800 only)
- e) TIA TSB-155 (DTX-1800 only)
- f) TR24750 (DTX-1800 only)
- g) EN 50173 Class C, D, E
- h) EN 50173 Class Ea, F (DTX-1800 only)
- i) ANSI TP-PMD
- j) IEEE 802.3 10 BASE-T, 100 BASE-T, 1000 BASE-T
- k) IEEE 802.3an 10GBASE-T

### 3. Supported Test Parameters

- a) Wire Map
- b) Length
- c) Propagation Delay
- d) Delay Skew
- e) DC Loop resistance
- f) Insertion Loss (Attenuation)
- g) Return Loss
- h) NEXT
- i) Attenuation to cross talk Ratio
- j) ACR-F
- k) Power Sum ACR-F
- l) Power Sum NEXT
- m) Power Sum ACR-N
- n) Power Sum Alien Near End Xtalk
- o) Power Sum Alien Attenuation XTalk Ratio for End

### B. Fiber Certification Tester

- 1. Wavelengths
  - a) Multimode: 850 nm, 1300 nm
  - b) Single Mode: 1310 nm, 1550 nm
- 2. Compatible Fiber Types:
  - a) Multimode: 50/125 um, 62.5/125 um
  - b) Single Mode: Single Mode
- 3. Event Dead Zone:
  - a) Multi Mode: 850 nm: .5 m, 1300 nm: .7 m
  - b) Single Mode: 1310: 3.6 m, 1550: 3.7 m
- 4. Attenuation Dead Zone:
  - a) Multi Mode: 850 nm: 2.2 m, 1300 nm: 4.5 m



## Specifications

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- b) Single Mode: 1310: 3.6 m, 1550: 3.7 m
    - 5. Dynamic Range:
      - a) Multi Mode: 850 nm: 28 dB, 1300 nm: 30 dB
      - b) Single Mode: 1310: 32 dB, 1550: 30 dB
    - 6. Max Distance Range Setting:
      - a) Multi Mode: 40 km
      - b) Single Mode: 130 km
    - 7. Distance Measurement Range:
      - a) Multi Mode: 850 nm: 9 km, 1300 nm: 35 km
      - b) Single Mode: 1310: 80 km, 1550: 130 km
  - C. Acceptable Testing Devices
    - 1. Copper
      - a) Fluke DTX 1800 CableAnalyzer
    - 2. Fiber
      - a) Fluke OptiFIBER Pro OTDR
- 3.10 COMPLETION
- A. Results Expected
    - 1. All equipment and materials shall be in place and all systems shall be demonstrated to be operationally complete.
    - 2. All testing, start-up and cleaning work shall be complete.
    - 3. All documented testing results are submitted and approved by the Architect. THE CONTRACTOR AT NO ADDITIONAL COST SHALL REPLACE ANY COMPONENT OF THE SYSTEM THAT FAILS TO MEET TEST PERFORMANCE STANDARDS.
    - 4. The Contractor shall provide test equipment to the Architect to spot check test result documentation.
    - 5. All O & M Manuals and Record Documents are reviewed and accepted.
    - 6. Substantial Completion inspection is performed and granted. The Substantial Completion inspection punch list is completed by the Contractor.
    - 7. All facility training shall be complete and DVD of the training sessions are reviewed.
    - 8. All "minimum" twenty (20) year structured cable plant certifications and warranties are received.
    - 9. Transmittal letter listing delivery of complete spare parts inventory.
- 3.11 DEMONSTRATION/INSPECTION
- A. Upon completion of approved testing procedure and submittal of testing documentation as described

## Specifications

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above, the Contractor shall notify the Architect, who will visit the project for a demonstration of the systems and an inspection of the completed work in conformance with the Construction Documents. It is mandatory for a representative from the Contractor directly responsible for the project to be present during demonstration and inspection periods.

- B. Items which do not comply with the Contract Documents, or which function incorrectly, will be listed and the list will be submitted by the Architect to the Contractor.
- C. After all corrections have been made, the Contractor shall notify the Architect who will recheck the system for compliance of all items listed. **IF THE ARCHITECT IS REQUIRED TO RETURN TO THE SITE FOR FURTHER INSPECTIONS, ALL LABOR AND TRAVEL EXPENSES SHALL BE REIMBURSED BY THE CONTRACTOR.**
- D. All bright metal or plated work shall be thoroughly polished. All pasted labels, dirt and stains shall be removed from the devices.

### 3.12 TRAINING

- A. Provide training after all final tests and adjustments have been completed. Instruct the Owner/User's personnel according to the approved Training Plan specified above in "Training Plan and Documentation." Training shall cover all aspects of systems operation, maintenance and programming, and will be provided by the responsible Contractor technical representatives.
- B. Provide written operating instructions specific to the basic operation of the system. Basic instructions should cover all operational aspects of the system required for basic operation including system powering, signal patching and routing, and level control. These instructions are to be laminated and located with the main system power control.
- C. Schedule training sessions to meet the needs of facility personnel as determined by the Owner/User. Provide training during second and third shifts if the Owner/User determines it is necessary.
- D. **Record all training sessions.** Submit an **edited** DVD copy (maximum of 2 hours) to the Architect for review and approval. Present all materials used in the training session on the video. Any DVD found to be inferior in recording or material content shall be reproduced at no cost until an acceptable tape is submitted.
- E. Provide a minimum of 4 hours of training. All training is to be completed during the time frame established during scheduling with the Owner/User and training may not necessarily be in continuous periods.
- F. Contractor is required to be in attendance at the first two major uses of the system.
- G. Refer to individual sections for system specific training requirements.

### 3.13 MAINTENANCE MATERIALS

- A. All special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered in conformance with Section 017700 Closeout Procedures.



## Specifications

- B. Provide spare materials as indicated in Contract Documents and as required for proper maintenance of systems.

### 3.14 WARRANTY, WARRANTY SERVICE AND MAINTENANCE

#### A. Warranty

1. The Structured Cabling System shall have a factory warranty for twenty (20) years beginning on the date of Owner/User acceptance.
2. The Division 27 Structured Cable Systems not covered under the Structured Cabling System "minimum" twenty (20) year warranty shall be fully guaranteed by the Contractor for a period of two (2) years beginning on the date of Owner/User acceptance.
3. The guarantee shall include the entire Division 27 Structured Cable Systems scope of work including all equipment, devices, materials, cable/wire, software and installation.
4. Work shall be guaranteed to be free from defects. Any defective materials or workmanship, as well as damage to the Work of all other Trades resulting from same, shall be replaced or repaired as directed by the Owner/User for a period of two (2) years from the date of Owner/User final acceptance. The Contractor shall provide written warranties for all systems and all buildings to the Owner/User.
5. The guarantee shall exclude acts of God, vandalism, physical abuse or operator misuse.
6. Acceptance by a manufacturer of an order for equipment for this contract signifies acceptance of this warranty. During the warranty period there shall be no charge to the Owner/User for equipment, material, software, etc. for guarantee work.
7. During the warranty period, there shall be no charges to the Owner/User for service calls (mileage, labor, travel, expenses, etc.) for guarantee work.

#### B. Warranty Service

1. Warranty service shall be provided as part of this Contract by the Contractor during the warranty period.
2. Warranty service agreement must be submitted separately and must contain the name, voice phone number, facsimile phone number and pager number of the service provider capable of meeting the response time as defined by the Architect.
3. This service shall consist of the following:
  - a) 24-hour phone number.
  - b) Technician's factory trained by the manufacturers of the system's components.
  - c) Authorized representation of the manufacturer via an agreement of factory support.
  - d) Five years experience (minimum) servicing systems of the type included in this project.
  - e) Capability of making additions or changes to the software systems used in this project.
  - f) Capability of servicing the individual system components and the total structured cable system.
  - g) Equipment and knowledge to test all specified equipment and devices.
  - h) Current system documentation including but not limited to the following:
    - 1) Wiring Diagrams
    - 2) Operation and Maintenance Manuals
    - 3) Software Programs
    - 4) Other documentation as required to provide assistance to the Owner/User in the





## Specifications

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- operation and maintenance of the systems.
  - 5) All documents shall be made available to the Owner/user upon request.
  - 6) Upon termination of maintenance agreement, all system documents shall be furnished to Owner/User for maintenance continuity.
4. The Owner/User and/or Architect shall notify the Contractor in writing, outlining operational malfunctions or defects in the Division 27 Structured Cable Systems. This report shall be faxed to the service provider, which will establish the date and time of problem notification.
5. Upon successful completion of warranty service, the responsible technician shall return a copy of the original service request to the facility with a detailed description of the problem found, and corrective action taken including a list of equipment/parts/software repaired or replaced. The technician shall also sign the on-site service log at the facility.
6. Response Times:
- a) Telephone Call Response: Within 1 hour of request
  - b) On-Site Response:
  - c) M-F 8:00 am to 5:00 pm – Within 24 hours of request
7. Saturday, Sunday or after 5:00p.m. – Response the next business day

END OF SECTION 270500





**Specifications**

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**27 05 26 - GROUNDING AND BOUNDING FOR TELECOMMUNICATIONS**

**PART 1 - GENERAL**

**1.1 SYSTEM DESCRIPTION**

**A. General**

1. Provide a complete Telecommunications Grounding and Bonding system as indicated in Project Documents.
2. Provide all necessary materials and labor for the Backbone Cabling system and the Telecommunications Grounding and Bonding system in all Telecommunication Entrance Facilities, Telecommunications Rooms and Telecommunications Equipment Rooms as indicated in Project Documents.

**B. Telecommunications Grounding and Bonding System**

1. Provide Telecommunications Grounding Busbar (TGB), Telecommunications Bonding Backbones (TBB), Grounding Equalizer (GE), and Bonding Conductor for Telecommunications as indicated in Project Documents.
2. It shall be the responsibility of this contractor to ensure that the telecommunication grounding system for this facility is continuous, complete, and meets or exceeds all applicable codes and standards.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Equipment specified is intended as a reference standard for level of quality.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the schedule bid time. Refer to Division 01
- C. Provide materials listed by UL or ETL.

**2.2 TELECOMMUNICATIONS GROUNDING BUSBAR**

**A. Specifications**

1. Pre-drilled solid copper 3/8" diameter holes, spaced 5.75" apart.
2. Hole patterns accommodate two-hole lugs
3. Bolt hole sizing and spacing: NEMA standard
4. Minimum thickness: 0.25"
5. Minimum dimensions: 4" H x 12" W minimum. Sized to accommodate all indicated and required connections
6. Mounting: 300 series stainless steel insulated standoff brackets
7. Follow BICSI and ANSI/EIA/TIA-607 standards.



**Specifications**

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B. Acceptable Manufacturers

1. Chatsworth
2. Hubbell
3. Panduit
4. Square D
5. Storm Cooper Components

2.3 BONDING CONDUCTOR FOR TELECOMMUNICATIONS

A. Specifications

1. Gage: #6 AWG through 3/0 based on length, see drawings for sizing requirements
2. Insulation: Green PVC 600V insulated

B. Acceptable Manufacturers

1. General Cable
2. Belden Cable
3. Alpha Cable

2.4 TWO HOLE COMPRESSION LUGS

A. Specifications

1. UL listed for use up to 35 KV
2. Temperature rated 90 degrees Celsius
3. CSA certified to 600V
4. Meets J-STD-607-A
5. Electroplated tinned copper
6. Two hole minimum

B. Acceptable Manufacturer

1. Chatsworth
2. Hubbell
3. Panduit
4. Square D
5. Storm Cooper Components

2.5 RACK BUSBAR KIT

A. Specifications

1. Vertical Rack Busbar Kit
2. 72" long x 1/4" thick
3. Copper



**Specifications**

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B. Acceptable Manufacturer

1. Chatsworth
2. Hubbell
3. Panduit
4. Square D
5. Storm Cooper Components

2.6 TWO HOLE GROUND TERMINAL BLOCK

A. Specifications

1. ¾" H x 1 ½" W
2. 5/8" Hole Spacing
3. #14 AWG to 2/0

B. Acceptable Manufacturers

1. Chatsworth
2. Hubbell
3. Panduit
4. Square D
5. Storm Cooper Components

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Ground all equipment as per manufacturer's recommendations, IEEE 1100, NEC and TIA/EIA guidelines.
- B. Provide equipment grounding conductor from equipment grounding lugs to ground bar. Size conductor based on length; see drawings for sizing requirements.
- C. Provide green insulated grounding conductors from ground bar to the following-
  1. Telecom Equipment Racks and Cabinets
  2. Building Steel
  3. Local electrical panel
  4. Conduits and conduit sleeves
  5. Cable tray
- D. Provide a green insulated grounding conductor from each end of the metallic sheath on the telephone backbone cable to the ground bar.
- E. Provide surge protection for all copper telecommunications cable entering the building.
- F. Remove paint and or finish on all equipment racks, cable trays, etc., exposing bare metal at all locations where grounding conductor is terminated.



**Specifications**

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3.2 LABELING

- A. Use TMGB for the Telecommunications Main Grounding Busbar.
- B. Use TGB for the Telecommunications Grounding Busbar.
- C. Provide an identifier for each Telecommunications Grounding Busbar that incorporates the identifier of the Telecommunications Space the busbar serves.
- D. Label both ends of all grounding conductors with both bus bars connected.

3.3 TESTING

- A. Certify system is complete and functional.
- B. Test all cabling and connections. Perform final functional tests in presence of the Architect.
- C. Complete certified testing report.

END OF SECTION 270526



**Specifications**

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**27 11 16 - CABINETS AND ENCLOSURES FOR TELECOMMUNICATIONS**

**PART 1 - GENERAL**

**1.1 SYSTEM DESCRIPTION**

- A. Provide equipment racks as required to support backbone and horizontal system cabling.
- B. Provide required horizontal and vertical cable management.
- C. Provide rack mount power distribution strips.
- D. Telecommunications equipment racks shown in IT closets and Server room will be used for mounting of Owner/User furnished equipment. Coordinate work with Owner/User during shop drawing submittal.
- E. Provide grounding of equipment racks.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Equipment specified is intended as a reference standard for level of quality.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the schedule bid time. Refer to Division 01
- C. Provide materials listed by UL or ETL.

**2.2 FOUR POST FREE STANDING EQUIPMENT RACKS**

- A. Specifications
  - 1. (4) post open frame equipment rack.
  - 2. Provide rack for mounting standard 19-inch rack width equipment.
  - 3. 84" height. 44U available rack mounting space.
  - 4. Minimum 36" deep
  - 5. Independent adjustable front and rear mounting rails. Capable of being adjusted after rack is secured to the floor.
  - 6. Printed rack space identification all equipment rails.
  - 7. UL Listed for 2500 lbs load rating.
  - 8. Mounting holes in top flanges for securing ladder rack.
  - 9. Provide 3 x 3 vertical finger ducts, front and back, on both sides for the full height of the rack frame.
  - 10. Provide double sided horizontal finger ducts between each patch panel, or space allocated for active equipment.
  - 11. Bottom of rack with holes for bolting to floor.
  - 12. Threaded equipment mounting rails.



## Specifications

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13. Black painted finish.
14. TIA/EIA compliant (310-D)

B. Acceptable Manufacturers

1. Panduit
2. Amp-Netconnect
3. Chatsworth Products
4. Middle Atlantic
5. Hubbell
6. Provide quantity as shown on plans. Coordinate installation with CCTV racks furnished by security contractor under 281116. Coordinate installation, grounding, and placement with other racks.

### 2.3 FREE STANDING IDF EQUIPMENT RACKS

A. Specifications

1. Provide two post open frame rack for mounting standard 19-inch rack width equipment.
2. 84" height.
3. Printed rack space identification on all equipment rails
4. UL Listed for 1500 lbs load rating.
5. Mounting holes in top flanges for securing ladder rack.
6. Provide dual sided 3 x 3 vertical finger ducts on both sides of rack, front and back, for the full height of the rack frame.
7. Provide covered double sided horizontal finger ducts between each patch panel, or space allocated for active equipment.
8. Bottom of rack with holes for bolting to floor.
9. 12-24 threaded equipment mounting rails.
10. Black finish.
11. TIA/EIA compliant (310-D)

B. Acceptable Manufacturers

1. Panduit.
2. Amp-Netconnect.
3. Chatsworth Products
4. Middle Atlantic
5. Hubbell
6. Refer to plans for quantity of racks.

### 2.4 WALL MOUNT EQUIPMENT RACK

A. Specifications

1. Dual hinge, open left or right
2. EIA-310-D compliant
3. Universal 5/8"-5/8"-1/2" alternate hole pattern





## Specifications

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4. RMU Spaces are marked
5. Supports minimum 100 lbs of equipment in the open and closed position
6. UL Listed
7. 25" depth
8. Rack mounting space to accommodate equipment shown and allowance for 30% growth.

B. Acceptable Manufacturer

1. Chatsworth Products
2. Middle Atlantic
3. Amp-Netconnect
4. Hubbell
5. Refer to plans for quantity and rack mounting space requirements.

### 2.5 WALL MOUNT REBOX

A. Specifications

1. 16 gauge CRS welded construction
2. Tamper resistant
3. Durable power coat finish
4. Two sets of universal mounting rails with #12-24 tapped holes 5/8", 5/8", 1/2" EIA standard pattern.
5. 100 lb load capacity.
6. Maximum hub depth of 22".
7. Cable entry on top, bottom, and sides
8. Designed to dissipate 160W without fan.

B. Acceptable Manufacturer

1. Hubbell RE4X wall mount cabinet. Refer to plans for quantity of cabinets.
2. Middle Atlantic

### 2.6 HORIZONTAL WIRE MANAGEMENT

A. Specification

1. Compatible with standard 19" equipment racks.
2. Welded steel construction
3. Finished in durable powder coat.
4. 1 and 2 space construction
5. Provide horizontal management suited for cable load above and below all patch bays, routers, and hubs.

B. Acceptable Manufacturer

1. Amp Netconnect
2. Chatsworth Products



## Specifications

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3. Middle Atlantic
4. Hubbell
5. Panduit
6. Provide one wire management above and below each patch panel. Provide (3) additional wire managers for each rack.

### 2.7 RACKMOUNT POWER STRIP

#### A. Specifications

- |                        |                            |
|------------------------|----------------------------|
| 1. Input Voltage:      | 120VAC                     |
| 2. Output Voltage:     | 120VAC                     |
| 3. Current:            | 40 amp total input/output  |
| 4. Form Factor:        | Zero U vertical rack mount |
| 5. Input Receptacles:  | 2x NEMA L5-20P             |
| 6. Output Receptacles: | 32xNEMA 5-20R              |

#### B. Acceptable Manufacturer

1. Tripp Lite PDUMV40 Digital Dual Circuit power strip.
2. Panuit
3. Middle Atlantic
4. Hubbell
5. Provide one strip for each equipment rack. Mount vertically in rear of rack.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install racks in location as indicated on the Project Documents.
- B. Install vertical wire management ducts.
- C. Install horizontal wire management system
- D. Install racks as per manufacturer's recommendations.
- E. Provide rack alignment kits for all racks installed side-by-side.
- F. Secure top of racks to structure above per the manufacturer's instructions, and as detailed herein.
- G. Bolt relay racks to floor using machine bolts and expansion anchors.
- H. Ground racks using the manufacturer's ground lug kit for all bonding conductors.
- I. Maintain proper bend radius for all cable transitioning into and out of the racks using drop out fittings.

### 3.2 LABELING



## Specifications

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### A. General

1. Provide labeling based on ANSI/TIA/EIA-606 administration concepts
2. Provide typewritten labels, hand labeling is not acceptable
3. Administration database shall utilize identifiers on labels

### B. Telecommunication Spaces and Pathways

1. Use the identifier EF for the Telecommunications Entrance Facility
2. Use the identifier MTR for the Main Telecommunications Room
3. Provide an identifier for each Intermediate Telecommunications Room that indicates the floor and an ordinal designation (e.g. TR2A is the first telecommunications room on the second floor)
4. Provide an identifier for each Relay Rack in each Telecommunications Space that incorporates the Telecommunications Space identifier (e.g. TR2A-RR3 is the third relay rack in the first intermediate telecommunications room on the second floor).
5. Provide an identifier for each Telecommunications Backboard in each Telecommunications Space that incorporates the Telecommunications Space identifier (e.g. TR2A-TBB3 is the third backboard in the first intermediate telecommunications room on the second floor).

END OF SECTION 27 11 16





**Specifications**

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**27 11 20 – CATV**

**PART 1 - GENERAL**

**1.1 SYSTEM DESCRIPTION**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The system will provide in house multi channel RF distribution with its input being provided by the User. The provided signal will be amplified and distributed to the CATV jack locations indicated on the plans.
- C. System will include cable plant, head end electronics, equipment mounting hardware, and outlet plates.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Equipment specified is intended as a reference standard for level of quality.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the schedule bid time. Refer to Division 01.
- C. Provide materials listed by UL or ETL.

**2.2 AMP**

- A. Specifications
  - 1. Frequency Range: 54-1000 MHz
  - 2. Gain: 30 dB
  - 3. Output Level: +45 dB
  - 4. Gain Control Range: 12 dB
  - 5. Slope Control Range: 9 dB
  - 6. Impedance: 75 ohms
  - 7. Hum Modulation: -70 dB
- B. Acceptable Manufacturers
  - 1. Pico Macom CA-30/1000 distribution amplifier.
  - 2. Blonder Tongue
  - 3. RL Drake



## Specifications

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### 2.3 SPLITTERS

#### A. Specifications

1. Frequency Range: 5-1000 MHz
2. 2, 3, 4, and 8 way models
3. Die cast housing
4. RFI Shielding: 120 dB
5. Splitter Loss: 3.6-12 db, frequency and output dependant.

#### B. Acceptable Manufacturers

1. Pico Macom TSV-\*SB series splitters. Provide termination resistors as required. Splitters are to be wall mounted in the tele/data rooms as shown on the project documents.
2. Blonder Tongue
3. RL Drake
4. Toner

### 2.4 TAP-OFFS

#### A. Specifications

1. Frequency Range: 5-1000 MHz
2. Die cast housing
3. RFI Shielding: 120 dB
4. Isolation Output to Tap: 27-40 dB, frequency and output dependant>
5. Tap Values: 4-26 dB

#### B. Acceptable Manufacturers

1. Pico Macom TSC-\*SB series tap offs. Provide termination resistors as required. Tap-offs are to be wall mounted in the tele/data rooms as shown on the project documents.
2. Blonder Tongue
3. RL Drake

### 2.5 OUTLET PLATES

#### A. Specifications

1. Single gang plate
2. 4 ports capacity
3. UL 1863 compliant
4. Typical faceplate shall be stainless steel construction. The exception being faceplates located in the detention area. Faceplates in detention area shall be plastic. Faceplates in detention area shall be secured using tamper security screws.
5. CATV outlets shown adjacent Voice/Data outlets shall share the same faceplate. Coordinate mounting and termination of CATV cable and drop with Voice/Data faceplate.



## Specifications

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6. Text to read "TV" above connector.
7. Flush mount isolated F feed thru connector.

B. Acceptable Manufacturers:

1. AMP/Netconnect
2. Uniprise-Commscope
3. Avaya Systimax
4. Panduit
5. Belden/CDT
6. Hubbell

### 2.6 CONNECTORS, AS REQUIRED

A. In-line Cable Connectors. Provide quantity and type as needed

- |                           |                  |
|---------------------------|------------------|
| 1. Phono (RCA) plug:      | Neutrik NF2CB//2 |
| 2. 75 Ohm BNC Crimp Plug: | Canare BCP-C4B   |
| 3. 75 Ohm F-Connectors:   | Canare FP series |

B. Chassis Mount Connectors. All chassis mount connectors are to be isolated from the panel. Provide quantity and type as needed

- |                              |                  |
|------------------------------|------------------|
| 1. BNC feed through:         | Neutrik NBB75DFI |
| 2. F feed through:           | Canare FJ-JRU    |
| 3. RCA (audio) feed through: | Canare RJ-RU     |
| 4. RCA (video) feed through: | Canare RJ-BCJRU  |

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. The System shall be installed by qualified personnel in strict compliance with manufacturers instructions.
- B. Wiring shall be color coded, uniform and in accordance with national electric codes and manufacturer's instructions.
- C. Equipment shall be firmly secured, plumb and level.
- D. All cable runs to the main equipment rack shall be tagged and identified.
- E. The Contractor is responsible for selection tap-offs appropriate for establishing optimal signal level at the outlet based on as-built conditions. As part of the shop drawing submittal, provide calculated tap-off values for all drops as based on existing field conditions and cable lengths.



## Specifications

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- F. After cable routing is established between the head end equipment rack and the outlet location, Contractor shall determine required tap off setting based on attenuation of cable run and additional splitters that are inline between the outlet and the head end equipment rack.
- G. All unused tap-off and splitter outputs are to be terminated with 75 ohm terminating resistors.
- H. Coordinate all work with other trades and Contractors.
- I. Grounding of cables, and peripheral equipment shall be installed per manufacturer's direction to eliminate noise induction and achieve optimum system performance.
- J. As part of the project record documents, the Contractor shall provide as-built documentation showing all splitters, tap-offs, and cable routing for the CATV system. Documentation to include signal level measurements at all outlet locations.

### 3.2 SYSTEM INITIALIZING AND PROGRAMMING

- A. The System shall be turned on and adjustment made to meet requirements of the specification and on-site conditions.
- B. The System shall be programmed to function as specified.
- C. Any special programming shall be documented and a written copy given to the User.

### 3.3 SYSTEM TEST PROCEDURES

- A. Testing to be performed in the Contractors shop prior to delivery-
  - 1. Test 120VAC power equipment and hardware. Test all conductors for shorts, opens, and polarity.
- B. Testing to be performed at the job site prior to powering the system
  - 1. Verify all signal cables are free of shorts and opens prior to termination of head-end electronics.
  - 2. Test all 120VAC power sources for correct polarity and voltage. Test grounding system for continuity. Notify Electrical Contractor of any problems.
- C. The System shall be completely tested to assure that all components are hooked up and in working order. The System shall be adjusted for optimum signal level at each CATV outlet location.
- D. Inspect system for defects. Correct all causes of such defects. If the cause is outside of the scope of the Division 27 series scope of work, promptly notify the Architect in writing, indicating the cause of the defect and suggested corrective procedures.
- E. Test all cabling for continuity. Verify all lines are free from shorts and opens. Testing shall include all passive components including tap-offs and splitters.





**Specifications**

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- F. Test all cabling verifying that all cables are terminated accordingly.
- G. All outlet signal level readings shall be +10dBmV, +/-5 db. The Contractor is responsible for providing tap-offs required for establishing consistent levels.
- H. Provide riser diagram of system components indicating calculated visual carrier level at 55.25 MHz (channel 2) and 433.25 MHz (channel WW). Indicate levels at the inputs and outputs of active components and multi-taps, and at TV set outlets. Indicate physical location (e.g., room number, column line, etc.) of each component.
- I. Provide written documentation showing all test results.
- J. The System shall be final tested in the presence of the Architect.

END OF SECTION 27 11 20





**Specifications**

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**27 13 00 - BACKBONE CABLING FOR TELECOMMUNICATIONS**

**PART 1 - GENERAL**

**1.1 SYSTEM DESCRIPTION**

**A. Fiber Optic Backbone Cabling System**

1. Provide a complete Fiber Optic Backbone Cabling system that supports broadband voice, voice, and data as indicated in Project Documents.
2. Backbone shall consist of multi-mode and single mode fiber.
3. Provide Fiber Optic Backbone system cables, rack/wall mounted fiber optic termination enclosures, terminations, labeling, and testing for the Fiber Optic Backbone Cabling system as indicated in Project Documents.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Equipment specified is intended as a reference standard for level of quality.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the schedule bid time. Refer to Division 01.
- C. Provide materials listed by UL or ETL.

**2.2 FIBER OPTIC BACKBONE CABLE**

**A. Specifications**

**1. Multi Mode**

- |    |  |               |
|----|--|---------------|
| a) | Core Diameter:                           | 50 +/- 2.5 um |
| b) | Core Non-circularity:                    | 5% max        |
| c) | Cladding Diameter:                       | 125 +/- 1 um  |
| d) | Core/Clad Concentricity Error:           | < 1.5 um      |
| e) | Coating fiber diameter:                  | 245 +/- 10 um |
| f) | Cladding Non-circularity:                | <1%           |
| g) | Coating/Cladding Concentricity Error:    | <6 um         |
| h) | Colored Fiber Diameter:                  | 254 um        |
| i) | Numerical Aperture:                      | .275 +/- .015 |
| j) | Effective Group Index of Ref. @850nm:    | 1.496         |
| k) | Effective Group Index of Ref. @1300nm:   | 1.491         |
| l) | Point Discontinuities @ 850 and 1300 nm: | <.08dB        |
| m) | Max. Fiber Loss @850:                    | 3 dB/km       |
| n) | Max. Fiber Loss @1300:                   | 1 dB/km       |
| o) | Minimum Bandwidth @ 850:                 | 200 MHz-km    |

## Specifications

- p) Minimum Bandwidth @1300: 500 MHz-km
- q) NEC CMP rated

### 2. Single mode

- a) Core Diameter: 8.3 um nominal
- b) Cladding Diameter: 125 +/- 1 um
- c) Core/Clad Concentricity Error: < .5 um
- d) Coating fiber diameter: 245 +/- 10 um
- e) Cladding Non-circularity: <1%
- f) Coating/Cladding Concentricity Error: <12 um
- g) Colored Fiber Diameter: 254 um
- h) Effective Group Index of Ref. @1310 nm: 1.466
- i) Effective Group Index of Ref. @1550 nm: 1.467
- j) Point Discontinuities: .1 dB
- k) Max. Fiber Loss @1310: .7 dB/km
- l) Max. Fiber Loss @1550: .7 dB/km
- m) NEC CMP rated

## B. Acceptable Manufacturer

### 1. Intra Building

- a) AMP/Netconnect
- b) Commscope/Uniprise/Systimax
- c) Panduit/General Cable
- d) Hubbell/Mohawk
- e) Belden/CDT
- f) Multi mode indoor plenum rated cable. Refer to drawings for strand count.

### 2. Inter Building

- a) AMP/Netconnect
- b) Commscope/Uniprise/Systimax
- c) Panduit/General Cable
- d) Hubbell/Mohawk
- e) Belden/CDT
- f) Multi mode outdoor armored cable. Refer to drawings for strand count.

## 2.3 FIBER OPTIC PATCH PANEL

### A. Specifications

- 1. 14 ga. CRS construction
- 2. 19 rack mount, 4 RMS (7" high)
- 3. Modular construction
- 4. Provide fiber management bend limiting clips

## Specifications

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5. Provide strain relief brackets
6. Provide adapter panels to support the fiber optic strand count shown on the plans.

B. Acceptable Manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT

### 2.4 FIBER OPTIC WALL INTERCONNECT

A. Specifications

1. 14 ga. CRS construction
2. Modular construction
3. Provide fiber management bend limiting clips
4. Provide strain relief brackets
5. Provide adapter panels to support the fiber optic strand count shown on the plans.

B. Acceptable Manufacturers

1. AMP/Netconnect.
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT

### 2.5 FIBER OPTIC PATCH PANEL ADAPTOR PLATE

A. Specifications

1. SC duplex multi mode adaptors
2. Provide adaptor panels to support the fiber optic strand count shown on the plans.
3. Ferrell color based on cross-connect field identification color code, TDMM 12<sup>th</sup> edition, chapter 7.

B. Acceptable Manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT



## Specifications

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### 2.6 FIBER OPTIC CONNECTORS

#### A. Specifications

1. Duplex SC type connector
2. High impact plastic body
3. Zerconia/Ceramic ferrule
4. .3dB typical insertion loss
5. -30dB/-40dB reflectance, Multimode respectively
6. 32° – 131° F operating temperature
7. 12 pound tensile strength
8. Ferrell color based on cross-connect field identification color code, TDMM 12<sup>th</sup> edition, chapter 7.

#### B. Acceptable Manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT

### 2.7 FIBER OPTIC PATCH CABLES

#### A. Specifications

1. Duplex SC connectors
2. Ferrell color based on cross-connect field identification color code, TDMM 12<sup>th</sup> edition, chapter 7.
3. 2 meters in length.
4. Patch cables are to be turned over to the Owner/User for use in installation of active equipment outside the scope of the project.
5. Furnish 40 multi mode patch cables.

#### B. Acceptable Manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT

## PART 3 - EXECUTION

### 3.1 INSTALLATION

#### A. General

1. Install all fiber and copper cabling in accordance with applicable standards and codes.
2. Maintain fire rating of all penetrations through rated walls during construction.

**Specifications**

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3. Coordinate fire stopping of all cable runs through floor sleeves with general contractor.
  4. Install all fiber cabling and secure in a high state of dress utilizing wire management brackets and hook and loop type (Velcro) Straps. No plastic cable ties shall be used to secure any cabling.
- B. Main Telecommunications Room
1. LAN racks
    - a) Install racks in location as indicated on the Drawings.
    - b) Install fiber termination enclosures and patch panels.
    - c) Install copper termination enclosure and patch panels.
    - d) Install vertical and horizontal wire management.
    - e) Ground racks.
- C. Telecommunication Closets
1. LAN rack
    - a) Install racks in locations as indicated on the Drawings.
    - b) Install fiber termination enclosures and patch panels.
    - c) Install copper termination enclosure and patch panels.
    - d) Install vertical and horizontal wire management.
    - e) Ground racks.
- D. Backbone Cabling
1. Install cabling as per manufacturer's recommendations.
  2. Do not exceed specified pulling tensions.
  3. Do not exceed specified bend radius.
  4. Provide a 3 meter maintenance loop of fiber cable in the cable tray prior to dropping onto the LAN rack.
  5. All fiber optic cable shall be installed in plenum inner duct.
- E. Fiber Optic Termination Enclosures
1. Install all cabling and secure in a high state of dress utilizing wire management system.
  2. Secure fiber jacket in a minimum of two locations.
  3. Install minimum one meter of unjacketed fiber strands coiled on the enclosure routing guides.
  4. Terminate and connect all fibers in fiber termination enclosure:
    - a) Populate the single mode fibers on the ports beginning with 1.
    - b) Populate the multi-mode fibers on the next available port after the single-mode fibers.
  5. Use only hook and loop (Velcro) type straps to secure and dress fiber cables.

## Specifications

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F. Wall Mount Copper Terminations

1. Securely attach punch down blocks to wall back board.
2. Strip sufficient amount of jacket from cable.
3. Secure cable to wall back board
4. When applicable, ground cable shield to telecommunications grounding network.

G. Rack Mount Copper Terminations

1. Install all cabling and secure in a high state of dress utilizing wire management system.
2. Terminate and connect all copper to patch panel/punch down block:
3. Use only Velcro type tie wraps to secure and dress fiber cables.

### 3.2 LABELING

A. All cables shall be properly identified using a high quality thermal transfer labeling device such as the Kroy K4100 or equal.

B. Provide labeling based on ANSI/TIA/EIA-606 administration concepts

C. Administration database shall utilize identifiers on labels

D. Equipment Room Terminating Hardware

1. Provide an identifier for each Patch Panel that incorporates the Cabinet identifier. (e.g. TR2A-RR3-PP1 is the first patch panel in the third relay rack in the first intermediate telecommunications room on the second floor)
2. Provide an identifier for each Patch Panel port that incorporates the Patch Panel identifier. (e.g. TR2A-RR3-PP1-09 is the ninth port on the first patch panel in the third relay rack in the first intermediate telecommunications room on the second floor)
3. Provide an identifier for each Connecting Block that incorporates the Cabinet identifier. (e.g. TR2A-RR3-PB1 is the first patch block in the third relay rack in the first intermediate telecommunications room on the second floor)
4. Provide an identifier for each Connecting Block port that incorporates the Connecting Block identifier.(e.g. TR2A-CB1 is the first connecting block in the first intermediate telecommunications room on the second floor)

E. Backbone Cable

1. Provide both of the cable's Patch Panel Port identifiers on both ends of all backbone cables.
2. Insure that label is intact after termination of cable.





**Specifications**

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3.3 TESTING

A. General

1. Certify system is complete and functional.
2. Test all cabling and connections. Perform final functional tests in presence of the Architect
3. Complete certified testing report.

B. Fiber Cable Testing

1. Test in accordance with ANSI/TIA/EIA 526-7 and 526-14-A-98.
2. Test all fiber optic cabling using a digital cable analyzer similar to a Fluke DSP-4000 with fiber test adaptors, and certify that the system is complete and functional.
3. All fiber testing shall be performed on all fibers in the completed end to end system.
4. Every fiber shall be tested in both directions with a light source tester.
5. Maximum allowable attenuation for 50 micron fiber shall be 3.0 dB per km at 850nm and 1.0 dB per km at 1300 nm.

C. Copper Cable Testing

1. Test in accordance with ANSI/TIA/EIA TSB 67.
2. Test all Category 3 cabling for continuity and performance.

D. All testing documentation shall be provided in both hard copy (paper) and electronic format (Microsoft Office Word) for all copper and fiber cable.

END OF SECTION 27 13 00





## **27 15 00 - HORIZONTAL CABLING FOR TELECOMMUNICATIONS**

### **PART 1 - GENERAL**

#### **1.1 SYSTEM DESCRIPTION**

##### **A. General**

1. Provide a complete UTP Horizontal Cabling system that supports voice, and data as indicated in Project Documents.
2. Provide telecommunications room rack mounted termination equipment, telecommunications room cross connect and equipment patch cables, telecommunications outlets, telecommunications outlet equipment cables, terminations, labeling and testing for the Horizontal Cabling system as indicated in Project Documents.
3. Provide Telecommunications Grounding and Bonding of all Horizontal Cabling system components as indicated in Project Documents.
4. Provide Fire stopping Materials for Horizontal Cabling as indicated in Project Documents, provide all labor and materials to maintain Fire stopping at all penetrations at all times during construction and to insure adequate Fire stopping at all penetrations at completion.
5. Provide all necessary materials and labor for the Horizontal Cabling system in all Telecommunication Entrance Facilities, Telecommunications Rooms and Telecommunications Equipment Rooms as indicated in Project Documents.

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. Cable specified is intended as a reference standard for level of quality. Installing contractor is to verify prior to installation that all cables meet or exceed the performance and operational requirements noted by the manufacturer of the field device that is to be connected.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the scheduled bid time. Refer to Division 01.
- C. All cable must be NEC type OFNP or NEC type CMP unless otherwise noted

#### **2.2 UTP HORIZONTAL CABLE**

##### **A. Specifications**

1. ANSI/EIA/TIA Category 6 compliant
2. NEC CMP rated
3. Quantities and locations as indicated in Project Documents
4. 4 pair, 23 AWG, solid bare annealed copper
5. Flame retardant semi-rigid PVC insulation
6. Longitudinal rip-cord
7. Color of cable to be blue



## Specifications

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B. Acceptable manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT

### 2.3 CATEGORY 6 PATCH PANELS

A. Specifications

1. Modular rack mounted
2. ANSI/EIA/TIA Category 6 RJ-45 connectors
3. Port count as indicated in Project Documents
4. Sweep tested through 250 MHz
5. UL 94VO polycarbonate construction
6. Phosphor bronze 90/10 tin lead IDC contacts
7. UL 1863 compliant
8. IDCs accept 26 through 22 AWG solid copper conductors

B. Acceptable Manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT

### 2.4 CATEGORY 6 RJ-45 JACKS

A. Specifications

1. Backwards compatible to Category 3
2. ANSI/EIA/TIA 568-B.2-1 Category 6 compliant
3. Sweep tested through 250 MHz
4. UL 94VO polycarbonate construction
5. Phosphor bronze 90/10 tin lead IDC contacts
6. IDCs accept 26 through 22 AWG solid copper conductors
7. Jack color based on cross-connect field identification color code, TDM 12<sup>th</sup> edition, chapter 7.
8. Provide quantity of jacks to support the number of telecommunications outlets shown on the plans.

B. Acceptable Manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable



## Specifications

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4. Hubbell/Mohawk
5. Belden/CDT

### 2.5 CROSS CONNECT AND PATCH CABLE ASSEMBLIES

#### A. Specifications

1. ANSI/EIA/TIA Category 6
2. 4 pair RJ45
3. Strain relief boot
4. Snap in color coded icon
5. 2 meters in length
6. Tested to 250 MHz
7. Patch cable and connector color based on cross-connect field identification color code, TDMM 10<sup>th</sup> edition, chapter 7.
8. Patch cables are to be turned over to the Owner/User for use in installation of active equipment outside the scope of the project.
9. Furnish (130) 5' patch cables, (130) 7' patch cables, and (130) 10' patch cables for use with the horizontal cable system.

#### B. Acceptable Manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT

### 2.6 TELECOMMUNICATIONS OUTLET

#### A. Specifications

1. Wall Faceplate
  - a) Single gang plate
  - b) 4 ports capacity
  - c) UL 1863 compliant
  - d) Typical faceplate shall be stainless steel construction. The exception being faceplates located in the detention area. Faceplates in detention area shall be plastic. Faceplates in detention area shall be secured using tamper security screws.
  - e) Voice/data outlets shown adjacent CATV drops shall share the same faceplate. Coordinate mounting and termination of CATV cable and drop with Voice/Data faceplate.
  - f) Clear label cover.
2. Jack
  - a) Front loading and front removable
  - b) ANSI/TIA/EIA Category 6 compliant (Tested to T568B-2.1)



## Specifications

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- c) T568 A/B wiring
      - d) 22-26 AWG wiring
      - e) UL 1863 compliant
      - f) Provide icons for Voice, Data, and blank icons for spare ports
      - g) Color based on cross-connect field identification color code, TDMM 12<sup>th</sup> edition, chapter 7.
    - 3. Shutter
      - a) Footprint equal to jack
      - b) Color to match jack
      - c) Icon included on shutter mount
  - B. Acceptable Manufacturers
    - 1. AMP/Netconnect
    - 2. Commscope/Uniprise/Systimax
    - 3. Panduit/General Cable
    - 4. Hubbell/Mohawk
    - 5. Belden/CDT
- 2.7 WALL PHONE OUTLET
- A. Specifications
    - 1. Faceplate
      - a) Single gang plate
      - b) Stainless Steel Construction
      - c) 1 ports capacity
      - d) Integrated telephone mounting posts
      - e) UL 1863 compliant
    - 2. Jack
      - a) Front loading and front removable
      - b) ANSI/TIA/EIA Category 6 compliant (Tested to 568B-2.1)
      - c) T568 A/B wiring
      - d) 22-26 AWG wiring
      - e) UL 1863 compliant
      - f) Icon compatible
      - g) Color based on cross-connect field identification color code, TDMM 12<sup>th</sup> edition, chapter 7.
  - B. Acceptable Manufacturers
    - 1. AMP/Netconnect
    - 2. Commscope/Uniprise/Systimax



## Specifications

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3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

##### A. General

1. Follow all ANSI/EIA/TIA installation guidelines.
2. Follow all cabling solution provider installation guidelines.
3. Install all cabling and secure utilizing wire management and hook and loop (Velcro) straps. No plastic cable ties shall be used to secure any cabling.

##### B. Telecommunications Rooms

1. Install all Horizontal Cable System Telecommunications Room equipment as indicated in Project Documents.
2. Install cable management to support and train cables with spacing as required to meet bend radius and support requirements.

##### C. Telecommunications Outlet

1. Install all Horizontal Cabling System telecommunications outlet equipment and cabling as indicated in Project Documents.
2. Do not exceed recommended pulling tensions.
3. Route cabling from outlets to patch panel in the nearest telecommunication closet.
4. Do not exceed 90 meter horizontal length for Category 6 cables. Notify Architect immediately if any Category 6 route exceeds 90 meters.
5. Terminate data cabling per T568B wiring method.
  - a) Maintain wire twists to within 0.5 inches of termination.
  - b) Remove no more than 1.0 inches of cable jacket.

#### 3.2 LABELING

##### A. Telecommunications Room Patch Panel Labeling

1. Provide each Patch Panel with a laminated black phenolic resin label with a white core and engraved lettering, a minimum of 1/4-inch high.
2. Provide permanent, computer-generated labels at each Patch Panel port.



## Specifications

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B. Horizontal Cable Labeling

1. Provide permanent, computer generated labels on both ends of every Horizontal Cable, Patch Cord and Work Area Equipment Cable.
2. Example of horizontal wiring label: 1A-A001 1A=Equipment Room number, A=the patch panel, and 001= patch panel port.

C. Telecommunications Outlet Labeling

1. Provide permanent, computer generated labels at the station faceplate.

D. General

1. Provide labeling based on ANSI/TIA/EIA-606 administration concepts.
2. Provide typewritten labels, hand labeling is not acceptable.

E. Telecommunication Space Terminating Hardware

1. Provide an identifier for each Patch Panel that incorporates the Relay Rack identifier (e.g. TR2A-RR3-PP1 is the first patch panel in the third relay rack in the first intermediate telecommunications room on the second floor).
2. Provide an identifier for each Patch Panel port that incorporates the Patch Panel identifier (e.g. TR2A-RR3-PP1-09 is the ninth port on the first patch panel in the third relay rack in the first intermediate telecommunications room on the second floor).

F. Telecommunications Outlet

1. Provide an identifier for each telecommunications outlet that indicates the room number and an ordinal designation (e.g. 142A is the first activation point in room 142).
2. Provide an identifier for each telecommunications outlet jack designation (e.g. 142A-2 is the second jack in the first TO in room 142).

G. Horizontal Cable

1. Provide the cable's Patch Panel Port identifier and Work Area Activation Point Jack identifier on both ends of all Horizontal cables.
2. Insure that label is intact after termination of cable.

### 3.3 TESTING

A. Copper cable testing

1. Test all Category 6 horizontal cabling using a digital cable analyzer and certify that the system is complete and functional.
2. A level IIe or better test unit is required and must be updated to include the requirements of ANSI/TIA/EIA-568-B.





## Specifications

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3. The basic tests required are:
  - a) Wire Map
  - b) Length
  - c) Attenuation
  - d) NEXT (Near and crosstalk)
  - e) Return Loss
  - f) Propagation Delay
  - g) Delay Skew
  - h) PSNEXT (Power sum near-end crosstalk loss)
  - i) PSELFET (Power sum equal level far-end crosstalk loss)
4. Submit all test data to the architect for review and approval.
5. Spot test cabling in the presence of the architect to verify the accuracy of the data submitted.
6. Spot tests will be reflective of the test data submitted or the entire system will be retested in the presence of the architect, and at the contractor's expense.

END OF SECTION 27 15 00





## **28 05 00 - COMMON WORK RESULTS FOR ELECTRONIC SECURITY**

### GENERAL

#### 1.1 DESCRIPTION OF WORK

- A. Provide all labor, equipment, supplies and materials for the complete installation of a fully functional Security Control System in accordance with the Criteria Documents. Security Systems include but are not limited to:
  - 1. Backbone and Horizontal Cabling
  - 2. Grounding and Bonding
  - 3. Tamperproof Fasteners
  - 4. Cabinets and Enclosures
  - 5. Proximity Access Control System
  - 6. Video Surveillance System
  - 7. PLC/GUI Hardware and Software
  - 8. Intercom System
  - 9. Miscellaneous Systems
- B. The work includes the following, as well as work not listed below but described elsewhere as it applies to Security Systems:
  - 1. Coordination with division 26
  - 2. Field device installation and termination
  - 3. Head-end equipment installation and termination
  - 4. Programming
  - 5. Start up, testing, de-bugging and commissioning
  - 6. Documentation and training
  - 7. Maintenance and service
- C. Interpretation of Contract Documents
  - 1. This section of the specifications describes general provisions applicable to all Division 28 Security Systems.
  - 2. Refer to specification section 28 05 05 for information regarding coordination of work with division 26.
  - 3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
  - 4. Mention in these specifications or indications and/or reasonable implications whereby articles, materials, operation or methods related to execution of the work are noted, specified, drawn or described, thereby requires execution of each such item of work and provision of all labor, materials, equipment and accessories required for execution thereof.
  - 5. No exclusions from, or limitations in the language used in the specifications shall be interpreted as meaning that the accessories necessary to complete any required system or item of equipment are to be omitted.

## Specifications

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6. The use of words in the singular shall not be considered as limiting where other indications denote that more than one item is referred to.
7. This is a renovation/addition project. The project includes the upgrade of existing systems and equipment. Where indicated herein and on the drawings, existing field devices will remain as is, be repaired or refurbished, or be replaced with new equipment. Furnish and install all materials for complete and functioning systems, resulting upon completion, in functioning systems in compliance with the performance requirements specified. The omission of express reference to any parts necessary for, or reasonably incidental to a complete installation shall not be construed as a release from furnishing such parts. This reference shall apply to all systems and sub-systems specified herein or otherwise included in these contract documents.
8. Drawings are diagrammatic and are intended to indicate general arrangement of system and equipment, quantities and overall scope except when specifically dimensioned or detailed. They are to show size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement.
9. Field verification of measurements take priority over dimensioned drawings.
10. Dimensions indicated anywhere, are limiting dimensions.
11. The Owner reserves the right to make any reasonable change in location of devices and equipment prior to rough installation without involving additional expense. All changes from the drawings as are necessary to make the work of the SEC conform to the building as constructed shall be included and installed without extra cost.

### 1.2 SCOPE AND RESPONSIBILITY

- A. Provide full time on site field representation for Division 28 Security Control Systems series scope for work for the duration of installation and prior to turn over. This requirement shall commence upon the start of the installation of field wiring and device installation.
- B. Include detailed scheduling information for Security Electronics systems installation and testing in the construction schedule. Provide detailed GHANT chart construction schedule showing all tasks referenced in the project phasing plans. Include:
  1. Engineering
  2. Shop Drawing Preparation
  3. Software Programming
  4. Shop Fabrication
  5. Equipment Installation
  6. Electrical Work
  7. Testing, Commissioning, and training.
  8. This schedule must be submitted fourteen (14) calendar days after receipt of contract. The duration of this schedule must also comply with the completion dates of the construction schedule contained in the contract documents.
  9. Work with the Design Builder – to schedule/conduct periodic coordination meetings between SECs to make everyone aware of critical areas of construction. Distribute the meeting minutes and attendance to the Owner Representative, the Architect, Engineer, Design Builder – and the Owner in a timely fashion.
  10. SEC shall provide coordination of mechanical and electrical installation requirements with the Design Builder - and the Electrical Trade Contractor.
  11. Provide coordination of the Security Electronics System installation.

## Specifications

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12. Provide coordination as required to complete the inspection described in paragraph 3.1 INSPECTION.
13. When on-site Inspect existing conduit raceway system including back boxes, junction boxes, and mortar boxes for all Security Systems. Notify the Architect Engineer of any discrepancies immediately.
  - a. Furnish and install all equipment racks and cabinets.
  - b. Furnish and install all required surge protection field devices.
  - c. Provide all required circuit protection internal to the head end equipment racks.
  - d. Where new work is required, all security electronics systems cabling shall be installed in conduit from the field device to the secured equipment rooms.
  - e. Furnish and install all devices, equipment, and appurtenances resulting in complete, functional, and fully operational systems as specified herein, indicated on the drawings and listed below:
    - 1) Section 280510 – Maintenance Service, and Warranty for Electronic Security
    - 2) Section 280511 – Backbone System Cabling for Electronic Security
    - 3) Section 280512 – Horizontal System Cabling for Electronic Security
    - 4) Section 280513 – Conductors and Cables for Electronic Security
    - 5) Section 280526 – Grounding and Bonding for Electronic Security
    - 6) Section 281116 – Cabinets and Enclosures for Electronic Security
    - 7) Section 281300 – Access Control System for Electronic Security
    - 8) Section 284619 – PLC Hardware for Electronic Security
    - 9) Section 284620 – PLC Software for Electronic Security
    - 10) Section 285123 – Integrated Intercom/Paging System for Electronic
  - f. Furnish and install the Security equipment.
  - g. Coordinate with division 26 all requirements of the security electronics signal cable plant including access control, CCTV, PLC/GUI and intercom/paging, and miscellaneous systems per NEC, as shown in the project documents.
  - h. Furnish and install all miscellaneous systems equipment and materials as required for a complete and fully functional security system as specified and/or indicated on the drawings.
  - i. Prior to fabrication, coordinate exact location and installation of security electronic devices.
  - j. Provide coordination to complete the inspection described in Paragraph 3.1 INSPECTION.
  - k. Provide complete system test, operational certification and Owner training as called for in the contract documents.
  - l. Provide complete factory certified training to the Owner.
  - m. Coordinate the work of this Section with the Design Builder – and that of other Sections to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinate fashion.

### 1.3 RELATED DOCUMENTS

#### A. General

## Specifications

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1. Drawings, specifications and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section. The SEC and all subcontractors are responsible for locating information pertaining to required items of work specified or indicated elsewhere in the Contract Documents.
- B. Related Work Specified Elsewhere
  1. Division 00 - BIDDING REQUIREMENTS
  2. Division 01 - GENERAL REQUIREMENTS
  3. Division 08 - DOORS AND WINDOWS
  4. Division 11 - DETENTION EQUIPMENT
  5. Division 25 - MECHANICAL
  6. Division 26 - ELECTRICAL
- C. Reference Specifications, Materials, and/or Codes
  1. Submit all items necessary to obtain all required permits to the appropriate Regulatory Agencies, obtain all required permits and pay all required fees.
  2. All work shall conform to the National Electrical Code (NEC) and to applicable National Fire Protection Association (NFPA) codes.
  3. All work shall conform to all Federal, State and local ordinances.
  4. Where applicable, all fixtures, equipment and materials shall be as approved or listed by the following:
    - a. Factory Mutual Laboratories (FM).
    - b. Underwriters Laboratories, Inc. (UL).
    - c. National Electrical Manufacturers Association (NEMA).
  5. References to the National Electrical Code and National Fire Protection Association (NFPA) are a minimum installation requirement standard. Design drawings and specification sections shall govern in those instances where requirements are greater than those specified in the NEC and NFPA.
  6. All material and equipment shall be listed, labeled or certified by Underwriters' Laboratories, Inc. where such standards have been established. Equipment and material which are not covered by UL Standard will be accepted provided equipment and material are listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class, which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe will be considered, if inspected or tested in accordance with national industrial standards such as NEMA, ICEA or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings. NOTE: It is not required that the final installed system be UL listed as a single product.
  7. All work shall meet or exceed the standards and procedures of the following:
    - a. National Fire Protection Association (NFPA): NFPA 70, NFPA 72, NFPA 90A
    - b. National Electrical Code (NEC)
    - c. American National Standards Institute (ANSI)
    - d. National Electrical Manufacturers Association (NEMA)
    - e. American Society of Testing Materials (ASTM)

## Specifications

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- f. Institute of Electronic & Electrical Engineers (IEEE)
  - g. Underwriters Laboratory (UL)
  - h. Americans With Disabilities Act (ADA)
8. Include all items of labor and material required to comply with such standards and codes. Where quantity, sizes or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specifications or drawings, respectively, shall govern.

### 1.4 QUALITY ASSURANCE

#### A. General

- 1. Furnish and install only new equipment and materials required (less than 1 year from manufacture), unused without blemish or defect.
- 2. Each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent is not permitted. NEMA Code Ratings, UL label, or other data which is die-stamped into the surface of the equipment shall be stamped in a location easily visible. Performance as delineated in schedules and in the specifications shall be interpreted as minimum performance. In many cases, equipment is oversized to allow for pickup loads which cannot be delineated under the minimum performance.
- 3. All equipment of the same type shall be the product of one manufacturer.
- 4. The original factory condition of manufactured equipment shall not be modified without the written approval of the Architect Engineer.
- 5. If it is determined that the SEC has not complied completely with the specified turnover of the "NON-PROPRIETARY" code for the Owner as well as provided all "NON-PROPRIETARY" equipment, the SEC bonds will be called and all costs associated with this non-performance will be borne solely by the SEC.
- 6. Provide only non-proprietary software. All software logic shall be developed in the Wonderware or Omron InduSoft environment and not developed in third party software or provided in a compiled DLL, EXE file format or other encrypted file format/extension. Any software approach that is found to be provided with proprietary approach shall be removed and the SECs bond shall be "called". All costs to remove and rewrite the software shall be the SECs responsibility.

#### B. Qualifications

- 1. Bids will only be accepted from Design Builders who's security electronics subcontractor is licensed by the State of Florida.
- 2. All bidders must be in full compliance with the rules and regulations set forth by the State.
- 3. The SEC shall have been in existence for a minimum of 10 years.
- 4. The integrator shall be a UL listed panel shop manufacturer and must be able to apply the UL 508A Listing mark at their facility to each relay control panel, PLC equipment cabinet and audio equipment rack assembled for this project.
- 5. The Electronic Security System integrator shall have completed a minimum of 5 projects similar in scope to this project. The company's Project manager/coordinator assigned to this project must have been involved in at least 4 of the 5 company projects.

**Specifications**

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6. The SEC shall specialize in the installation of security control systems in correctional facilities of equal scope, quality, type, and complexity to that required herein.
  7. The SEC will own, at time of bid, all required testing equipment called for in the specifications. Technicians responsible for operating testing equipment will have successfully completed all manufacturers approved training courses for the successful operation of the testing equipment.
  8. The SEC shall be trained and certified on the programming, configuration, and setup of all micro processor based electronics including Programmable Logic Controllers (PLC), Graphical User Interface (GUI), IP based Video Surveillance, Access Control and Intercom including recording/storage devices.
  9. The principal members and key personnel to be assigned to the project shall each have a minimum of 10 years experience in completing projects of equal scope, quality, type, and complexity to that required herein.
  10. On-site installing personnel will have successfully completed all training requirements set forth by the primary security electronics product manufacturers. A copy of the training certificates shall be available upon request.
  11. Project Lead Technician
    - a. Trained and certified by the primary Security product manufactures specified for the project.
    - b. Minimum 5 years experience as Lead Technician on Security Systems projects of similar size and scope.
  12. Project Technicians
    - a. Minimum 2 years experience on Security Systems projects of similar size and scope
- C. Qualification Proposal Requirements
1. SECS SEEKING TO BE INCLUDED ON THE APPROVED LIST ARE RESPONSIBLE FOR PROVIDING DOCUMENTED PROOF THAT ALL QUALIFICATIONS HAVE BEEN MET. BURDEN OF PROOF IS ON THE PROPOSER. DELIVERY OF THE FOLLOWING DOCUMENTATION IS REQUIRED NO LATER THAN 14 CALENDAR DAYS PRIOR TO THE BID OPENING. QUALIFICATION PROPOSAL SHALL INCLUDE THE FOLLOWING-
    - a. A history of the Contractor that reflects the length of time they have performed services similar to those required for this project.
    - b. Contractor Qualification Statement AIA-305A.
    - c. Audited financial statement for the previous year.
    - d. Name, address, and telephone number of organization's current Bonding company and level of bonding capacity.



## Specifications

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- e. Resume's of the principal members and key personnel of the organization indicating years of experience in successfully completing projects of equal scope, quality, type and complexity to that required herein. Include resume(s) of personnel in the employ of the organization responsible for the engineering, fabrication, and installation of comparable systems. Include a delineation of each individual's responsibilities on this project. Resumes must include information about the individual's security experience and systems integration capabilities.
- f. Provide integrators UL508A custom control panel manufacturing certificates.
- g. Provide proof of compliance with PLC/GUI manufacturer's integrator certification program; IE: Omron IWS Certified System Integrator Certificate.
- h. List all completed projects, on which work has been performed, that have been operational for at least 1 year. Include for each facility the following:
  - 1) Name and location of project.
  - 2) Date of occupancy.
  - 3) Name, address, and telephone number of Owner/User.
  - 4) Name, address, and telephone number of Architect
  - 5) Name, address, and telephone number of GC/CM/DB.
  - 6) Name, address, and telephone number of organization's Bonding Company for the individual project.
  - 7) A description of the systems involved, the construction dates, and the contract amount for the equipment and services for which the Contractor had responsibility.
- i. List all projects, within the last 5 years, in which the organization has been involved in litigation with a City, County, State or Federal government agency. Include summary of final decisions and status of pending litigation.
- j. Provide line list of all manufactures represented (established dealer) and period of time represented.
- k. A technical proposal that indicates an understanding of the scope, quality, and technical aspects of the work and shall include the following:
  - 1) A technical description of the SECs approach to implementing each of the major systems included in the work. Interfaces with other contractor's work, if any, must be specifically addressed.
  - 2) For each major system, a delineation of the tasks to be performed by the SEC's staff and those tasks, if any, to be performed by subcontractors.
  - 3) A list of major systems components, including the equipment manufacturer's product numbers, to be used on this project. Detailed technical specifications and catalog cut sheets must accompany any proposed substitutions for the specified equipment in accordance with Division 01 requirements.
  - 4) A description of the overall system integration, which shall include a functional block diagram of the integrated system. For each functional unit shown on the diagram, the SEC shall provide a description of the functional capabilities and characteristics of the unit, including the hardware and software systems associated with the functional unit.



## Specifications

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- 5) A functional description of the software to be furnished. Software that is currently available and software that is to be developed by the SEC shall be identified. The system integrator shall provide a software data flow diagram/chart indicating in what programs and where all control logic will reside. Provide a detailed description of software approach and provide a signed statement that all software shall be developed in the Wonderware or Omron InduSoft environment. Integrators who develop logic in compiled DLL, EXE files or other encrypted software shall not be considered.
- 6) The system integrator must certify that they will provide one complete Wonderware or Omron Indusoft software development package including license (issued to the Owner). Include all other independent development licenses such as but not limited to CCTV, audio, card access system I/O servers utilized on the project. In addition provide 40 hours of software programming instruction to the designated Owners Representative. Programming instruction shall include a detailed explanation of how to create I/O and memory tags, icon creation, event logging, create and edit scripts, PLC modifications, independent system programming methods (CCTV, audio, card access system) for all devices within the project.

- I. THE QUALIFICATION PROPOSAL WILL BE EVALUATED BY THE ARCHITECT ENGINEER. THE SEC WILL BE REQUIRED TO MEET ALL QUALIFICATIONS LISTED PRIOR TO BEING ADDED TO THE APPROVED BIDDERS LIST VIA ADDENDUM.

### 1.5 SUBMITTALS

- A. Refer to Section 013300 – Submittal Procedures
- B. Duplicate copies of the bidding documents are not acceptable and will be rejected.
- C. The SEC shall participate in a MANDATORY PRE-SUBMITTAL MEETING.
  1. Location: Project Job Site
  2. Time Line: Sixty (60) days after award of contract
  3. Participants:
    - a. Architect Engineer
    - b. Design Builder -
    - c. Electrical Trade Contractor
    - d. SEC
      - 1) Project Manager
      - 2) Project Estimator
  4. The initial assembly of submittal materials as described herein shall be submitted for review.



## Specifications

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D. Bill of Materials

1. Provide complete bill of materials for all major components, accessories, and hardware to be provided in order to assemble a complete functioning system.
2. Bill of Materials shall include-
  - a. Manufacturer Name
  - b. Model
  - c. Version
  - d. Quantity

E. Unless sated differently in the Bidding General Provisions, provide six (6) copies of submittals as called for below.

F. The formal submittal shall be transmitted 30 days after Pre-Submittal Meeting.

G. Product Submittal

1. Submittal must consist of a complete package, bound in a three ring binder, including, Product Data for each Section of the Division 28 Security Systems series specifications, and Shop Drawings as applicable. PARTIAL OR INCOMPLETE SUBMITTALS ARE NOT ACCEPTABLE. The Submittal shall include the following:
2. A Title Page complete with the following required information:
  - a. Project name.
  - b. Date.
  - c. Name and address of the Architect Engineer.
  - d. Name and address of the GC/CM/DB
  - e. Name and address of the Electrical Trade Contractor
  - f. Name and address of any Subcontractors.
3. An Index Page complete with the following required information:
  - a. Name of the Supplier.
  - b. Name of the Manufacturer.
  - c. Title, section and paragraph of the Specification Sections. (Example section 281116, paragraph 2.4)
  - d. Products in order as specified in PART 2 of the related specification.
4. Each Specification section shall be separated, collated in order, and complete with the following information:
  - a. Title sheet.
  - b. Descriptive purpose of the system, stating how each product is to function.
5. Each Data Sheet shall have the specific reference to the Specification it is to be used for, noting the section and paragraph.

## Specifications

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6. Product Data showing multiple products, models, or options shall be clearly marked identifying the specific product, model, and options which are submitted for review. Unmarked submittals or facsimile copies shall not be acceptable.
7. Submit product data for all equipment showing:
  - a. Original Data Sheets Only. Fax copies are not acceptable.
  - b. Product performance, mechanical and electrical specifications.
  - c. Manufacturer's installation instructions.
  - d. Certification from the submitted manufacturers that the SEC's designated personnel are trained on the installation of the system. Include installer's name, experience and responsibility.
  - e. Product test compliance certificates if required.

### H. Shop Drawings

1. Submittals consisting of reproduced copies of the original bidding documents will be rejected. The SEC is required to develop a complete set of drawings specific to the final configuration of the system based on the manufacture and models of all components included. Shop drawings are to include all changes noted in addenda, as well as any changes included in architects special instructions or change orders issued prior to the submittal of the shop drawings.
2. Shop drawings shall be submitted with product data.
3. Electronics files of floor plans and reflected ceiling plans are available from the ARCHITECT ENGINEER at a cost of \$150.00 per sheet. Detail sheets, block diagrams, and riser sheets are not available.
4. All drawings shall be created using an industry recognized computer aided design program. Recognized programs include AutoDesk Revit, Auto Cad, and Microstation. All drawings are to be made using the latest software release available.
5. Submit shop drawings for all equipment showing:
  - a. Location and layout of all field equipment on floor plans.
  - b. Large scale (minimum  $\frac{1}{4}"=1'$ ) floor plan and elevation view drawings of all security electronics rooms and control rooms depicting all racks, consoles, cabinets, equipment, outlets, etc.
  - c. Size and spacing of all anchors, wall penetrations, joinery construction, etc., required for complete system installation.
  - d. Sizes, shapes, thickness and finishes of all materials and equipment surfaces.
  - e. Electrical riser diagrams identifying all signal, power and ground circuitry.
  - f. Block diagram(s) depicting system integration details.
  - g. Scaled elevations of all security equipment racks showing equipment mounting locations (front and rear if any equipment is rear-mounted).
  - h. Wall elevations showing mounting of cabinets and enclosures, conduit routing, etc.
  - i. Wire management details for the installation of cable harnesses inside racks, equipment cabinets, consoles, control panels and other areas of exposed cable.
  - j. Wiring diagrams for all equipment and devices (active and passive).
    - 1) Wiring diagrams are required to show point-to-point connection of all terminations for all devices.
    - 2) Indicate wire type used for connection.

## Specifications

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- 3) Indicated type of termination to be made. (i.e. terminal strip, euro block, XLR, etc.)
- 4) Indicate wire tag number.

- k. Scaled layout of all custom integrated control system graphic user interface panels.
- l. Installation detail of all surface or flush mounted devices including but not limited to speakers, cameras, readers, etc. Detail to show all required mounting and suspension hardware, as well as connection made to structure. Provide front, side, and top views.
- m. Installation detail of all suspended devices including but not limited to speaker systems, projection systems, etc. Detail to show all required mounting and suspension hardware, as well as connection made to structure. Provide front, side, and top views.
- n. Functional and operational written reports of all security systems.

### I. Samples

- 1. Provide samples as requested for review and approval of substitutions or as specified in Division 28 Security Systems specification.
- 2. Submit for each type of tamper-proof fastener. Indicate materials, finish, head design, strength, corrosion resistance, and installation/removal methods.
- 3. Submit four (4) samples of each type of tamper proof fastener proposed for use

### J. Test Plan and Documentation

- 1. Submit a complete testing plan for all systems for approval with the shop Drawing/Product Data submittal.
- 2. Plan submitted must include shop and field-testing of each and every field device and control function.
- 3. Plan submitted must include examples of testing documentation. Shop testing documentation must be submitted for approval prior to control system shipment to job site. Field-testing documentation must be submitted when requesting final Demonstration/Inspection (described below).
- 4. Detailed testing agenda and testing documentation forms for all systems. Detailed agenda outlining the "hands-on" training sessions to be provided to the User. The operation, programming/debugging, troubleshooting, repair and maintenance of all systems shall be covered.

### K. Training Plan and Documentation

- 1. Submit a complete training plan for all systems for approval.
- 2. As a minimum, the plan submitted must include individualized training paths for the following personnel on all aspects of the Security Electronics system.
  - a. Administrators
  - b. Supervisors
  - c. Operators
  - d. Maintenance Personnel

**Specifications**

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3. As a minimum, the plan submitted must include the following:
  - a. Proposed classes or sessions.
  - b. Recommended attendees for each class or session.
  - c. Proposed class or session objectives.
  - d. Proposed class or session agenda and duration.
  - e. Proposed supporting materials for each class or session.
  - f. Proposed testing procedure for evaluation purposes.
  - g. Proposed documentation of testing and evaluation.
4. Do not commence training until the Architect Engineer has approved the plan.
5. Plan submittal must include names of technical instructors. SEC must provide technician responsible for project as instructor. SEC instructor shall submit evidence of factory training on system provided.

**L. Operating and Maintenance Data**

1. Provide a bound and illustrated control console operator's manual. One copy shall be provided for each control station.
2. The operator's manual shall be written in laymen's language and printed so as to become a permanent reference document for the operators, describing all control panel icon operations, graphic symbol definitions, and all indicating functions and a complete explanation of all software.
3. Provide a bound and illustrated service manual. Three copies of the manual shall be provided.
4. The service manual shall be written in laymen's language and printed so as to become a permanent reference document for maintenance personnel, describing how to run internal self-diagnostic software programs, troubleshoot head-end hardware and field devices with a complete scenario simulation of all possible system malfunctions and the appropriate corrective measures.
5. Provide four (4) copies of each operating and maintenance manual for each Division 28 Security Systems. Manuals shall be bound in "D-ring" binders with a detailed table of contents.
6. The O & M manuals shall be cross-referenced to the Record Documents and contain the following information for all systems:
  - a. Product catalog cut sheets and specifications of all equipment.
  - b. "Hands-on" operational description of all equipment and performance features in each system using clear and understandable terminology.
  - c. Detailed programming instructions for all systems and all software programs.
  - d. Printed copy of all equipment settings.
  - e. Copy of all software programs required. Copy shall include most recent version of manufacturer's software, and all final programming settings. Software shall be stored on CD/DVD and USB thumb drive. Provide one CD/DVD copy for each O&M Manual, and one USB thumb drive that is to be left in the rear of the equipment rack.
  - f. Troubleshooting procedures to diagnose malfunctions in each system.
  - g. Repair procedures for all equipment.

## Specifications

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- h. Preventative maintenance procedures for all equipment.
- i. Table listing the model numbers for all equipment in each system including the names and phone numbers of the manufacturer and their representative directly responsible for this project.

### M. Record Documents

- 1. Submit three (3) black line prints, and electronic copy of the "As-built" condition of all systems including:
  - a. A set of updated shop drawings showing all Contract changes.
  - b. A set of updated product data showing all Contract changes.
  - c. "Hands-on" operational description of all equipment and performance features in each system using clear and understandable terminology.
  - d. Floor plan showing conduit raceway routing including all equipment rack, cabinet and pull box locations, and conduit sizes.
  - e. Complete point-to-point wiring diagrams showing ALL equipment, devices, wire and cable (Signal, power and ground). This document shall also include all terminal block designations, abbreviations and color-coding.
  - f. Provide report showing results of all tests required and outlined in individual Div 28 series specifications.
  - g. Two (2) copies of approved training session DVD.
  - h. Transmittal letter listing delivery and acceptance of complete spare parts inventory.
  - i. Copy of warranty statement
  - j. Procedures for addressing warranty/repair issues.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. [Refer to Section 016000 – Product Requirements]
- B. All products shall be new (less than one year from manufacture and unused and without blemish or defect).

### 2.2 SUBSTITUTIONS

- A. Submit substitutions in accordance with [Section 016000 – Product Requirements]. No other method of substitution is acceptable.
- B. Deviations from specifications
  - 1. Any deviations from the specifications must be approved 10 calendar days prior to the bid date. This includes changes to the scope of work, equipment substitutions, and changes to the general provision.

**Specifications**

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2. Changes to the scope of work in the bid proposal are not acceptable. Any proposed change is to be submitted to the Architect/Engineer for review. Any approved changes will be listed by addendum prior to the bid opening.
3. Any proposed equipment substitution must be submitted 10 calendar days prior to the bid date. Accompany the request, the contractor must provide manufactures product specifications for the exact model be substituted. This literature must clearly state all specifications called for in the bidding documents, as well as performance characteristics not specified but inherent to the product listed in the specifications. Any items approved for substitution will be listed by addendum prior to the bid opening. Substitutions after the award of bid will only be allowed in case of discontinued equipment, or if an item of equal or better quality is available and will not affect the contract cost of the system.
4. Changes to the general provisions are not acceptable. Any proposed change is to be submitted to the Architect/Engineer for review. Any approved changes will be only listed by addendum prior to the bid opening.
5. When a specified item is found to be discontinued or obsolete by the manufacturer, the SEC is required to substitute the manufacturer recommended equivalent for that product. If an equivalent is not available, the contractor is instructed to notify the Architect in writing prior to bid time.
6. Where specific products are sole source specified, no substitutions will be allowed.

**2.3 MANUFACTURED PRODUCTS**

- A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.
- B. Equipment Assemblies and Components
  1. All components of an assembled unit need not be products of the same manufacturer; however, all components must be acceptable to the Architect/Engineer.
  2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
  3. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer.
  4. Components shall be compatible with each other and with the total assembly for the intended service.
  5. Constituent parts which are similar shall be the product of a single manufacturer.
  6. Moving parts of any element of equipment of the unit normally requiring lubrication shall have means provided for such lubrication, and shall be adequately lubricated at the factory prior to delivery.
    - a. All factory wiring shall be identified on or provided with the equipment being furnished and on all wiring diagrams and included with O & M manuals.
    - b. When factory testing is specified:
  7. The Architect/Engineer shall have the option of witnessing factory tests. The SEC shall notify the Architect/Engineer a minimum of 15 working days prior to the manufacturer making the factory tests.



**Specifications**

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8. Four copies of certified test reports containing all test data shall be furnished to the Architect/Engineer prior to final inspection and not more than 90 days after completion of tests.
9. When equipment fails to meet factory test and reinspection is required, the SEC be liable for all additional expenses.

**2.4 EQUIPMENT IDENTIFICATION**

- A. In addition to the requirements of the National Electrical Code, install an identification sign that clearly indicates information required for use and maintenance of items such as cabinets, control devices and other significant equipment.
- B. Nameplates shall be laminated black phenolic resin with a white core and engraved lettering, a minimum of 1/4-inch high. Nameplates that are furnished by manufacturer, as a standard catalog item, or where other methods of identification are herein specified, are exceptions.
- C. All inputs and outputs are to be clearly labeled. Inputs to include the source location and signal type. Outputs should indicate location signal is sent to.
- D. All custom input plates labeling shall be engraved and paint filled or laser etched with a contrasting color as shown on the specification.
- E. Any and all user serviceable devices shall be clearly labeled.

**PART 3 - EXECUTION****3.1 INSPECTION**

- A. Before installing electronic equipment, carefully inspect the installed Work of all other Trades. Verify that all such Work is complete to the point where the installation of electronic equipment may properly commence. Verify that the telecommunications closets are free of airborne contaminants prior to the installation of electronic equipment.
- B. Verify that all equipment is installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.
- C. In the event of discrepancy, immediately notify the Architect and Engineer.
- D. Do not proceed with installation in areas of discrepancy until such discrepancies have been fully resolved.
- E. Return to original (preconstruction) condition any work disturbed during system installation.

**Specifications**

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**3.2 INSTALLATION**

- A. Install all equipment in strict accordance with the manufacturer's recommendations, reviewed shop drawings and ANSI/EIA/TIA standards.
- B. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.
- C. Secure equipment with fasteners suitable for the use, materials and loads encountered. If requested, submit evidence proving suitability.
- D. National Electrical Code and other codes and standards listed elsewhere are applicable to all work.
- E. Working spaces shall be not less than specified in the National Electrical Code for all voltages specified.
- F. Where the Architect or Engineer determines that the SEC has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as directed at no additional cost to the Owner. "Conveniently accessible" is defined as being capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, and duct work.
- G. All programming of control panels and recording/storage devices shall be performed in the SECs shop prior to delivery to the job site. All equipment is to be fully tested.
- H. All equipment racks are to be fully assembled and wired in the SECs shop prior to delivery to the job site. All electronics are to be full tested.

**3.3 WORK PERFORMANCE**

- A. Coordinate location of equipment with other trades to minimize interferences.
- B. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Architect Engineer as required by limited working space.
- C. Holes shall be located so as not to affect structural sections such as ribs or beams.
- D. Holes shall be laid out in advance. The Architect Engineer shall be advised prior to drilling through structural sections for determination of proper layout.
- E. Any holes created in walls, floors, or ceilings by the SEC are to be fire-stopped according to Section – 078413 – Fire-stopping and all national, state, and local codes.



## Specifications

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- F. Hangers and other supports shall support only equipment and materials. Provide not less than a safety factor of 5, which shall conform to any specific requirements in the Construction Documents.
- G. The SEC is responsible for repairing and or replacing any damage caused by their workforce at no additional cost to the Owner.

### 3.4 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT

- A. Protect all materials and equipment from damage during storage at the Site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain.
- B. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering them on all sides with securely fastened protective rigid or flexible waterproof coverings.
- C. Piping shall be protected by storing it on elevated supports and capping the ends with suitable closure material to prevent dirt accumulation in the piping.
- D. During construction, cap the top of all conduits and raceway installed vertically.
- E. During installation, protect equipment against entry of foreign matter on the inside, and vacuum clean both inside and outside before testing and operating.
- F. Damaged equipment, as determined by the Architect Engineer, shall be replaced.
- G. Painted surfaces shall be protected with removable heavy craft paper, sheet vinyl or equal, installed at the factory and removed prior to final inspection.
- H. Repaint damaged "FINISH" paint on equipment and materials with painting equipment and finished with same quality of paint and workmanship as used by the original manufacturer so repaired areas are not obvious.
- I. Conduit back boxes, floor boxes, and poke thru's shall be vacuumed clean prior to the installation of cable.

### 3.5 IDENTIFICATION

- A. Nameplates shall be laminated black phenolic resin with a white core and engraved lettering, a minimum of 1/4-inch high. Nameplates that are furnished by manufacturer, as a standard catalog item, or where other methods of identification are herein specified, are exceptions.
- B. Uppercase letters of uniform height; centered on device, cover plate, or enclosure; engraved letters filled with a contrasting color; and all characters made clearly and distinctly.



## Specifications

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- C. Use abbreviations defined in the contract documents whenever possible. Use plan designations for labeling unless indicated otherwise.

### 3.6 LABELING

- A. All cables shall be properly identified using a high quality thermal transfer-labeling device such as the Kroy K4100 or equal.
- B. Cable
  - 1. Provide typewritten labels on both ends of all security electronics system cabling. Locate label within 6" of cable termination. Cover label with clear heat shrink tubing.
  - 2. Label designation to consist of letter indicating type of cable (i.e. V for video, C Control, M for Master Station etc.) and a number. Numerical designations shall be sequential.
    - a. Power Outlets
      - 3. Power outlet labels are to be mechanically generated.
      - 4. All power outlets designated for security equipment shall be labeled "SECURITY ELECTRONICS EQUIPMENT ONLY". On top.
      - 5. Provide a second label on the bottom of the outlet cover plate indicating service panel number and circuit breaker number.
      - 6. Text lettering to be 1/8" high.
- C. Rack Mounted Electronic Components
  - 1. Electronic component labels are to be mechanically generated.
  - 2. All inputs are to be labeled identifying source location of signal.
  - 3. All outputs are to be labeled identifying signal destination.
  - 4. Provide 1/4" diameter indicator dot showing level setting for all rotary knobs, sliders, and pushbutton switches.
  - 5. Power switches shall be clearly labeled indicating switch is to be left in the on position at all times.

### 3.7 CABLE TERMINATIONS AND DRESS

- A. Installation of signal, video, communication, and control conductors shall adhere to the following:
  - 1. Cables shall be installed in Panduit wire duct (or approved equal) in all cabinets, racks and/or at control panels and consoles for all wire and cable management.
  - 2. Cables shall be secured to equipment cabinet backboards, console members or to other system components using Panduit wire duct (or approved equal). SEC shall furnish and install cable support posts, cable clamps or wraps, if required, to facilitate system installation where plastic wire duct use is not possible.
  - 3. All cables and/or conductors shall be terminated with approved cable termination connectors compatible with the specific termination.



## Specifications

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4. Label all cables on both ends and on all termination points.

### 3.8 CLEANING

- A. Refer to Section 017419 – Construction Waste Management and Disposal
- B. Daily during construction and prior to User acceptance of the building, remove from the premises and dispose of all packing material and debris caused by work performed under Division 28 Security Systems.
- C. Remove all dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.
- D. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.
- E. All bright metal or plated work shall be thoroughly polished. All pasted labels, dirt and stains shall be removed from the devices.

### 3.9 COMPLETION

- A. Results Expected
  1. All equipment and materials shall be in place, all controls shall be set and calibrated, all programming shall be installed and debugged, and all systems shall be demonstrated to be operationally complete.
  2. All testing, start-up and cleaning work shall be complete.
  3. All documented testing results are submitted and approved by the Architect Engineer. The sec at no additional cost shall replace any component of the system that fails to meet the performance as specified.
  4. All O & M Manuals and Record Documents are reviewed and accepted.
  5. Substantial Completion inspection is performed and granted. The Substantial Completion inspection punch list is completed by SEC.
  6. All facility training shall be complete and the DVD of the training session is accepted.
  7. All warranties are received.
  8. Transmittal letter listing delivery and receipt of complete spare parts inventory.
  9. Special test equipment is received.

### 3.10 DEMONSTRATION/INSPECTION

- A. Upon completion of approved testing procedure and submittal of testing documentation as described above, the SEC shall notify the Architect Engineer, who will visit the project for a demonstration of the systems and an inspection of the completed work in conformance with the Construction Documents. It is mandatory for a representative from the SEC directly responsible for the project to be present during demonstration and inspection periods.

**Specifications**

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- B. Items which do not comply with the Contract Documents, or which function incorrectly, will be listed and the list will be submitted by the Architect to the Contractor.
- C. After all corrections have been made, the SEC shall notify the Architect Engineer who will recheck the system for compliance of all items listed. If the architect engineer or owner is required to again return to the site for further inspections, the sec shall reimburse all labor and travel expenses.

**3.11 TRAINING**

- A. Provide training after all final tests and adjustments have been completed. Instruct the User's personnel according to the approved Training Plan specified above in "Training Plan and Documentation." Training shall cover all aspects of systems operation, maintenance and programming, and shall be provided by the responsible SEC technical representatives.
- B. Provide written operating instructions specific to the basic operation of the system. Basic instructions should cover all operational aspects of the system required for basic operation including system powering, signal patching and routing, and level control. These instructions are to be laminated and located with the main system power control.
- C. Schedule training sessions to meet the needs of facility personnel as determined by the Owner. Provide training during second and third shifts.
- D. Record all training sessions. Submit an edited DVD copy to the Architect Engineer for review and approval. Present all materials used in the training session on the video. Any DVD found to be inferior in recording or material content shall be reproduced at no cost until an acceptable tape is submitted.
- E. Provide a minimum of 80 hours of training. All training is to be completed during the time frame established during scheduling with the Owner. Training may not necessarily be in continuous periods.
- F. Refer to individual sections for system specific training requirements.
- G. Shake Down Period:
  - 1. The SEC shall provide 10 days of system shakedown, which shall include providing a fully trained employee of the SEC who shall provide additional training, system repairs and alterations prior to, during and after the transfer of inmates into the facility. The system shall be fully operational and certified prior to the shakedown period beginning.
  - 2. This person shall be on-site during the 1st shift and be available or on-call during 2nd and 3rd shift.

**3.12 MAINTENANCE MATERIALS**

- A. All special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered in conformance with Section 017700 Closeout Procedures.



**Specifications**

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- B. Provide spare materials as indicated in Contract Documents and as required for proper maintenance of the Security Systems.

3.13 WARRANTY, WARRANTY SERVICE AND MAINTENANCE

- A. Refer to Section 280510 – Maintenance Service and Warranty for Electronic Security

END OF SECTION 28 05 00







## **28 05 10 - MAINTENANCE, SERVICE, AND WARRANTY FOR ELECTRONIC SECURITY**

### **PART 1 GENERAL**

#### **1.1 SYSTEM DESCRIPTION**

- A. Furnish and install all equipment, materials and labor necessary to complete the installation of specific systems described herein and integration of all systems as indicated, specified herein or both. The work includes the following, as well as work not listed below but described elsewhere:
  - 1. Scheduled Maintenance
  - 2. Non-Scheduled Maintenance
  - 3. Documentation of Maintenance
  - 4. Spare Parts Inventory
  - 5. Future Staff Training
  - 6. Third Party Service Contracts
- B. It is the intent of this Section to define maintenance services to support all systems included in the 280500 series specifications (excluding conduit and boxes furnished by others but including final connections).
- C. The SEC shall provide maintenance and service as part of the Contract during the two-year guarantee period. The guarantee period shall begin with Owner acceptance of the systems as "complete as specified" not at Substantial completion.

#### **1.2 PRODUCTS**

- A. All products used in parts replacement shall meet the specifications for the original equipment. The Architect Engineer must approve any substitutions.

#### **1.3 SPARE PARTS**

- A. One GUI including touch screen monitor, CPU, Keyboard and mouse.
- B. One case of paper and four replacement cartridges for printer specified.
- C. 10 spares of each type of relay used on this project.
- D. Two proximity card readers
- E. One Surveillance camera of each type used
- F. 25 fuses of each type used
- G. One spare PLC CPU



**Specifications**

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- H. One spare PLC Module of each type used
- I. One spare PLC power supply
- J. One spare linier power supply of each type used
- K. One spare surveillance desktop monitor
- L. One spare intercom master station
- M. One spare intercom call station of each type used

**1.4 SOFTWARE SERVICE**

- A. Update software to latest version at project completion.
  - 1. Install and program software upgrades that become available within one year from date of substantial completion.
  - 2. Upgrading software shall include the operating system.
  - 3. Upgrade shall include new or revised licenses for use of software.
- B. Provide (30) days notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

**PART 2 - NOT USED**

**PART 3 EXECUTION**

**3.1 WARRANTY AND WARRANTY SERVICE**

- A. Warranty
  - 1. The Division 28 series security systems shall be fully guaranteed for a period of two (2) years beginning on the date of Owner acceptance.
  - 2. The guarantee shall include the entire Division 28 series scope of work including all equipment, devices, materials, cable/wire, software and installation as it applies to security electronics.
  - 3. Work shall be guaranteed to be free from defects. Any defective materials or workmanship, as well as damage to the Work of all other Trades resulting from same, shall be replaced or repaired as directed by the Owner for a period of two (2) years from the date of Owner final acceptance. The SEC shall provide written warranties for all systems and all buildings to the Owner.
  - 4. The guarantee shall exclude acts of God, vandalism, physical abuse or operator misuse.
  - 5. Acceptance by a manufacturer of an order for equipment for this contract signifies acceptance of this warranty. During the warranty period there shall be no charge to the Owner for equipment, material, software, etc. for guarantee work.



**Specifications**

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6. During the warranty period, there shall be no charges to the Owner for service calls (mileage, labor, travel, expenses, etc.) for warranty work.

**B. Warranty Service**

1. The SEC shall provide warranty service as part of this Contract during the warranty period.
2. Warranty service agreement must be submitted separately and must contain the name, voice phone number, facsimile phone number and pager number of the service provider capable of meeting the response times as defined by the Architect Engineer.
3. This service shall consist of the following:
  - a. 24-hour staffed phone number.
  - b. Technician's factory trained by the manufacturers of the system's components.
  - c. Authorized representation of the manufacturer via an agreement of factory support.
  - d. Five years experience (minimum) servicing systems of the type included in this project.
  - e. Capability of making additions or changes to the software systems used in this project.
  - f. Capability of servicing the individual system components and the total security electronics system.
  - g. Equipment and knowledge to test all specified equipment and devices.
  - h. Current system documentation including but not limited to the following:
    - 1) Wiring diagrams.
    - 2) Operation and maintenance manuals.
    - 3) Software programs.
    - 4) Other documentation as required to provide assistance to the Owner in the operation and maintenance of the systems.
    - 5) All documents shall be made available to Owner upon request.
    - 6) Upon termination of maintenance agreement all system documents shall be furnished to Owner for maintenance continuity.
4. The Owner and/or Architect Engineer shall notify the SEC in writing, outlining operational malfunctions or defects in the Division 28 series Security Electronics system. This report shall be emailed or faxed to the service provider, which will establish the date and time of problem notification.
5. Upon successful completion of warranty service, the responsible technician shall return a copy of the original service request to the facility with a detailed description of the problem found, and corrective action taken including a list of equipment/parts/software repaired or replaced. The technician shall also sign the on-site service log at the facility.
6. The SEC shall maintain a repair parts inventory sufficient to maintain the response times specified. All parts used from the Owner's spare parts inventory for warranty service shall be replaced at no cost to the Owner.



## Specifications

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### 3.2 OWNER INSPECTIONS

- A. Inspections by the Owner shall consist of "go, no-go" type inspections to determine the operational state of a system. It is not intended that the Owner perform adjustments or modifications for system restoration.
- B. The Owner as a result of daily inspections and/or operational use of the systems will initiate non-scheduled maintenance. Categories of maintenance support and the response time for system restoration are defined in NON-SCHEDULED MAINTENANCE below.

### 3.3 SCHEDULED MAINTENANCE

- A. The SEC shall provide scheduled maintenance as described below.
- B. Quarterly Scheduled Maintenance
  - 1. Security Control System
    - a. Touch Screens and CPUs (inspect and clean).
    - b. Programmable logic controllers.
    - c. Test all duress/panic pushbuttons.
    - d. Relay cabinets.
    - e. Electro-mechanical detention hardware (Note: The Division 11 Detention Equipment Trade Contractor shall perform all maintenance and adjustment of these devices. The Trade Contractor shall verify proper security control system operations only).
    - f. Inspect and clean all system filters.
    - g. Auxiliary devices such as indication lights, push buttons, door position switches.
  - 2. Video Surveillance System
    - a. Verify proper video signal at each monitor.
    - b. Verify proper auto-iris operation, video and sync. signal at each camera.
    - c. Check video clarity of each camera.
    - d. Perform focus adjustments, etc. as required.
  - 3. Intercom, Paging and Communication Systems
    - a. Verify proper operation of master stations.
    - b. Verify proper adjustment of all remote intercom amps.
    - c. Verify proper adjustment and operation of all paging amplifiers.
  - 4. Uninterruptible Power Systems (UPS)
    - a. Verify proper voltage and current levels
    - b. Exercise UPS function by system power blackout and emergency generator test.



**Specifications**

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- 5. Grounding and Surge Protection
  - a. Check status of all devices.
  - b. Perform ground measurements.
- 6. Video Visitation
  - a. Check status and operation of all stations, kiosks.
  - b. Verify recording.

3.4 NON-SCHEDULED MAINTENANCE

- A. The SEC shall provide non-scheduled or "on-call" maintenance services in accordance with the following Service Response Categories.
  - 1. Critical: Items which compromise the security of the facility or have an adverse effect on the operations of the facility. Items in this category shall be returned to service within 8 actual hours after receipt of a service call by the SEC. Service shall be available on a 7-day, 24-hour basis.
  - 2. Sensitive: Items which adversely impact the operations of the facility but are not considered "critical" as defined above. Items in this category shall be returned to service within 24 actual hours after receipt of a service call by the SEC.
  - 3. Normal: Items which require maintenance support but are not "critical" or "sensitive" as defined above. These are typically items which staff personnel identify and accept that maintenance shall be performed by SEC during the standard quarterly inspection.
- B. System/Response Category Table

PRODUCT/SYSTEM	CATEGORY
1. Touch Screen/PLC/Security Control	
a. All components	Critical
b. Card Reader	Sensitive
c. Duress/Panic Pushbutton	Critical
2. Closed-Circuit Television	
a. Digital Video Recorder	Critical
b. Video Recording System	Critical
c. Video Surveillance Camera	Sensitive
d. Video Surveillance Monitor	Sensitive
e. Video Surveillance Controller	Sensitive



**Specifications**

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- |    |                                     |           |
|----|-------------------------------------|-----------|
| 3. | Intercom System                     |           |
| a. | Master Station                      | Critical  |
| b. | Single remote station               | Sensitive |
| c. | Paging                              | Critical  |
| 4. | Uninterruptible Power Systems (UPS) |           |
| a. | All components                      | Critical  |
| 5. | Surge Suppression                   |           |
| a. | All components                      | Sensitive |
| 6. | Video Visitation                    |           |
| a. | Individual Stations                 | Sensitive |
| b. | Entire system in an area            | Critical  |

**3.5 DOCUMENTATION OF MAINTENANCE**

- A. It shall be the responsibility of the SEC to maintain all documents and modify drawings, schedules, and other documents as required to effect documentation which reflects the current system or wiring configuration.
- B. Create and maintain a maintenance log that details maintenance services provided, system modifications, and software upgrades. One copy of log is to remain at the facility.
- C. Upon termination of the service contract, the SEC shall return all system documents to the Owner.

**3.6 SPARE PARTS INVENTORY**

- A. An inventory of spare parts consisting of at least the quantity of items herein must be provided and maintained by the SEC to support the maintenance response requirements defined in this document.
- B. The spare parts inventory may be comprised of SEC furnished and/or maintained parts.
- C. The SEC shall maintain a spare parts inventory in excess of the amount indicated in Contract Documents, as he deems necessary to support the maintenance and service requirements of this section.
- D. During the maintenance and service period, the Contractor shall maintain a log of all component failures and parts replaced.
- E. Six months prior to the expiration of the maintenance and service period, the SEC shall submit the replaced parts log to the Owner. The Owner shall use the replaced parts log to evaluate the on-site spare parts inventory required for future maintenance by the Owner/User.



**Specifications**

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3.7 FUTURE STAFF TRAINING

- A. It shall be the responsibility of the SEC to train the Owner on new system features or software which may be provided to enhance the system's capability.

3.8 THIRD PARTY SERVICE CONTRACTS

- A. The SEC shall provide a third-party service contract for all equipment supplied that is more efficiently serviced by the third-party company.
- B. The service contract shall provide service response times as described above.
- C. All third-party service requests shall be acknowledged through the SEC to verify appropriate service procedures have been followed as outlined in the service manual.

END OF SECTION 28 05 10







## **28 05 11 - BACKBONE SYSTEM CABLING FOR ELECTRONIC SECURITY**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specifications Sections, apply to this Section.

#### **1.2 SYSTEM DESCRIPTION**

##### **A. General**

- 1. Provide Fiber Optic Backbone Cabling for the security electronics system Ethernet LAN.
- 2. Backbone shall consist of multi-mode fiber.
- 3. Provide Fiber Optic Backbone system cabling, fiber optic termination enclosures, patch cables, terminations and testing for the Fiber Optic Backbone Cabling system as indicated in Project Documents.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL**

- A. Equipment specified is intended as a reference standard for level of quality.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the schedule bid time. Refer to Division 00 and Division 01.
- C. Provide materials listed by UL or ETL.

#### **2.2 FIBER OPTIC BACKBONE CABLE**

##### **A. Specifications**

##### **1. Multi Mode**

- |    |                                |               |
|----|--------------------------------|---------------|
| a. | Core Diameter:                 | 50 +/- 2.5 um |
| b. | Core Non-circularity:          | 5% max        |
| c. | Cladding Diameter:             | 125 +/- 1 um  |
| d. | Core/Clad Concentricity Error: | < 1.5 um      |
| e. | Coating fiber diameter:        | 245 +/- 10 um |
| f. | Cladding Non-circularity:      | <1%           |

## Specifications

- g. Coating/Cladding Concentricity Error: <6 um
- h. Colored Fiber Diameter: 254 um
- i. Numerical Aperture: .275 +/- .015
- j. Effective Group Index of Ref. @850nm: 1.496
- k. Effective Group Index of Ref. @1300nm: 1.491
- l. Point Discontinuities @ 850 and 1300 nm: <.08dB
- m. Max. Fiber Loss @850: 3 dB/km
- n. Max. Fiber Loss @1300: 1 dB/km
- o. Minimum Bandwidth @ 850: 200 MHz-km
- p. Minimum Bandwidth @1300: 500 MHz-km
- q. NEC CMP rated

### 2. Single mode

- a. Core Diameter: 8.3 um nominal
- b. Cladding Diameter: 125 +/- 1 um
- c. Core/Clad Concentricity Error: < .5 um
- d. Coating fiber diameter: 245 +/- 10 um
- e. Cladding Non-circularity: <1%
- f. Coating/Cladding Concentricity Error: <12 um
- g. Colored Fiber Diameter: 254 um
- h. Effective Group Index of Ref. @1310 nm: 1.466
- i. Effective Group Index of Ref. @1550 nm: 1.467
- j. Point Discontinuities: .1 dB
- k. Max. Fiber Loss @1310: .7 dB/km
- l. Max. Fiber Loss @1550: .7 dB/km
- m. NEC CMP rated

## B. Acceptable Manufacturer

### 1. Intra Building

- a. AMP/Netconnect
- b. Commscope/Uniprise/Systimax
- c. Panduit/General Cable
- d. Hubbell/Mohawk
- e. Belden/CDT
- f. Multi mode indoor plenum rated cable. Refer to drawings for strand count.

### 2. Inter Building

- a. AMP/Netconnect
- b. Commscope/Uniprise/Systimax
- c. Panduit/General Cable
- d. Hubbell/Mohawk
- e. Belden/CDT
- f. Multi mode outdoor armored cable. Refer to drawings for strand count.



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**Specifications**

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2.3 FIBER OPTIC PATCH PANEL

A. Specifications

1. 14 ga. CRS construction
2. 19 rack mount, 4 RMS (7" high)
3. Modular construction
4. Provide fiber management bend limiting clips
5. Provide strain relief brackets
6. Provide adapter panels to support the fiber optic strand count shown on the plans.

B. Acceptable Manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT
6. Leviton

2.4 FIBER OPTIC WALL INTERCONNECT

A. Specifications

1. 14 ga. CRS construction
2. Modular construction
3. Provide fiber management bend limiting clips
4. Provide strain relief brackets
5. Provide adapter panels to support the fiber optic strand count shown on the plans.

B. Acceptable Manufacturers

1. AMP/Netconnect.
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT
6. Leviton

2.5 FIBER OPTIC PATCH PANEL ADAPTOR PLATE

A. Specifications

1. SC duplex multi mode adaptors
2. Provide adaptor panels to support the fiber optic strand count shown on the plans.
3. Ferrell color based on cross-connect field identification color code, TDMM 12<sup>th</sup> edition, chapter 7.



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**Specifications**

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B. Acceptable Manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT
6. Leviton

2.6 FIBER OPTIC CONNECTORS

A. Specifications

1. Duplex SC type connector
2. High impact plastic body
3. Zerconia/Ceramic ferrule
4. .3dB typical insertion loss
5. -30dB/-40dB reflectance, Multimode respectively
6. 32° – 131° F operating temperature
7. 12 pound tensile strength
8. Ferrell color based on cross-connect field identification color code, TDMM 12<sup>th</sup> edition, chapter 7.

B. Acceptable Manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable
4. Hubbell/Mohawk
5. Belden/CDT
6. Leviton

2.7 FIBER OPTIC PATCH CABLES

A. Specifications

1. Duplex SC connectors
2. Ferrell color based on cross-connect field identification color code, TDMM 12<sup>th</sup> edition, chapter 7.
3. 2 meters in length.
4. Patch cables are to be turned over to the Owner for use in installation of active equipment outside the scope of the project.
5. Furnish (40) multi mode patch cables.

B. Acceptable Manufacturers

1. AMP/Netconnect
2. Commscope/Uniprise/Systimax
3. Panduit/General Cable



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**Specifications**

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4. Hubbell/Mohawk
5. Belden/CDT
6. Leviton

## PART 3 EXECUTION

### 3.1 INSTALLATION

#### A. General

1. Install all fiber cabling in accordance with applicable standards and codes.
2. Maintain fire rating of all penetrations through rated walls during construction.
3. Coordinate fire stopping of all cable runs through floor sleeves with the General Contractor-Advisor. Refer to Section 078413 - Firestopping.
4. Install all fiber cabling and secure utilizing wire management brackets and hook and loop type (Velcro™) straps. No plastic cable ties shall be used to secure any cabling.

#### B. Backbone Cabling

1. Install cabling as per manufacturer's instructions.
2. Do not exceed specified pulling tensions.
3. Do not exceed specified bend radius.
4. Provide a 3 meter maintenance loop of fiber cable
5. All fiber optic cable shall be installed in plenum inner duct.

#### C. Fiber Optic Termination Enclosures

1. Install all cabling and secure utilizing wire management system.
2. Secure fiber jacket in a minimum of two locations.
3. Install minimum one meter of unjacketed fiber strands coiled on the enclosure routing guides.
4. Terminate and connect all fibers in fiber termination enclosure:
  - a. Populate the single-mode fibers on the ports beginning with 1.
  - b. Populate the multi-mode fibers on the next available port after the single-mode fibers.
5. Use only hook and loop (Velcro™) type straps to secure and dress fiber cables.

### 3.2 LABELING

#### A. General

1. Provide labeling based on ANSI/TIA/EIA-606A administration concepts for all conduits, fiber, patch panels, jacks, bus bars, racks, etc.
2. Provide machine generated typewritten labels, hand labeling is not acceptable



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**Specifications**

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**B. Equipment Room Terminating Hardware**

1. Provide an identifier for each Patch Panel that incorporates the Cabinet identifier. (e.g. TR2A-RR3-PP1 is the first patch panel in the third relay rack in the first intermediate telecommunications room on the second floor)
2. Provide an identifier for each Patch Panel port that incorporates the Patch Panel identifier. (e.g. TR2A-RR3-PP1-09 is the ninth port on the first patch panel in the third relay rack in the first intermediate telecommunications room on the second floor)

**C. Backbone Cable**

1. Provide both of the cable's Patch Panel Port identifiers on both ends of all backbone cables.
2. Insure that label is intact after termination of cable.

**3.3 TESTING**

**A. General**

1. Certify system is complete and functional.
2. Test all cabling and connections. Perform final functional tests in presence of the Architect Engineer.
3. Complete certified testing report.

**B. Fiber Cable Testing**

1. All fiber testing shall be performed on all fibers in the completed end to end system.
2. Every fiber shall be tested in both directions with a light source tester.
3. There shall be no splices unless clearly defined in construction documents.
4. Maximum allowable attenuation for 50 micron fiber shall be 3.0 dB per km at 850nm and 1.0 dB per km at 1300 nm.
5. Maximum allowable attenuation for single mode fiber shall be .5 dB per km at 1310 nm and 0.4 dB per km at 1550 nm.
6. All testing shall follow TIA/EIA-TSB-140 (or later revisions of this document) standards.

END OF SECTION 28 05 11

## **280512 - HORIZONTAL CABLING SYSTEM FOR ELECTRONIC SECURITY**

### **PART 1 GENERAL**

#### **1.1 RELATED DOCUMENTS:**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

#### **1.2 SYSTEM DESCRIPTION**

##### **A. General**

1. Provide a complete Horizontal Cabling system that supports voice, voice, and data as indicated in Project Documents relative to the electronic security system(s).
2. Provide, equipment room rack mounted termination equipment, equipment room patch cables, work area outlets, work area equipment cables, terminations, labeling and testing for the Horizontal Cabling system as indicated in Project Documents.
3. Provide Fire stopping Materials for Horizontal Cabling as indicated in Project Documents, provide all labor and materials to maintain Fire stopping at all penetrations at all times during construction and to insure adequate Fire stopping at all penetrations at completion.
4. Provide all necessary materials and labor for the horizontal cabling system in all equipment rooms and closets as indicated in project documents.

##### **B. Horizontal Cabling Subsystems**

1. Provide a complete UTP horizontal cabling system as indicated in project documents relative to the electronic security system(s).
2. Provide UTP horizontal system cables, equipment room rack mounted UTP termination equipment, equipment room UTP patch cables, work area UTP jacks and faceplates, work area equipment cables, UTP terminations, labeling and testing for the UTP Horizontal Cabling system as indicated in Project Documents.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL**

- A. Provide materials listed by UL or ETL. All cables shall be marked according to current standards.
- B. All cable must be NEC type CMP unless installed in conduit from end to end.

#### **2.2 UTP HORIZONTAL CABLE**

##### **A. Specifications**

1. ANSI/EIA/TIA Category 6 compliant

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**Specifications**

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2. Quantities and locations as indicated in Project Documents
3. 4 pair, 23 AWG, solid bare annealed copper
4. Flame retardant semi-rigid PVC insulation
5. Longitudinal rip-cord
6. Color based on cross-connect field identification color code, TDMM 11<sup>th</sup> edition, chapter 7.
7. All cables terminated per T568B.

B. Acceptable manufacturers

1. Panduit
2. Belden
3. Berk-Tek
4. Commscope
5. Superior Essex

2.3 PATCH PANELS

A. Specifications

1. Modular rack mounted
2. Release snap feature on faceplate allowing front access to installed modules.
3. Label version for easy port identification
4. Replacement label/label covers
5. Mount standard EIA 19" rack
6. Jack color to correspond with color of jack at work area outlet location.

B. Acceptable Manufacturers

1. Panduit
2. Belden
3. Berk-Tek
4. Commscope
5. Leviton

2.4 CATEGORY 6 RJ-45 JACKS

A. Specifications

1. Exceeds TIA/EIA-568-B.2 Category 6 and ISO 11801 2nd Edition Class D standards
2. Each jack is 100% tested to ensure NEXT and RL performance and is individually serialized for traceability
3. Utilizes patent-pending enhanced *Giga-TX*<sup>™</sup> Technology for jack terminations which optimizes performance by maintaining cable pair geometry and eliminating conductor untwist
4. No punchdown tool required; termination tool ensures conductors are fully terminated by utilizing a smooth forward motion without impact on critical internal components for maximum reliability
5. Can be re-terminated a minimum of twenty times
6. Red termination cap designates Category 6 performance and provides a positive strain relief; helps control cable bend radius and securely retains wires
7. Terminates 4-pair, 22 – 26 AWG, 100 ohm, solid or stranded twisted pair cable
8. Termination cap is color coded for T568A and T568B wiring schemes



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**Specifications**

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9. Accepts 6 and 8-position modular plugs without damage
10. Can be clearly identified with optional labels and icons
11. Colors include blue, white, green, yellow, red, or violet.

B. Acceptable Manufacturers

1. Panduit
2. Belden
3. Berk-Tek
4. Commscope
5. Leviton

2.5 CROSS CONNECT AND PATCH CABLE ASSEMBLIES

A. Specifications

1. ANSI/EIA/TIA Category 6
2. 4 pair RJ45
3. Bootless
4. All patch cables shall be an appropriate length. (this may require custom cable lengths in the telecommunications room)
5. Patch cables shall be constructed with cable of the same manufacturer as installed horizontal cable.

B. Acceptable Manufacturers

1. Panduit
2. Belden
3. Berk-Tek
4. Commscope
5. Leviton

2.6 TELECOMMUNICATIONS OUTLET FACEPLATE

A. Specifications

1. Single gang plate
2. 6 ports capacity
3. UL 1863 compliant
4. White thermoplastic construction
5. Provide blank insert for all open ports.

B. Acceptable Manufacturers

1. Panduit
2. Belden
3. Berk-Tek
4. Commscope
5. Leviton

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**Specifications**

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**PART 3 EXECUTION**

**3.1 INSTALLATION**

**A. General**

1. Follow all ANSI/EIA/TIA installation guidelines
2. Follow all cabling solution provider installation guidelines
3. Install all cabling and secure utilizing wire management and hook and loop( Velcro™) Straps. No plastic cable ties shall be used to secure any cabling.

**B. Equipment Rooms**

1. Install all Horizontal Cable System equipment as indicated in Project Documents
2. Install cable management to support and train cables with spacing as required to meet bend radius and support requirements.

**C. Work Area**

1. Install all Horizontal Cabling System Work Area equipment and cabling as indicated in Project Documents
2. Do not exceed recommended pulling tensions
3. Route cabling from outlets to patch panel in equipment rooms or closets as indicated on the drawings.
4. Do not exceed 90 meter horizontal length for horizontal cables. Notify the Architect Engineer prior to install if any horizontal runs that have the potential of exceeding 90 meters.
5. Terminate data cabling per T568B wiring method.
  - a. Maintain wire twists to within 0.5 inches of termination.
  - b. Remove no more than 1.0 inches of cable jacket.

**3.2 LABELING**

**A. Equipment Room Cabinet Labeling**

1. Provide each cabinet a laminated black phenolic resin label with a white core and engraved lettering, a minimum of 1/4-inch high.

**B. Equipment Room Patch Panel Labeling**

1. Provide each Patch Panel with a laminated black phenolic resin label with a white core and engraved lettering, a minimum of 1/4-inch high.
2. Provide permanent, computer-generated labels at each Patch Panel port.

**C. Horizontal Cable Labeling**

1. Provide permanent, computer generated labels on both ends of every Horizontal Cable, Patch Cord and Work Area Equipment Cable.
2. Example of horizontal wiring label: 1A-A001 1A=Equipment Room number, A=the patch panel, and 001= patch panel port.

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**Specifications**

D. Work Area Outlet Labeling

1. Provide permanent, computer generated labels at the station faceplate

E. General

1. Provide labeling based on ANSI/TIA/EIA-606 administration concepts
2. Provide typewritten labels, hand labeling is not acceptable

F. Telecommunication Spaces and Pathways

1. Use the identifier ER for the Equipment Rooms
2. Provide a unique identifier for each Equipment Room that indicates the floor and an ordinal designation (e.g. ER2A is the first equipment room on the second floor)
3. Provide an identifier for each cabinet in each equipment room that incorporates the ER identifier (e.g. ER2A-RR3 is the third cabinet in the first equipment room on the second floor).
4. Provide an identifier for each cabling pathway

G. Equipment Room Terminating Hardware

1. Provide an identifier for each Patch Panel that incorporates the cabinet identifier (e.g. ER2A-EC3-PP1 is the first patch panel in the third equipment cabinet in the first equipment room on the second floor)
2. Provide an identifier for each Patch Panel port that incorporates the Patch Panel identifier (e.g. ER2A-EC3-PP1-09 is the ninth port on the first patch panel in the third equipment cabinet in the first equipment room on the second floor)

H. Work Area

1. Provide an identifier for each Work Area Activation Point that indicates the room number and an ordinal designation (e.g. 142A is the first activation point in room 142).
2. Provide an identifier for each Work Area Activation Point jack that Work Area Activation Point designation (e.g. 142A-2 is the second jack in the first TO in room 142).

I. Horizontal Cable

1. Provide the cable's Patch Panel Port identifier and Work Area Activation Point Jack identifier on both ends of all Horizontal cables.
2. Insure that label is intact after termination of cable.

3.3 TESTING

A. Copper cable testing

1. Test all Category 6 horizontal cabling using a digital cable analyzer and certify that the system is complete and functional.
2. A level IIe or better test unit is required and must be updated to include the requirements of ANSI/TIA/EIA-568-B.
3. The basic tests required are:
  - a. Wire Map

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**Specifications**

- b. Length
- c. Attenuation
- d. NEXT (Near and crosstalk)
- e. Return Loss
- f. Propagation Delay
- g. Delay Skew
- h. PSNEXT (Power sum near-end crosstalk loss)
- i. PSELFET (Power sum equal level far-end crosstalk loss)

END OF SECTION



## **28 05 13 - CONDUCTORS AND CABLES FOR ELECTRONIC SECURITY**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary conditions and Division 1 Specifications Sections, apply to this Section.

#### **1.2 SYSTEM DESCRIPTION**

- A. General:
  - 1. This is a renovation project, to the extent possible the existing wire and cable will be reused.
  - 2. Where existing cabling does not exist, provide cabling that supports Access Control, PLC/GUI, Surveillance, Intercommunications and other systems as indicated in Project Documents.
  - 3. Provide all necessary materials for the cabling system in all equipment rooms and at all field devices as indicated in the project documents.
- B. For both new and existing wire and cable, include all termination and cable management as described in section 280500.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL**

- A. Provide materials listed by UL or ETL.
- B. All cable must be NEC type CMP unless installed in conduit from end to end.

#### **2.2 MULTICONDUCTOR SHIELDED PAIRED CABLING**

- A. Specifications
  - 1. #18 AWG 19 x 30 stranded tinned copper conductor
  - 2. Overall aluminum polyester tape foil shield 100% coverage
  - 3. 18 AWG drain wire
  - 4. Pair count as appropriate to the application
  - 5. Type CMP jacket (Type CM if installed in conduit)



**Specifications**

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B. Acceptable manufacturers

1. Belden
2. West Penn Wire
3. Commscope
4. Mohawk

2.3 MULTICONDUCTOR UNSHIELDED PAIRED CABLING

A. Specifications

1. #18 AWG 19 x 30 stranded tinned copper conductor
2. Pair count as appropriate to the application
3. Type CMP jacket (Type CM if installed in conduit)

B. Acceptable manufacturers

1. Belden
2. West Penn Wire
3. Alpha

2.4 LOW VOLTAGE BUILDING WIRE

A. Specifications:

1. Conform to system manufacturer's requirements regarding size and type.
2. Conforms to UL Article 444 for low smoke and low flame and rated for use in air plenums.
3. Conforms to NEC 300-21, 300-22, and 725-2.
4. Low voltage wire shall be type THHN, THWN, or TFFN as appropriate to the application.
5. All low voltage building wiring shall be installed in conduit.

B. Acceptable manufacturers

1. Atlas Wire
2. Cerrowire
3. Arthur J. Hurley Company

2.5 UTP HORIZONTAL CABLE

A. Specifications

1. ANSI/EIA/TIA Category 6 compliant
2. NEC CMP rated
3. Quantities and locations as indicated in Project Documents
4. 4 pair, 23 AWG, solid bare annealed copper
5. Flame retardant semi-rigid PVC insulation



## Specifications

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6. Longitudinal rip-cord
  7. Color of cable to be blue
- B. Acceptable manufacturers
1. AMP/Netconnect
  2. Commscope/Uniprise/Systimax
  3. Panduit/General Cable
  4. Hubbell/Mohawk
  5. Belden/CDT

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. General:
1. Follow all ANSI/EIA/TIA installation guidelines
  2. Follow all manufacturer installation guidelines
  3. Follow all applicable NFPA and NEC codes
- B. Cabling
1. Do not exceed recommended pulling tensions
  2. Use only hook and loop type (Velcro™) Straps to secure and dress cabling.

### 3.2 LABELING

- A. Equipment Room Cabinet Labeling:
1. Provide each cabinet with a laminated black phenolic resin label with a white core and engraved lettering, a minimum of 1/4-inch high.
- B. Horizontal Cable Labeling:
1. Provide permanent, computer generated labels on both ends of every Horizontal Cable, Patch Cord and Equipment Cable
- C. General:
1. Provide labeling based on ANSI/TIA/EIA-606 administration concepts
  2. Provide typewritten labels, hand written labeling is not acceptable

END OF SECTION 28 05 13







## **28 05 26 - GROUNDING BONDING AND POWER CONDITIONING FOR ELECTRONIC SECURITY**

### **PART 1 - GENERAL**

#### **1.1 SYSTEM DESCRIPTION**

- A. Furnish all materials and labor necessary to complete the installation of specific systems described herein and integration of all systems as indicated, specified herein or both. The work includes the following, as well as work not listed below but described elsewhere:
  - 1. Surge Protectors.
    - a. Protection of exterior power circuits
    - b. Protection of exterior data circuits
    - c. Protection of exterior signal circuits
    - d. Protection of power circuits entering equipment racks
  - 2. Ground Circuits
    - a. Ground circuitry for proper dissipation of lightning, voltage spikes, surges, transients and as required for life safety.
  - 3. Back Up Power
    - a. All microprocessor-based equipment shall be powered by an un-interruptible power supply (UPS).

### **PART 2 - PRODUCTS**

#### **2.1 GENERAL**

- A. Equipment specified is intended as a reference standard for level of quality.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the schedule bid time. Refer to Division 00 and Division 01.
- C. Provide materials listed by UL or ETL.

#### **2.2 POWER LINE SURGE PROTECTION**

- A. Specifications

## Specifications

1. Load Rating: 20 amps at 120 volts
2. Limiters: Series surge reactor current limiter. Cascaded auto-tracking dual polarity voltage limiter. Dual pulse inverters.
3. Clamping Voltage Onset: 172 volts nominal (2 volts above peak line voltage, auto tracking)
4. Filter: With 50 ohm load: 3 dB @ 3 kHz; 38 dB @ 100 kHz; 50 dB @ 300 kHz; 50 dB @ 5 MHz; 50 dB @ 30 MHz.
5. Let-Through Slew Rate: 5000 volt/us disturbance reduced to 28 volts/us within power wave envelope; less than 10 volts/us outside power wave envelope.
6. Snubber: Instant reacting snubber for fast-rising surges generated within the building.
7. Max Applied Surge Pulse Voltage: 6000 volts (1.2 x 50 us pulse)
8. Max Applied Surge Pulse Joule Rating: Unlimited, due to current limiting. (8x20 us)
9. Max Applied Surge Pulse Current: 100,000 amperes (8x20 us)
10. UL 1449-2 Adjunct Classification Test Results: 1000 surges, 6000 volts, 3000 amps, C1 pulse, measured suppressed voltage 290 volts, no failures.

B. Acceptable Manufacturer

1. SurgeX SX20-NE/RT, wall-mount applications. SurgeX SX2120, rack mount applications. Provide one power conditioner for each 20-amp circuit feeding security electronics equipment including access control, intercom, and CCTV.

### 2.3 FLAT PANEL DISPLAY SURGE PROTECTION

A. Specifications

1. Load Rating: 8 amps @120 volts
2. Power Requirements: 10 Watts
3. UL Adjunct Class. Test Results: 1000 surges, 6000 volts, 3000 amps, C1 pulse, measured suppressed voltage 290 volts, no failures.
4. Federal Guidelines: Grade A, Class 1, Mode 1
5. EMI/RFI Filter, Normal Mode: 40 dB@ 100 kHz, 50 dB @ 300 kHz,
6. Max. Applied Surge Pulse Joule Rating: Unlimited, due to current limiting.
7. Maximum Applied Surge Pulse Voltage: 6000 volts (1.2 x 50 us pulse)
8. Overvoltage Shutdown: 145 volts

B. Acceptable Manufacturer

1. SurgeX SA82FlatPak.

### 2.4 DATA LINE SURGE PROTECTION

A. Specifications

1. Primary Tech: Bipolar Silicon Avalanche Diode
2. Operating Frequency: DC to 30 MHz
3. Response Time: <5 nanoseconds



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**Specifications**

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- |    |                         |                      |
|----|-------------------------|----------------------|
| 4. | Protected Lines:        | Two pairs            |
| 5. | Peak Pulse Energy Disp: | 10 joules each mode  |
| 6. | Interface:              | Wire clamp terminals |
| 7. | Current Rating:         | 7 amps max           |
| 8. | Series Impedance:       | <.01 ohms            |
| 9. | UL497B listed           |                      |

B. Acceptable Manufacturer

1. Northern Technologies PLP-S series surge protectors.
2. Ditek
3. Edco

2.5 RS-232 SURGE PROTECTION

A. Specifications

- |    |                                  |                |
|----|----------------------------------|----------------|
| 1. | Max Operating Voltage:           | /- 20 V        |
| 2. | Typ. Leakage current:            | 5 u amps       |
| 3. | Max Data Rate:                   | 22 kbps        |
| 4. | Max Surge Current (10x1000usec): | 43 amps        |
| 5. | Max Clamp Voltage :              | 35 volts       |
| 6. | Max Transient Voltage :          | 6 kV           |
| 7. | Clamp Response Time:             | < 1 nanosecond |
| 8. | UL 497B listed                   |                |

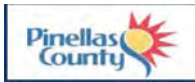
B. Acceptable Manufacturers:

1. Edco SRS-232 series surge protector
2. Ditek
3. Northern Technologies

2.6 RACK MOUNT UNINTERRUPTIBLE POWER SUPPLIES

A. Specifications

- |     |                        |                                   |
|-----|------------------------|-----------------------------------|
| 1.  | Nominal Input Voltage: | 120 VAC +10% to -30%              |
| 2.  | Frequency:             | 50/60 Hz +/- 5 Hz                 |
| 3.  | Capacity:              | 2.2kW                             |
| 4.  | Power Factor:          | >.97                              |
| 5.  | Harmonic Distortion:   | Less than 5%                      |
| 6.  | Battery:               | Maintenance free sealed lead acid |
| 7.  | Backup:                | 7mins full load                   |
| 8.  | Life:                  | 8 year design                     |
| 9.  | Output Voltage:        | 120 VAC +/- 3%                    |
| 10. | Frequency:             | 50/60 Hz +/- .5%                  |
| 11. | Capacity:              | 1.4 kW                            |



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**Specifications**

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- |     |   |                     |
|-----|---|---------------------|
| 12. | THD:  | 1% typical, 3% max  |
| 13. | Current (RMS):  | 16.7 amps           |
| 14. | Max Peak Current:   | 50 amps             |
| 15. | Crest Factor:   | 3.0                 |
| 16. | Overload Capacity:  | 150% for 60 seconds |
| 17. | Monitoring:   | RS-232              |
| 18. | UL 1778 listed, CUL Listed  |                     |
| 19. | True online double conversion design utilizing Insulated Gate, Bipolar Transistor (IGBT) technology |                     |

B. Acceptable Manufacturer

1. Toshiba UPS. Provide UPS for all circuits feeding security electronics headend equipment except those circuits feeding inductive loads.
2. Mitsubishi
3. MGE
4. Powerware

## 2.7 DESKTOP UNINTERRUPTIBLE POWER SUPPLY

A. Specifications

- |     |   |  |
|-----|---|--|
| 1.  | Output Power Capacity:  | 780W/1200VA  |
| 2.  | Max Configurable Power:   | 780W/1200VA  |
| 3.  | Nominal Output Voltage:   | 120V   |
| 4.  | Output Connections:   | (2) NEMA 5-15R (Surge protection), (6) NEMA 5-15R (Battery Backup)   |
| 5.  | Nominal Input Voltage:  | 120V   |
| 6.  | Input Frequency:  | 47-63 Hz   |
| 7.  | Input Connections:  | NEMA 5-15P   |
| 8.  | Input Voltage Range:  | 88-148 V   |
| 9.  | Typical Recharge Time:  | 15 hours   |
| 10. | Battery Type:   | Maintenance free sealed Lead-Acid battery with suspended electrolyte |
| 11. | Typical Backup Time at Half Load:   | 17.4 minutes   |
| 12. | Interface Port:   | USB  |
| 13. | Surge Energy Rating:  | 420 joules   |
| 14. | Filtering: Full time multi-pole noise filtering:  | Meets UP 1449  |
| 15. | True online double conversion design utilizing Insulated Gate, Bipolar Transistor (IGBT) technology |  |

B. Acceptable Manufacturer

1. Toshiba
2. Mitsubishi
3. MGE



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**Specifications**

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**2.8 WALL MOUNT UNINTERRUPTIBLE POWER SUPPLY**

**A. Specifications**

1. Input Voltage: 120VAC
2. Rated Input Current: 6.7 Amps
3. Input connection: 5-15 P
4. Output VA Capacity: 1050
5. Output watts capacity: 705
6. Output connections: (6) 5-15R
7. Output waveform: Sine wave
8. Battery output waveform: PWM Sine wave
9. Battery runtime: 7 minutes at full load
10. Wall mountable using mounting kit accessory

**B. Acceptable manufacturer**

1. Tripp Lite Omnismart 1050
2. Equal by APC
3. Equal by Toshiba

**2.9 GROUNDING BUSS BAR**

**A. Specifications**

1. Predrilled solid copper
2. NEMA standard bolt hole spacing
3. 0.25" thick minimum
4. Minimum dimensions: 4" high x 12" wide size to accommodate required connections.
5. Mounting: Minimum 2" insulated standoffs.
6. Cover: Lettered plexiglass as detailed in drawings.

**B. Acceptable Manufactures**

1. Panduit
2. Harger
3. Andrew

**2.10 GROUNDING CONDUCTORS**

**A. Specifications**

1. Gauge: As indicated on drawings
2. Insulation: Green PVC 600 volt rated

**B. Acceptable Manufacturers**

1. Harger
2. Tessco
3. Kris-Tech



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**Specifications**

2.11 TWO HOLE CODE CONDUCTOR

- A. Specifications
  - 1. UL listed for use up to 35 KV
  - 2. Temperature rated 90 degrees Celsius
  - 3. CSA certified to 600V
  - 4. Meets J-STD-607-A
  - 5. Painting piercing washers required
- B. Acceptable Manufacturer
  - 1. Panduit
  - 2. Harger
  - 3. Andrew

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The System shall be installed by qualified personnel in strict compliance with manufacturer's instructions.
- B. Wiring shall be color coded, uniform and in accordance with national electric codes and manufacturer's instructions.
- C. Equipment shall be firmly secured, plumb and level.
- D. All cable shall be tagged and identified.
- E. Coordinate all work with other trades.
- F. Ground all equipment as per manufacturer's recommendations, IEEE 1100, NEC, and EIA/TIA guidelines.
- G. Provide equipment grounding conductor from equipment grounding lugs to ground bar. Size conductor based on length; see drawings for sizing requirements.
- H. Provide a green insulated grounding conductor from rack to ground bar.
- I. Provide secondary surge protection for all copper cable entering the building.
- J. Grounding of security cables and peripheral equipment shall be installed per manufacturer's direction to eliminate noise induction and achieve optimum system performance.
- K. The Trade Contractor shall provide power line surge and noise suppressor/filters for all equipment proposed. These devices shall buffer all video, control, and paging systems.



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**Specifications**

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3.2 SYSTEM INITIALIZING AND PROGRAMMING

- A. The power system shall be turned on and adjustment made to meet requirements of the specification and on-site conditions prior to powering any security systems.
- B. Verify the output voltage of each power source outlet is within NEC guidelines for variation in voltage.
- C. All UPS units shall be fully charged prior to powering any security systems.

3.3 GROUNDING

- A. All equipment shall be grounded in accordance with the NEC, these specifications, and the equipment supplier's recommendations. Discrepancies shall be brought to the attention of the Architect Engineer for resolution prior to execution of the work.
- B. Power ground system and security electronics ground system shall remain physically separated throughout the facility and terminated at a single point on ground buss bar in the main electrical equipment room.
- C. Each equipment cabinet shall be bonded and grouped cabinets shall be bonded together and connected at a single point on ground buss bar.

3.4 LABELING

- A. Provide an identifier for each Grounding Bus bar that incorporates the identifier of the space the bus bar serves.
- B. Label both ends of all grounding conductors with both bus bars connected.

3.5 SPARE PARTS

- 1. Refer to section 28 05 10

3.6 SURGE PROTECTION

- A. All security metallic data and video lines entering or leaving a building shall be protected with surge protection devices. This specification also applies to field devices mounted on the exterior of the building.
- B. Grounding of protective devices shall be in accordance with the manufacturer's recommendations and/or as described in these specifications and drawings.
- C. All signal line protective devices shall be located at the terminal point nearest the cable interface with the exterior cable plant. Devices shall be mounted to the back panel of the cabinet. Provide separate enclosure for all surge protection devices mounted in equipment cabinets.



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**Specifications**

3.7 SYSTEM TEST PROCEDURES

- A. The System shall be completely tested to assure that all components are hooked up and in working order. Inspect system for defects. Correct all causes of such defects. If the cause is outside of the scope of the 28 series scope of work, promptly notify the Architect Engineer in writing, indicating the cause of the defect and suggested corrective procedures.
- B. Provide written documentation showing all test results.
- C. The System shall be final tested in the presence of the Architect Engineer.

3.8 OWNER INSTRUCTION

- A. Instruct Owner on replacement of all user serviceable components including surge protectors, UPS units, breakers, and fuses.

END OF SECTION 28 05 26





## **28 11 16 - CABINETS AND ENCLOSURES FOR ELECTRONIC SECURITY**

### **PART 1 GENERAL**

#### **1.1 SYSTEM DESCRIPTION**

- A. Furnish and install all equipment, materials and labor necessary to complete the installation of specific systems described herein and integration of all systems as indicated, specified herein or both. The work includes the following, as well as work not listed below but described elsewhere:
  - 1. Cabinets
  - 2. Workstation Console
  - 3. Non-standard manufacturer furnished enclosures and back boxes

### **PART 2 PRODUCT**

#### **2.1 GENERAL**

- A. Equipment specified is intended as a reference standard for level of quality.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the schedule bid time. Refer to Division 00 and Division 01.
- C. Provide materials listed by UL or ETL.

#### **2.2 FREE STANDING ELECTRONIC EQUIPMENT CABINETS**

- A. Specifications
  - 1. Provide freestanding equipment cabinets to house 19" rack mountable equipment in the equipment rooms. Each cabinet shall have a rectangular frame with removable top panel, side panels and doors. Installed cabinets shall include thermal, power, and cable management accessories that control airflow through the cabinet and keep signal and power cables separate and organized
  - 2. The cabinet frame shall be rectangular with four corner posts, manufactured from steel with welded frame construction. The sides of the frame shall be punched at the top and bottom with a hole pattern to allow attachment of equipment mounting rails and thermal, cable and power management accessories. The cabinet frame shall support 2000 lbs of equipment.
  - 3. The cabinet shall be 27.6" wide by 36.3" deep by 88.8" high when doors, top panel and side panels are installed. Leveler feet will add approximately 1" to the height of the frame/cabinet.

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**Specifications**

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4. Each cabinet shall include two pairs of equipment mounting rails. Mounting rails shall bolt to the side of the cabinet frame at the top and bottom of the frame and shall be adjustable in depth to provide front and rear support for equipment. Equipment Mounting Rails shall be spaced horizontally to support 19" wide EIA-310-D compliant rack-mount equipment and shall provide up to 30.3" of rail-to-rail depth for equipment. Mounting rails shall be square-punched according to the EIA-310-D Universal hole pattern with equipment mounting holes on alternating 5/8" – 5/8" – 1/2" vertical hole centers. Square-punched holes shall accept cage nut hardware with various threads. Rack mount spaces or units (RMU) shall be 1-3/4" high and shall be marked and numbered on the mounting rails. Numbering shall start at the bottom of the rail. Mounting rails shall provide 48 RMU for equipment.
  5. The cabinet shall include a solid top panel with one 3" x 11.5" cable access port located near the center of the frame. The cable access port shall be plastic with a brush seal to allow easy addition and removal of cables while limiting bypass airflow.
  6. The cabinet shall include two locking solid side panels with spring loaded latches for easy installation and removal. The cabinet shall be designed to allow baying with or without side panels installed.
  7. The cabinet shall include a single front door with a perforated metal panel, hidden tamper-resistant hinges with quick-release hinge pins and a swing handle. The door shall be removable and reversible to open from the right or left. The door shall open to 150° when the cabinet is bayed with other cabinets. The front door shall have a single-point slam latch with a keyed lock.
  8. The cabinet shall include a Single rear door with a perforated metal panel, hidden tamper-resistant hinges with quick-release hinge pins and a swing handle. The door shall be removable and reversible to open from the right or left. The door shall open to 150° when the cabinet is bayed with other cabinets. The front door shall have a single-point slam latch with a keyed lock.
  9. The cabinet frame, top panel and side panel shall be manufactured from steel. The door frames shall be manufactured from steel and aluminum. Door panels shall be steel. The door handle, side panel latches, rear door hinges and top panel cable access ports shall be plastic. The cabinet frame and front and rear door shall be welded and bolted. Cabinet components shall assemble with hardware.
  10. The mounting rails, top panel, side panels and doors shall be electrically bonded to the cabinet frame.
  11. The cabinet shall be UL Listed as an Information Technology and Communications Equipment Cabinet, Enclosure and Rack System to standard UL 60950 under category NWIN. UL Listing will be stated in the manufacturer's product literature.
  12. The metal components of the cabinet frame, top panel, side panels, and doors shall be painted black with epoxy-polyester hybrid powder coat paint. The mounting rails shall be zinc-plated and silver-colored. Plastic components shall be black.
  13. The cabinet shall include (4) leveling feet, (4) clamps for securing the leveling feet to the floor, cage nuts of size and type required to mount all equipment and a means for bonding the cabinet to the Telecommunications Grounding Busbar.
- B. Acceptable Manufacturers
1. Chatsworth Products, Inc.
  2. APC
  3. HP



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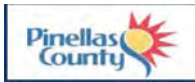
**Specifications**

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2.3 SWING OUT SECURITY EQUIPMENT CABINET

A. Specifications

1. Wall-Mount, Floor standing, Pivoting Communications Equipment Racks.
2. Type: 19-inch pivoting rack.
3. Compliance: EIA/TIA 310D.
4. UL Listed: US and Canada.
5. Overall Height: 90.75 inches
6. Overall Width: 23.56 inches
7. Overall Depth: 32.34 inches, USABLE Depth 30 inches.
8. Rackspaces: 40
9. Weight Capacity: 500 pounds
10. Assembly: Tool-free "Quick-Mount" system for one-person mounting of center section to backpan at site.
11. Materials: 14 gauge steel top and bottom. 16 ga steel center section and backpan. Finished Black Textured powder coat.
12. Corner Braces: 1/8-inch thick.
13. Rackrail: 11-gauge steel with tapped 10-32 mounting holes in universal EIA spacing.
14. Bottom Cable Entry Platform: Removable 7-inch front access cover Supports weight of rack on floor. Shroud to conceal conduit stubs
15. Low-Friction Wear Strip: Allows rack to swing open easily.
16. Raceways: Wiremold 4000 Series.
17. Knockouts:
18. Center Section:
19. Decora Knockouts: Top and bottom of face.
20. Fan Knockouts: Top and bottom, each accepts up to two 4-1/2-inch fans.
21. Backpan:
22. Electrical Knockouts: Top and bottom, 3/4 inch, 1 inch, 1-1/2 inches, 2 inches, and 3 inches.
23. BNC Knockouts: Top and bottom, 5/8-inch UHF/VHF antenna knockouts.
24. Laser Knockout: Backpan, 12-1/2-inch by 12-inch opening for through-wall cable pass-through.
25. UCP Knockouts: Locking side of backpan accepts 1 UCP panel.
26. Top, Bottom, and Sides: Vertical vent pattern.
27. Lacing Points: Throughout interior to facilitate cable management.
28. Grounding and Bonding Studs: 1/4-20 by 1-inch threaded, installed in center section and backpan.
29. Provide with the following options:
  - a. Front Door: Vented
  - b. Hinges: Zinc die cast, can be installed while rack is fully loaded with equipment.
  - c. Zero-Clearance Latch: Allows side-by-side or corner mounting.
  - d. AC power strips.
  - e. Copper buss bar.
  - f. Cable lacing bars.



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**Specifications**

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- g. Black textured touch-up paint.
- h. Vent fans on top.

B. Acceptable Manufacturers

- 1. Chatsworth
- 2. APC
- 3. HP
- 4. Lowell

2.4 SECTIONAL WALL EQUIPMENT CABINET

A. Specifications

- 1. Sectional wall cabinet with detachable center section.
- 2. Center section shall be 16 gauge steel.
- 3. Back pan section shall be 16 gauge steel.
- 4. Cabinet rail shall be 11 gauge steel, with tapped 10-32 holes in universal E.I.A. spacing.
- 5. Center section shall key lock close
- 6. Cabinet shall be phosphate pre-treated and finished in a durable black powder coat.
- 7. Cabinet shall be of welded construction.
- 8. Vented front door shall be of 16-gauge steel.
- 9. Overall dimensions shall be 22.5" d x 23.4" wide. Available racking space shall accommodate equipment shown. Provide 30% additional space for future mounting needs.
- 10. ½", ¾", 1", and 1 ½" EKO's available top and bottom.

B. Acceptable Manufacturers

- 1. Chatsworth
- 2. Middle Atlantic
- 3. Lowell
- 4. Atlas Sound

2.5 CONTROL WORKSTATION CONSOLE

A. Specifications

- 1. The Trade Contractor shall supply a system capable of supporting specified electronics.
- 2. The system shall be comprised of end frames and/or intermediate frames with horizontal stringers and decorative end panels. The system will also feature a hinged dual-channel duct cover with integrated aluminum Versa-Trak mounting system for LCD monitor arrays.
- 3. The system shall have a minimum 1-1/8" (29mm) thick MDF core PVC work surface. The work surface shall be not less than 22-3/4" (577mm) deep overall and should include a 1-3/4" (44mm) deep beveled edge covering the work surface's entire front width.
- 4. Tapped rack rails for lower storage compartment shall comply with Electronic Industry Association (E.I.A.) specifications for rack mounting ANSI/E standard RS-310.
- 5. Modular Pre-Engineered Construction
- 6. Minimum width shall be 72".



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**Specifications**

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7. All components within the system shall be:
  - a. Of a pre-engineered modular construction, i.e: constructed from a series of independent sectional compartments.
  - b. Available from a pre-defined set of manufacturers model numbers.
  - c. Free from alterations to the design either prior to or following installation. The assembly of the console shall be accomplished without the need for either welding or carpentry work.
  - d. Constructed of a steel super-structure framework consisting of intermediate and end frames connected by horizontal stringers. External decorative side panels are available in TruForm or laminated MDF core.
8. Self supporting skeleton framework shall:
  - a. Be installed at the site in advance of any external finishing panels. The framework shall be fully capable of supporting all specified electronics without the need for attachment of any external panels.
  - b. Be capable of being supplied to site in knockdown (flat packed) form and be capable of assembly using 10-32 bolts and Insta-Lock fastening system without welding or carpentry work.
  - c. Include front and rear horizontal stringers constructed of 12 gauge\* (.104") formed sheet metal. Stringers will connect, and span, 14 gauge (.074") end frames and/or intermediate frames to form a complete structure.
9. Components
  - a. Intermediate and End Frames 14 gauge (.074") intermediate and end frames shall be a minimum of 1-5/8" (41mm) in width and capable of supporting fully loaded console. Intermediate and end frames shall incorporate 3/8" (10mm) diameter threaded adjustable glides and 2" (51mm) vertical slots for mounting two and four gang electrical boxes. End frames shall feature an anti-tip extension and the intermediate frames shall feature four grommet holes.
  - b. Horizontal Stringers 12 gauge (.104") formed sheet metal horizontal stringers with Insta-Lock fastening system shall be 2" (51mm) high and available in 24" (609mm), 48" (1218mm), and 72" (1827mm) widths.
  - c. Bottom Shelf 16 gauge (.060") stationary steel shelf shall extend 17-5/8" (447mm) from the front of the console to the rear. Features four grommet holes and has a load capacity of 200 pounds.
  - d. Lower Doors Vented double-panel doors with offset face design and spring hinges for easy removal without the use of tools. Doors shall be supplied with a keyed-alike locking lever latch and integrated cable management. Doors shall be able to accept an optional CPU shelf or file/storage bin for convenient swing-out access.
  - e. Corners 15, 45, and 90 degree 12 gauge (.104") steel corner fillers shall be available. Corners fillers will feature Insta-Lock fastening system for ease of installation. Corners shall be available in concave and convex configurations.
  - f. Duct Cover 18 gauge (.047") steel hinged duct cover conceals, and allows easy access to, dual cable raceway so signal and power cords can be separated.



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**Specifications**

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- g. Data/Power Rail 14 gauge (.074") angled data/power rail shall include cable grommets and openings for a universal data mounting plate and/or duplex power box. The data/power rail shall incorporate Insta-Lock fastening system and, combined with 14 gauge (.074") shelf brackets, will support the work surface.
- h. Versa-Trak Fully integrated black anodized aluminum track system capable of supporting a wide variety of monitor arrays while providing simple horizontal adjustment. Constructed of extruded 6105-T5 aluminum with a T-slot profile. Monitor array support posts shall be available in 15" (381mm), 28-1/2" (723mm), and 42" (1066mm) heights. The support posts shall be 1.9" (48mm) in diameter with a wall thickness of .110" (2.8mm). Monitor arrays are mounted to the Versa-Track with ball spring drop-in T-nuts.
- i. All exterior and frame steel components including doors, rack turrets, duct covers, and shelving shall be zinc oxide wash primer with a black powder coat textured finish.
- j. Provide fans for cooling of electronic storage
- k. Provide electrical distribution for all active components
- l. Provide CPU shelves.
- m. Provide monitor mounts

B. Acceptable Manufacturer

- 1. Winsted Sight-Line series console.

2.6 MISCELLANEOUS EQUIPMENT RACK PANELS AND VENTS

A. Blank Panels

- 1. Specifications
  - a. 16 gauge steel.
  - b. Flanged top and bottom.
  - c. Durable textured black powder coat finish.
  - d. Available in 1-6 space sizes.
- 2. Acceptable Manufacturers
- 3. Middle Atlantic SB Series
- 4. Atlas Soundolier
- 5. Lowell

B. Vent Panels

- 1. Specifications
  - a. 1/16" diameter hole with 1/8" staggered centers. 23% open area.
  - b. 16 gauge perforated steel.
  - c. Flanged top and bottom.
  - d. Durable black powder coat finish.
  - e. Available in 1-4 space sizes.



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**Specifications**

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2. Acceptable Manufacturers

- a. Middle Atlantic VTF Series
- b. Atlas Soundolier
- c. Lowell

2.7 FREE STANDING EQUIPMENT CABINET COOLING FAN

A. Specifications

1. 115V 10" fan
2. Ball bearing design
3. Fan guard
4. Proportional speed control
5. Free air CFM, 500
6. Thermostatic fan control

B. Acceptable Manufacturer

1. Middle Atlantic MW-10FT-FC fan and control. Furnish one for each free standing equipment cabinet. Provide vent blockers in accordance with manufacturers recommendations.
2. Lowell
3. Atlas Sound

2.8 POWER DISTRIBUTION UNITS

A. Specifications

1. 120 VAC output nominal
2. Max total current draw 16 Amps
3. NEMA L5-20P single phase locking plug
4. NEMA 5-20R receptacles (quantity of 24)
5. One, 3 meter line cord
6. Vertical rack design

B. Acceptable manufacturers

1. APC AP7530
2. Middle Atlantic
3. Lowell
4. CPI



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**Specifications**

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**2.9 SECTIONAL WALL EQUIPMENT CABINET COOLING FAN**

**A. Specifications**

1. 115V fan
2. 4 ½" ball bearing design
3. Proportional speed control
4. Thermostatic fan control
5. Fan guard
6. Free air CFM, 400

**B. Acceptable Manufacturer**

1. Middle Atlantic DWR-FK series fan kit. Provide vent blockers in accordance with manufacturers recommendations
2. Lowell
3. Atlas Sound

**2.10 NEMA RATED SECURITY EQUIPMENT ENCLOSURES**

**A. Specifications**

1. All equipment enclosures installed indoors shall be NEMA 12 enclosures.
2. All equipment enclosures installed outside or exposed to weather shall be NEMA 4 X enclosures.
3. Provide double door, continuous hinge enclosures
4. Enclosures shall be constructed of 14 gauge rolled steel, minimum.
5. Enclosure doors shall be furnished with key lock-able doors with all Enclosures under Division 28 keyed alike.
6. All enclosures shall be furnished with removable steel back panels for mounting equipment.
7. 60" x 48" and larger enclosures will be equipped with floor standing "feet"
8. Enclosures shall be grounded as specified in Section 28 05 26.
9. All enclosures shall be furnished with black-on-white laminated plastic nameplates identifying each cabinet.
10. Enclosures finish shall be ANSI 61 gray inside and out.
11. Enclosures shall be sized in strict accordance with the NEC. Minimum size is as indicated on the drawings.
12. Enclosure back panels shall be furnished with a grounding lug to be used to connect the cabinet to the signal grounding system specified in section 28 05 26.
13. Enclosures shall be furnished with cross-ventilated, forced-air cooling to maintain the optimum temperature performance range of the equipment.

**B. Acceptable Manufacturers**

1. Hoffman.
2. Wiegmann
3. Hammond Manufacturing
4. Saginaw Control and Engineering





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**Specifications**

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**PART 3 EXECUTION**

**3.1 INSTALLATION**

- A. The System shall be installed by qualified personnel in strict compliance with manufacturer's instructions.
- B. All equipment cabinets are to be assembled and tested in the SEC's facility prior to on-site installation. With the exception of field wiring, all interconnecting cables should be terminated and installed. All power distribution shall be completed.
- C. Wiring shall be color coded, uniform and in accordance with national electric codes and manufacturer's instructions.
- D. Equipment shall be firmly secured, plumb and level.
- E. Cabinets shall be installed with the minimum NEC clearance of three feet in the front and three feet in the rear of the cabinet.
- F. All cable shall be tagged and identified.
- G. Provide Panduit IN-Cabinet vertical cable management system. Provide four channels, one for microphone level cables, one for line level cables, one for speaker level cables, and one for 120vac power cables.
- H. All power cables lengths are to be kept to a minimum and plugged into the nearest power outlet. Additional cable length shall be bundled and tied together using nylon cable ties.
- I. Maintain separation between 120VAC power cables and all signal level cables. When necessary, cross 120vac power cables perpendicular to all other cable types.
- J. Coordinate all work with General Contractor-Advisor and other trades contractors.
- K. Grounding of audio cables and peripheral equipment shall be installed per manufacturer's direction to eliminate noise induction and achieve optimum system performance.
- L. All entrance and exit conduit shall utilize grounding bushings to terminate the conduit to the equipment enclosure. Route a green insulated ground conductor to the TMGB/TGB. See drawings for conductor sizing based on length.
- M. Blank panels and vent panels shall be used to fill all unused rack space.
- N. Every equipment rack shall be equipped with a ventilation fan and adequate venting. The fan shall be installed to bring air in from the bottom of the rack, drawing the cool air up and exiting out the top.
- O. Provide security covers for all rack mounted electronic components that do not require user interface.



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**Specifications**

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- P. The SEC is responsible for 120VAC power distribution within the equipment racks.
- Q. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools etc. and leave the premises clean, neat and orderly.

3.2 SYSTEM TEST PROCEDURES

- A. Verify that all doors open and close without obstruction.
- B. Verify that cabinet fans are capable of circulating cool air throughout the equipment rack.
- C. Verify that all door locks function properly.
- D. Provide written documentation showing all test results.
- E. The system shall be final tested in the presence of the Architect Engineer.

END OF SECTION 28 11 16

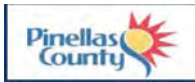


## **28 13 00 - ACCESS CONTROL SYSTEM FOR ELECTRONIC SECURITY**

### **PART 1 - GENERAL**

#### **1.1 SYSTEM DESCRIPTION**

- A. Furnish all materials and labor necessary to complete the installation of specific systems described herein and integration of all systems as indicated, specified herein or both. The work includes the following, as well as work not listed below but described elsewhere:
  - 1. Furnish and install additions to the existing enterprise access control system. Provide coordination to ensure that the system furnished includes integration of or interfacing to all devices and systems.
  - 2. Provide programming that integrates control and monitoring of devices indicated in the project documents.
  - 3. Access control system shall interface with the PLC Security Controls Systems allowing full control and monitoring of the access control system thru the PLC graphical user interface.
  - 4. Proximity card readers shall interface with the access control system. Card data base, door schedules, event schedules, etc. will be maintained on the access control software.
  - 5. Access control panel relay outputs shall interface with the security controls systems. Valid card reads shall initiate relay closures that in turn initiate the door open sequence.
  - 6. Access control panel relay feeds PLC input as valid read request to exit.
  - 7. Electro mechanical locking devices and door position switches shall terminate to the PLC I/O.
- B. Furnish all software and programming labor necessary to complete the installation of specific systems described herein and integration of all systems as indicated, specified herein or both. The work includes the following, as well as work not listed below but described elsewhere:
  - 1. Programming of Access Control Computer and Controllers. Include programming that implements system management, control, and information storage data bases.
- C. System Configuration
  - 1. The access control system shall be a modular and network capable system. The system shall have the ability of handling multiple remote sites and be compatible with various reader technologies supported simultaneously. The system shall allow for easy expansion or modification of readers, inputs, and outputs. The system control at the central computer location shall be under a single software program control, shall provide full integration of all components, and shall be alterable at any time, depending upon the facility requirements. Reconfiguration shall be accomplished on-line through system programming, without hardware changes.
  - 2. Access control functions shall include, validation based on time of day, day of week, holiday scheduling, automatic or manual retrieval of cardholder photographs, and access validation based on positive verification of card, card/PIN, and PIN.
  - 3. Utilizing assigned passwords, it shall be possible to define the levels of system operation for each individual Operator. Operator Actions range from basic monitoring to full control of the system databases.
  - 4. The method of communication from remote locations to the central components shall be transparent to the user.



## Specifications

5. After installation, the OWNER shall be able to perform hardware configuration changes as desired without the services of the Trade Contractor.
6. Equipment repair shall be able to be accomplished on site, by module replacement, utilizing spare components.
7. The system programming shall be user-friendly Windows environment (use conventional "Title Bar", "Menu Bar", "Tool Bar" and "Status Bar") and allow mouse control of key functions. The programming shall be MENU driven and include on-line "Documentation", "Help" or "Tutorial" information, as well as on-line data entry examples. The software shall utilize combo boxes for all previously entered system-required data. The system shall provide supervised alarm point monitoring. Upon recognition of an alarm, the system shall be capable of displaying alarm information in text format, on a graphic floor plan, and switching video surveillance cameras that are associated with the alarm point. The system shall be capable of arming or disarming alarm points both manually and automatically, by time of day, and day of week.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. Equipment specified is intended as a reference standard for level of quality.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the schedule bid time. Refer to Division 00 and division 01.
- C. Provide materials listed by UL or ETL.

### 2.2 CONTROLLER

- A. Specifications
  1. The controller board shall be microprocessor based, incorporating Flash ROM (firmware) downloadable from the Host Computer, RAM (User Information, System Setups, Event Transaction Buffer) and a Clock/Calendar. The ROM shall be modularly upgradeable in the field for enhancements to system features. Fuses shall protect all powered connections to the controller board. All wiring connections to the controller board shall be to "Phoenix" type screw terminals. Each door connection shall consist of terminals for two readers, one 10 Amp rated Form C dry output relay for lock control, and one input for monitoring a status switch, a request-to-exit device, and a tamper switch. There shall be status indicator lights for active relays, as well as diagnostic indicator lights to aid in system troubleshooting. There shall be dedicated alarm output relay/s for external reporting of the following conditions: Alarm; Duress; Tamper; and Trouble.
  2. All controllers shall be mounted in the Security electronics equipment rack. Controllers shall be securely fastened to the enclosure.
  3. The controller shall have an internal power supply that shall accept 50 Hz/ 200 - 240 VAC, or 60 Hz/100 - 120 VAC. The primary side of the power supply shall be protected with a fuse. The power supply shall provide 28 VDC power to the controller board, internal battery charger, selected card readers, and reader interface boards.
  4. The controller shall have an internal standby battery that is capable of running the system during AC power interruptions. A charging circuit incorporated into the controller board shall recharge it.

## Specifications

5. A maximum of 5 expansion boards can be installed in each controller, with the exception of 4 in the 1-64 relay expansion board
6. The controller shall be capable of accepting up to 32 additional supervised alarm inputs, in increments of 8. The sensitivity of the line supervision shall be 2%. The alarm expansion boards shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable. This option shall be limited to 16 additional supervised alarm inputs for the 16-zone alarm input controller.
7. The two access control and 1 alarm monitoring controllers shall be capable of accepting up to 32 additional Form C, 2 Amp rated relay outputs in increments of 8. The 1 - 32 relay controller shall accept up to a maximum of 24 additional Form C, 2 Amp rated relay outputs in increments of 8. The 1 - 64 relay controller shall not accept any additional relay outputs. These outputs shall be used for control applications other than standard door access, such as elevator floor control, local door annunciators, HVAC interface, etc. The relay expansion boards shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable.
8. The controller shall be capable of expanding the CODE database up to a maximum of 132,000 Users with the addition of a memory expansion board. The board shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable.
9. The controller shall be capable of expanding the event transaction buffer up to a maximum of 20,000 events and 2,000 alarms with the addition of a memory expansion board. The board shall be mounted in the controller cabinet and connect to the controller board via an expansion bus cable.
10. The control panels shall utilize an intelligent reader interface to communicate with card readers of various types. The interface shall be microprocessor based and allow data formats including ABA magnetic stripe, Wiegand (26 to 55 bit), Proximity, Bar Code, Touch Memory, Barium Ferrite, RF and Biometric. The interface shall utilize a digitizing algorithm, which shall convert the card data to a unique number, thus, eliminating the need for facility codes. A single interface shall support both entrance and exit readers with keypads associated with each door. The interface shall be U.L. Listed to U.L.294. The reader interface shall be included as standard in all Scramble Pads.

### B. Acceptable Manufacturers

1. Hirsch Electronics Digi\*trac Series Control Panels. Provide quantity and configuration as required to support quantity of doors shown on plans. Associated controller is to remain on the same floor as the door controlled.
  - a. Hirsch Velocity M8N eight door controller.
  - b. Lenel
  - c. Identocard

## 2.3 ACCESS CONTROL SERVER

### A. Specifications

1. 1RU Rack Mount
2. Windows Server 2012 standard, 64 bit OS
3. Intel Xeon E5-2603 Processor 1.8 GHz 4C 10M 6.4GT Hyper T 80 Watt
4. 16 GB 1RX4 RDIMM DDR3 1600
5. (4) 1TB 3.5" SATA enterprise hard drive 7.2K, 6 GB/s Hot Swap
6. Slim SATA DVD Optical



## Specifications

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7. Mouse
8. Keyboard
9. Single monitor video card
10. Intel Pro/1000 PT Dual Port 1GB Ethernet Adapter
11. Dual 800 Watt Redundant PS
12. 3 Year onsite service

B. Acceptable Manufactures

1. Lenovo Thinkserver RD530
2. HP
3. Hirsch

### 2.4 RACK MOUNT KEYBOARD/MOUSE

A. Specifications

1. Slide out rack mount keyboard
2. Full 101 key AT style keyboard
3. Track ball mouse
4. Padded wrist rests
5. Articulating arm with cable management
6. PS/2 and USB adapter

B. Acceptable Manufacturer

1. Middle Atlantic RM-KB rack mount keyboard.

### 2.5 POWER SUPPLIES

- A. No access control power supplies are required. Switching of power to the door locks shall be accomplished via the PLC and its associated interposing relays. Access control system outputs shall only be configured as request to exit inputs to the PLC.

### 2.6 ALARM LINE MODULES

A. Specifications

1. High Security Alarm Inputs
2. 2% Line Supervision
3. Monitor up to 3 Discrete Inputs
  - a. Alarm or Door Status
  - b. Alarm Masking or Request to Exit
  - c. Tamper Alarm, Tamper Secure



**Specifications**

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B. Acceptable Manufacturer

1. Hirsch Electronics - DTLM3
2. Lenel
3. Identocard

2.7 ALARM EXPANSION BOARD

A. Specifications

1. 8 Supervised inputs
2. 2% line supervision
3. Mounted in controller cabinet

B. Acceptable Manufacturer

1. Hirsch - AEB8
2. Lenel
3. Identocard

2.8 NETWORK INTERFACE BOARD

A. Specifications

1. Optically isolated
2. RS-485 and RS-232 ports
3. 115 Kbps Baud Rate
4. Supports AES encryption
5. Mounts inside model 8
6. Screw terminal connections

B. Acceptable Manufacturer

1. Hirsch – SNIB2
2. Lenel
3. Identocard

2.9 RELAY EXPANSION BOARD

A. Specifications

1. Provide 8 expansion relay outputs
2. 2 amp form C SPDT contacts
3. Up to 5 boards/40 relays per controller



**Specifications**

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B. Acceptable Manufacturer

1. Hirsch - REB-8
2. Lenel
3. Identocard

2.10 MATCH READER INTERFACE BOARD

A. Specifications

1. Dual technology entry and exit control
2. Provides 5VDC @ 250mA reader power
3. UL Listed

B. Acceptable Manufacturer

1. Hirsch – MRIB
2. Lenel
3. Identocard

2.11 WALL MOUNT PROXIMITY READERS

A. Specifications

1. 13.56 MHz.
2. 3.25" iClass Card maximum read range
3. 2" iClass Key/Tag maximum read range
4. Compatible with iClass 2kbits, 16kbits, 32kbits
5. Encrypted algorithm data transmission between card and reader
6. 64-bit authentication key

B. Approved Manufacturer

1. HID iClass readers. Provide model 6120B R40 reader for standard wall mount applications. Provide 6100B R10 for mullion mount applications.

2.12 PROXIMITY CARDS

A. Specifications

1. Graphics quality.
2. Printable PVC card
3. Sequentially numbered
4. Encoded
5. 2K EEPROM with 16 application sectors





**Specifications**

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B. Acceptable Manufacturer

1. HID 202X iClass Proximity Card. Furnish 500 cards.

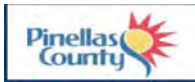
2.13 NETWORK SWITCH

A. Specifications

1. (24) Ethernet 10/100/1000 ports, (4) shared SFB/GBIC 1000ports
2. Switching fabric: 68 Gbps
3. Forwarding rate: 50 mpps
4. Memory: 64 MB DRAM & 32 MB flash
5. MAC addresses: Up to 10,000
6. IGMP groups/Multicast routes: Up to 255
7. Configurable MTU: 10000 Bytes with jumbo frames
8. 1000BaseT ports: RJ-45 connectors
9. Stacking: Minimum 16 switches
10. Stacking Backplane: 10gbps
11. Input power: 100 – 240 VAC auto-ranging
12. Indicators:
  - a. Port link integrity
  - b. Port disabled
  - c. Port speed
  - d. Port full duplex
  - e. System status
  - f. System RPS
  - g. System link status
  - h. System link duplex
  - i. System link speed
13. Operating Temp: 0 to 50 degrees C
14. Operating relative humidity: 10 – 85% non-condensing
15. Power consumption: 40 Watts max (120VAC)
16. Certifications: UL listed, FCC part 15 Class A
17. POE: IEEE 802.3af on all ports simultaneously

B. Acceptable Manufacturers

1. IFS NS3601-24P/4S
2. Cisco
3. HP



**Specifications**

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2.14 REQUEST TO EXIT PIR

A. Specifications

1. Passive infrared device
2. DSP filter technology
3. Curtain Fresnel lens
4. 12 VDC @ 50 mA
5. SPDT relay 1 Amp @ 30 VDC
6. ½ to 60 second main relay timer
7. UL 294 listed

B. Acceptable manufacturer

1. Detection Systems DS160
2. Bosch DS 150i

2.15 DRIVE UP BOLLARD

A. Specifications

1. sized as needed for mounting intercom, and camera
2. 2 x 4 steel tubing construction for base
3. 8" x 8" base plate
4. See detail. White powder coat finish

B. Acceptable Manufactures

1. Engineered Parking Systems
2. The Housing Company
3. Approved equals.

2.16 Desktop door release

- A. Secure Door Controls, TCC series slope front desk top console, or approved equal.
- B. Provide with switches as necessary for the quantity of controlled doors.

2.17 Door position switches.

- A. Swing door switches are included within the door hardware sets.
- B. Provide and install door positions switches at overhead doors and sliding gate.



**Specifications**

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2.18 ACCESS MANAGER SOFTWARE - SERVER

A. Specifications

1. General layout of the software “Windows” shall include but not be limited to:
  - a. **Main Menu Bar** shall be used to access all Functions from a standard pull down menu method.
  - b. **Tool Tips** describing the feature(s) that the selected item represent, shall be displayed in small “bubbles” underneath the selected item, field caption or other component. These tool tips shall be user definable.
  - c. **The Administration Console** shall use the familiar Explorer metaphor with a tree of folders in the left pane and details of selected folders in the right pane. The left pane shall include the following main components: Main Administration Console, Software System Configuration, Hardware Configuration, and Interface Configuration.
  - d. The Main Administration Console shall include:
    - 1) Browser
    - 2) Customization Manager
    - 3) Enrollment Manager
    - 4) Event Viewer
    - 5) Graphics
    - 6) Report Manager
    - 7) Status Viewer
    - 8) SQL Manager
    - 9) Task Scheduler
  - e. The Software System Configuration Module shall include:
    - 1) Credential Templates
    - 2) Time Zones
    - 3) Holidays
    - 4) Door Groups
    - 5) Function Groups
    - 6) Operators
    - 7) Operator Groups
    - 8) Command Sets
  - f. The Hardware Configuration Module shall contain:
    - 1) Add either an S\*NET or X\*NET communications port, either serial or TCP/IP
    - 2) Add hardware Controller
    - 3) Doors, Readers, Inputs, Outputs, Expansion Inputs, Expansion Outputs
  - g. The Interface Configuration Module shall define the parameters for communicating to a CCTV switcher.
2. **Dialog Boxes** shall provide a means for entering information into fields and displaying information from the System Software database.

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**Specifications**

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3. Workstation Customization
  - a. The Operator may customize the general functionality of several features of the System Software per individual Operator. The features that may be customized will include but not be limited to: Alarm Viewer, Event Viewer, and customizable Graphical User Interface.
4. The system shall allow the Operator to initiate a search for information in the database to be entered into another database field and shall allow the Operator to specify at least two search criteria such as Field and Data.
5. Time Zones define periods during which readers, cards, codes, alarm inputs, doors or other system features are active or inactive. Basic configuration parameters shall “ask” the Operator to define “when” the user is enabling (or disabling) a specific feature. In addition to Monday-Sunday, there shall be one day of the week called Holiday. When selected, there shall be 4 Holiday Schedules that determine if the Holiday is to be followed for this Time Zone. There shall be 64 Standard Time Zones, 64 Master Time Zones, and 20 Grand Master Time Zones.
  - a. Holidays- Holidays are used within the system for the purpose of defining if a Time Zone is to be followed on a defined Holiday. Each Time Zone has up to 4 Holiday schedules. There are 366 user definable Holidays this year and 366 days next year. It shall be possible for the Operator to “Make the rest of Today a Holiday”.
  - b. Door Groups- Door Groups shall allow the user to establish groups of readers, each with its own unique Time Zone, at a facility for the purpose of granting or denying access to Credentials. Door Groups are assigned to Credential Templates, and people being added to the system take on the Door Group of the Credential Template selected during the enrollment process. A new Door Group may be defined when adding a Credential or Credential Template without having to exit and re-enter the Credential function for that Person.
  - c. The Door Group application shall allow the user to view any existing Door Group listed in the dialog box. A user, with proper authority, shall be able to modify, add, or delete a Door Group from the System Software.
6. Function Groups- Credentials can be assigned to perform a single User Function, like Momentary Access. When a Person requires multiple User Functions, a Function Group may be defined and associated with one or more credentials. The Function Group requires a Scramble Pad keypad to be used, where the Person’s base Credential PIN number is entered, followed by an \* (Asterisk), followed by a one or two digit Extension digit, which defines which User Function shall be issued for which Control Zone. This allows for a single person to perform multiple User Functions like: Unlock Door, Relock Door, Change Threat Level, Mask Alarm Inputs, and Lock Down Doors.
7. A Credential Template shall be used when adding Credentials to people. The Credential shall take on the properties of the Credential Template selected. This shall minimize the number of keystrokes and time required to add a Credential to a person. The Credential Template properties include: Credential Name; Badge Template; Activation and Expiration Date and Time; ID Format; Card Type; Code Length; Duress Digit; Credential Function and Category; Door Group or Function Group; Threat Authority; 2 Person Rule options; Use Count, Day Limit, and Absentee Limits; Apply Credential Management Globally; Tag, Alert, Disable Credential; Issue Number; Status; Executive Override for Passback; Special Needs Access Extension.

## Specifications

8. A Command Set defines an action or actions to be sent to a controller or controllers. Command Sets can include: Unlock and Relock a Door; LockDown and Release a LockDown on one or more doors; make the rest of today a Holiday; Mask all Interior Alarm Points; change the facility Threat Level; Forgive All Passback. Once defined, a Command Set can be executed from the Command Set Window, or from a Graphic Floor plan ICON, if defined. There shall be an unlimited number of Command Sets available to be defined.
9. Each Operator entered into the System Software system shall be assigned to an "Operator Group". This feature shall allow the Operator to take on the Rights to Components, Reports and Graphic Floor plans. The Rights for Components can grant or deny the ability to Add, Delete, Save, or Open a component, as well as restrict to the Properties or Dialog boxes to the Tabbed level.
10. Operators entered into the system shall take on the Rights of the Operator Group to which they are assigned. In addition, a unique set of Permissions can be defined per Operator which grant or deny the Operator's ability to perform system functions, like: Acknowledge and Clear 1 or more alarms; Assign/Un-assign Credentials; Change Alarm and Event Viewer Properties; Display Scramble\*Pad Codes; Download Credentials; Preview and Print Badges; Use any or all of the Component Windows.
11. There shall be a Task Scheduler that allows functions to be performed on an as needed basis, like activating and deactivating credentials. It can also schedule Tasks like Synchronize Controller Clocks and Run Historical Log Archiver on a Daily, Weekly, Monthly basis.
12. The SQL Database Manager shall be used to Backup and Restore data from the SQL database. Manual or automatic backups may be defined. SQL Scripts may also be run from the SQL Database Manager.
13. There shall be a Diagnostic Window available to aid in system diagnostics / troubleshooting. Once a Controller is selected, the Standard Setup and Status diagnostic commands may be selected from a drop down list and sent to the selected controller. The response from the controller is displayed in the Diagnostic Window, and may be viewed, copied to the clipboard, a Report created and printed or saved to a file.
14. In addition, any supported command can be sent to the selected controller.
15. There shall be a Status Viewer which displays in a spreadsheets type format, the real-time status of all or selected Doors, Readers, Inputs, Relays, Expansion Inputs, Expansion Relays. Devices may be grouped in to "Status Groups", which are selectable from a drop down list. Devices may have selected information displayed. The available list includes the following:
  - a. Name and Address
  - b. Status
  - c. Alarm and Acknowledged Status
  - d. Masking Status
  - e. Line Module Input Status and Type
  - f. Relay Status
  - g. Revision Number
  - h. Enabled Status
  - i. Controller Alarm Relay, Tamper, and Battery Status.
16. Foreground, Background, and Secure colors may be changed. In addition, the Columns of data viewed in the Alarm and Acknowledged windows may be selected and the sequence in which they shall appear. The available columns include:
  - a. ICON
  - b. Controller Time
  - c. Host Time

## Specifications

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- d. Description
  - e. Address
  - f. Level
  - g. Acknowledge Time and Acknowledged By (available for the Acknowledged Pane)
17. Tool bar ICONS shall include:
- a. Acknowledge Selected
  - b. Clear Selected
  - c. Acknowledge All
  - d. Clear All
  - e. Silence Beeper
  - f. Add Note
18. The Event Viewer can display all or Filtered Transactions. Custom files may be defined and selected, or standard selections can be made for main categories of Event types. Column width, order, selection, and scrolling direction are user definable, as well as text and background color.
19. The number of cached events to load when launched, up to 10,000, may be defined. The Operator shall be able to scroll back in time to view events no longer seen on the screen, without the need for running a report.
20. The browser shall be an Internet Explorer like "Browser" for accessing on-line help, tutorials (AVI files), manuals, Known Issues, and Product Registration information.
21. There shall be a Customization Manager that allows the Operator to define an alternate language or change the English name or label for each element of the software.
22. Priority Levels may be defined (1-99) for each Alarm Type.
23. The Report Manager shall allow the Operator to select from a number of pre-defined Reports. Custom Reports can be created outside the software, and added to a Custom folder, making the Custom Reports available from within the Report Manager application.
24. Once a Report is selected, the default Criteria and sorting options may be used, or custom Criteria and sorting options may be selected.
25. Once the report is run, it may be viewed, printed, or saved in various standard file formats.
26. Standard Reports included as standard shall include:
- a. Customization Reports
    - 1) Component Resources
    - 2) Customizations Report
  - b. Control Configuration
    - 1) Controllers
    - 2) Doors
    - 3) Expansion Inputs
    - 4) Expansion Relays
    - 5) Inputs
    - 6) Network Layout
    - 7) Printers
    - 8) Readers
    - 9) Relays
-

**Specifications**

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- c. History Logs
    - 1) All Events Log
    - 2) External Events Log
    - 3) Internal Events Log
    - 4) Operator Log
    - 5) User Activity Log
  - d. Person Information
    - 1) Credential Status
    - 2) Door Access by Person
    - 3) Dossier Style by Person
    - 4) Expired and To-Be-Expired Person Access
    - 5) Expired Credentials
    - 6) Last Access by Person
    - 7) Person Access and Function Group Summary
    - 8) Person Access and Function Group Summary with Codes and Cards
    - 9) Person Access by Door
    - 10) Person Access Summary
    - 11) Person Access Summary with Codes and Cards
    - 12) Person FG Summary with Codes and Cards
    - 13) Person Function Group Summary
  - e. Software Configuration
    - 1) Command Sets
    - 2) Door Groups
    - 3) Function Group Extensions
    - 4) Functions Groups with Users
    - 5) Functions with Users
    - 6) Holiday Schedules
    - 7) Holidays
    - 8) Operator Groups
    - 9) Operators
    - 10) Time Zones – Grand Master Time Zone
    - 11) Time Zones – Master Time Zone
    - 12) Time Zones – Standard Time Zone
    - 13) Time Zones – Standard Time Zones in Use
27. The Console Preferences shall define specific settings or devices for use with Velocity. These shall include: File Paths; Show Splash Screen on Startup; Access and Enable Customized Values for Components in Customization Manager; Use 24-Hour Time Format; SQL Server and Network Connections settings; Enrollment Station properties; and Report.
28. This function shall contain the required definition of the hardware components of the system. The database files shall be based on the hierarchy of the system hardware as it is physically installed in the field.

## Specifications

29. Controller Properties shall define all General settings for the Controller. These setting shall include: Name, Type, Address, Local Time Zone, Enabled Status, Firmware Revision Number and Date, Expansion Option Boards Installed and available Hardware. All additional Controller Setup Options can be defined here and are detailed in the Firmware Features section below.
30. The Controller Device Properties shall define all connected field devices, including: Doors, Readers, Inputs, Relays, Expansion Inputs, and Expansion Relays. Device names and all operating parameters shall be definable if operation other than the included defaults is required.
31. The Graphics application shall allow the Operator to add, delete or modify graphic floor plans and add indicator icons to graphic floor plans that represent Controllers, input/output points, readers, or cameras located in the facility. Formats for Graphics supported include two Modes, Live and Design. The Live mode shall be used for real time monitoring. In addition, right clicking an ICON presents the Operator with a list of available Access or Control Functions that can be issued to the device. The Design mode allows the Operator to define which graphics are to be used, place ICONS on the Graphics, and define properties for each ICON.
32. There shall be a Bird's Eye Viewer that provides a key plan that can be panned and scrolled by moving the red box, which indicates the current viewing area.
33. There shall be a Directory of available Graphics to easily select the desired Graphic to display.
34. An Object Toolbar shall be available for selecting Objects to appear on the Badge Template, including: Bit Map Logos, Photos, Fixed Text, and Database Fields. Each Object shall have a Properties box where the specific Properties of that Object are defined, including: File, database field, Font color, Font Style, Font Size.
35. The Enrollment Manager application shall maintain information related to a Person, and Credentials assigned to that person. Multiple Credentials per person shall be supported. The list of People shall be able to have Custom filters applied, allowing for quick and easy grouping of desired people. There shall be a quick find option for finding a specific person or credential.
36. The Personal Information pane shall include the General and Additional User Defined fields. The system shall be capable of defining up to 36 user definable fields of information per Person. These field names can be either a "Text Box", "Dropdown" where the Operator can enter text, or select from a Dropdown List, or a "Dropdown List" where selecting from the List is required. A Photo field shall be available for acquiring a live video image, acquire an image from a TWAIN device, or acquiring a photo from an existing file. A Record Last Updated field shall be available, as well as Preview and Print a Badge. A signature field shall also be available.
37. Once a person is added, one or more Credentials may be added to that Person. Credentials may be added using a Credential Template, or directly without a Credential Template. The Credential shall take on the properties of the Credential Template if used. There shall be a Card Enrollment Station used for entering card data into the system. PIN Numbers can either be randomly selected, or Operator/User selected.
38. Once a Person is selected from the List, the Credential Status and information is displayed for the assigned Credentials. The information includes: IDF, ID, Function, Description, Status, Expires On, Last Access, Last Door, Tag, and Alert. An Operator may right click on a Credential, and shall be presented with the following options: Tag, Alert, Disable, Forgive Passback, Override Code Tamper, Reset Limit Count, Force Download, Un-assign, Delete, and Properties.
39. The bottom of the Enrollment Manager window shall display counters for: People, Assigned Credentials, Unassigned Credentials, and Guest Credentials.





**Specifications**

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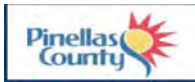
B. Acceptable Manufacturers

1. Hirsch Velocity System Software Package. Software to be installed on PC provided for Security Office. Software also to be installed on three owner furnished PC's in the human resources department, Director of Operations, and Director of Security.

2.19 CONTROLLER FIRMWARE

A. Specifications

1. The software for the controller shall reside in Flash ROM (firmware) and be located on a plug removable module on the controller board to facilitate easy field up-gradability of the features. All of the necessary software for a fully functional System is located in the controller. The controller firmware shall include the following general features at a minimum and be fully supported by the head-end.
  - a. 3 - 15 digit keypad Code's
  - b. Duress digit for keypad Code's
  - c. 150 Time Zones for access restriction and automatic event control
  - d. 128 Access Zones for access management
  - e. 256 Control Zones for alarm and relay management
  - f. 366 programmable holidays this year, 366 days next year. Each Holiday may be assigned to 1 – 4 Holiday Schedules.
  - g. Automatic daylight savings time clock adjustment
  - h. 27 different functions for Code's and cards, e.g. access, unlock, re-lock, alarm mask, relay control
  - i. Add user records
  - j. Tag users for annunciation at host computer
  - k. 4,000 Users
  - l. 750 event, 750 alarm transaction buffer
2. The controller shall include the following access control features at a minimum.
  - a. Restrict access by: time of day; day of week; door; holiday
  - b. Momentary Access of door up to 8100 seconds
  - c. Extended Access for User Definable Momentary Access duration (requires Scramble Pad). Scramble Pad shall display time remaining on the minute, and annunciate at the defined "Warning Time"
  - d. Special Needs Time Extension to provide additional time for Momentary Access and Door Open Too Long for selected people.
  - e. Unlock/Re-lock of door by CODE, card or Time Zone
  - f. Door status monitoring shall allow for: door forced monitoring; door-open-too-long monitoring; door-open-too-long while door is unlocked; auto-re-lock of door when opened or closed
  - g. Request-to-exit masks alarm and/or unlocks door
  - h. 2-person requirement by door. A user can be defined as Normal, A/B Rule A, A/B Rule B, Executive Override. Can be disabled by Time Zone.



## Specifications

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- i. 63 Passback Zones. Can be disabled by Time Zone. A User can designate with Passback Executive Override.
  - j. Use Count limits on users
  - k. Absentee Rule limits on users
  - l. Temporary Day limits on users
  - m. Occupancy Counting / Minimum & Maximum limits per Passback Zone
  - n. Deadman CODE / Timer
  - o. Threat Levels – 99 Levels may be defined. Based on the Level in effect for the facility, selected readers may be disabled, dual readers in Card/Code Only during Time Zone can require dual, and selected User's Credentials can be disabled.
3. The controller shall include the following alarm management features at a minimum.
- a. Momentarily mask alarm by CODE and/or card
  - b. Mask/unmask alarm by CODE and/or card or by Time Zone
  - c. Alarm device supervised while masked
  - d. Tamper switch on alarm device monitored while masked
  - e. Tamper Input may be configured to operate as a "Latch Monitor" with the appropriate door lock hardware.
  - f. Entry/Exit delay per alarm input
  - g. Alarm input triggers relay/s
4. The controller shall include the following relay control features at a minimum.
- a. CODE and/or card, input, or other relay triggers relay/s
  - b. Trigger relay/s by time zone
  - c. Relay may be normally de-energized or energized
  - d. Disable relay/s during time zone
  - e. Clear relay at end of time zone
- B. Acceptable Manufacturers
- 1. Hirsch Velocity Firmware.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Qualified personnel shall install the System in strict compliance with manufacturer's instructions.
- B. Wiring shall be color coded, uniform and in accordance with national electric codes and manufacturer's instructions.
- C. Equipment shall be firmly secured, plumb and level.
- D. All cable runs to the main equipment rack shall be tagged and identified.
- E. Coordinate all work with Design Builder and other Trades Contractors.
- F. Grounding of devices and peripheral equipment shall be installed per manufacturer's direction to eliminate noise induction and achieve optimum system performance.



## Specifications

- G. Install and configure Security local area network as required for control and communication between system devices. When required, provide necessary coordination, termination, and programming associated with integrating Security local area network with facility network.
- H. Equipment cabinets shall be assembled in the Trade Contractor's shop prior to delivery to the job site.

### 3.2 SOFTWARE SUPPORT

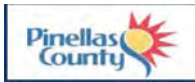
- A. Refer to Section 284620 for software support and programming requirements.

### 3.3 SYSTEM INITIALIZING AND PROGRAMMING

- A. All programming shall occur in the Trade Contractor's shop prior to installation on site.
- B. The System shall be turned on and adjustment made to meet requirements of the specification and on-site conditions.
- C. The System shall be programmed to function as specified.
- D. Any special programming shall be documented and a written copy given to the Owner.
- E. Coordinate integration of other electronic systems as called for in the contract documents.

### 3.4 SYSTEM TEST PROCEDURES

- A. The System shall be pre-tested by the Security Equipment Trade Contractor and certified, in writing, to function in accordance with the plans and specification.
- B. The Trade Contractor is to verify the system is communicating with all controlled devices.
- C. Testing to be performed in the Trade Contractors shop prior to delivery-
  - 1. Test 120VAC power equipment and hardware internal to all equipment racks. Test all conductors for shorts, opens, and polarity.
  - 2. Fully charge all UPS systems. Test unit by removing power thereby causing the unit to switch to battery reserve.
  - 3. Utilizing a test jig, simulate the operation of every circuit required.
- D. Testing to be performed at the job site prior to powering the system
  - 1. Test all 120VAC power sources for correct polarity and voltage. Test grounding system for continuity. Notify Electrical Trade Contractor of any problems.
  - 2. The System shall be completely tested to assure that all components are hooked up and in working order. Motion detectors are to be aligned allowing for optimal pickup area. Locking devices are to be adjusted so that doors lock and unlock without interference. Correct all causes of such defects. If the cause is outside of the scope of the 281300 series scope of work, promptly notify the Architect Engineer in writing, indicating the cause of the defect and suggested corrective procedures.
- E. Additional job site testing
  - 1. After installation of head end electronics, verify proper operation of all field devices including locks, door position switches, card readers, push buttons, and intercom stations.



**Specifications**

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2. Verify proper integration between access control system and

- a. PLC/GUI system
- b. Video Surveillance system
- c. Intercom/Paging system
- d. Overhead door controls
- e. Vehicular gates
- f. Handicap assist door operators

- F. The System shall be completely tested to assure that all components are hooked up and in working order. Inspect system for defects. Correct all causes of such defects. If the cause is outside of the scope of the Division 28 series scope of work, promptly notify the Architect Engineer and Design Builder in writing, indicating the cause of the defect and suggested corrective procedures.
- G. The system shall be capable of operating under normal operating conditions.
- H. Provide written documentation showing all test results.
- I. The System shall be final tested in the presence of the Architect Engineer. Trade Contractor is to provide all required testing equipment.

3.5 FIELD QUALITY CONTROL

- A. Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.
- C. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at Trade Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

3.6 TRAINING

- A. Provide the facility personnel with training in the use and maintenance of the entire access control system. Coordinate the training session with the Owner. Completed classroom sessions shall be documented by the Trade Contractor, certified by the attending Owner representative, and approved by the Architect Engineer. Instruction shall take place during normal working hours (Monday through Friday, 8:00 a.m. to 5:00 p.m.). Instruction shall not begin until all systems are operational as designed.
- B. The training sessions shall cover the operation and the maintenance manuals and the control console operators manuals and service manuals in detail, stressing all important operational and service diagnostic information necessary for the maintenance and operations personnel to efficiently use and maintain the control system.



**Specifications**

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- C. Trade Contractor is responsible for providing operational and maintenance training applicable to the entire control system. Training is to include, but not be limited to the following-
  - 1. Review all O+M manuals with Owner representatives present for training.
  - 2. Perform a tour of the entire facility. During the tour the trainer shall point out all control equipment and provide a brief description of its purpose and use. This is to include but not be limited to control panels (graphic and pushbutton), all control system hardware, and devices controlled.

END OF SECTION 28 13 00





**Specifications**

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**28 23 13 - VIDEO SURVEILLANCE FOR ELECTRONIC SECURITY**

**PART 1 - GENERAL**

**1.1 SYSTEM DESCRIPTION**

- A. Visual surveillance system is existing. Additions to the system as part of the overall project are provided by the County's CCTV vendor.
- B. Under this scope of work, provide integration of the existing VMS to the PLC/GUI system for the purpose of allowing camera call up functions via touch screen icons, video follow alarm and video follow intercom functions. All VMS work stations, network electronics and large format monitors are furnished and installed by the county.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

- A. Equipment specified is intended as a reference standard for level of quality.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the schedule bid time. Refer to Division 01.
- C. Provide materials listed by UL or ETL.

**2.2 FIXED VIDEO SURVEILLANCE CAMERA**

**A. Specifications**

**1. Power**

- |    |                    |  |
|----|--------------------|--|
| a. | Input Voltage:     | 12 VDC, 24 VAC, PoE IEEE 802.3af                   |
| b. | Power Consumption: | 500 mA (12VDC), 450 mA (24VDC), 150 mA (PoE 48VDC) |

**2. Video**

- |    |                    |                                     |
|----|--------------------|-------------------------------------|
| a. | Video Compression: | H.264, JPEG                         |
| b. | Resolution:        | 720P (1280x720)                     |
| c. | Overall IP Delay:  | Min 120 ms, Max 240 ms              |
| d. | GOP Structure:     | IP, IBP, IBBP                       |
| e. | Frame Rate:        | 1 to 60 H.264, 1 to 30 M-JPEG       |
| f. | Dynamic Range      | 84 dB                               |
| g. | Noise Reduction    | Intelligent Dynamic Noise Reduction |



## Specifications

- 
3. Video Out
    - a. Signal: Analog composite, Analog service
    - b. Connector: 2.5 mm jack and BNC 75 ohm
    - c. Horizontal Resolution: 540 TVL
    - d. Video S/N: 50 dB
  4. Sensitivity
    - a. Smart BLC: On/off
    - b. White Balance: ATW, ATW hold and manual
    - c. Auto Black: Automatic continuous, off
    - d. Shutter: Auto (1/60 to 1/10000) selectable Auto (1/60 to 1/50000) automatic flicker-less, fixed selectable
    - e. Minimum Illumination (30IRE): .017lx (.0017fc)  
Color/ .0057lx(.00057fc) Monochrome, 3200K, 89% scene reflectivity, 30 IRE
    - f. Imager: 1/3" CMOS HD Day/Night
  5. Optical
    - a. Varifocal: IR-corrected, remote zoom and focus
    - b. Iris Control: Automatic
    - c. Viewing Angle (3-9mm): Wide 96° x 52°, Tele 32° x 18°
  6. Software Control
    - a. Unit Configuration: Via web browser or configuration manager
    - b. Flicker Control: 50/60 Hz, selectable
    - c. Firmware: Flash ROM, remote update
  7. Network
    - a. Protocols: Telnet, RTP, HTTP, HTTPS, FTP, SMTP, SNMP, ARP, TCP, UDP, IP, ICMP, DHCP, IGMPv2/v3, SNMP, 802.1, UPnP
    - b. Encryption: TLS 1.0, SSL, AES (optional)
    - c. Ethernet: STP, 10/100 Base-T, autosensing, half/full duplex, RJ45
    - d. PoE: IEEE 802.3 af compliant
  8. Mechanical
    - a. Dome: Polycarbonate, clear, UV-blocking anti scratch, IK10
    - b. Impact Resistance
    - b. Camera Body: Aluminum





## Specifications

- |    |                   |   |
|----|-------------------|---|
| c. | Adjustment Range: | 360 deg pan, 90 deg tilt, +/-90 deg azimuth   |
| d. | Mounting:         | Recess mount into 4S electrical, surface, wall, pendant, pole, corner. Provide mounting accessories as required per mounting details. |

### B. Acceptable Manufacturers

1. Bosch NIN-733V03PS Flexidome Starlight Day/Night Camera. Typical of interior cameras. Bosch NIN-733V03PS Flexidome Starlight Day/Night Camera. Typical of exterior cameras. Provide required mounting supports and hardware. Provide quantity shown on plans. Provide software license as required.
2. Pelco
3. Panasonic
4. Vicon

## 2.3 SURVEILLANCE WORK STATION COMPUTER

### A. Specifications

1. Intel Xeon E5-1620, 10 Meg Cache, 3.6 GHz
2. Windows 7 professional 64 bit
3. 4GB ECC PC3 1333 MHz uDIMM
4. NVIDIA NVS510 2GB DDR3 Dual monitor video adaptor
5. 3.5" internal SATA HDD 1 TB, 7200 RPM
6. Integrated Ethernet Adaptor
7. USB Keyboard and Mouse

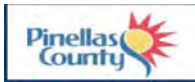
### B. Acceptable manufacturer

1. Lenovo S30
2. Equal by HP
3. Equal by Dell

## 2.4 DESKTOP VIDEO SURVEILLANCE MONITOR

### A. Specifications

- |     |                        |  |
|-----|------------------------|--|
| 1.  | LCD Panel:             | LED  |
| 2.  | Screen Size:           | 18.8" x 10.6"                                  |
| 3.  | Viewable Picture Area: | 21.53" diagonal                                |
| 4.  | Pixel Pitch:           | .248" x .248"                                  |
| 5.  | Resolution:            | 1920x1080 pixels                               |
| 6.  | Aspect Ratio:          | 16:9   |
| 7.  | Display Colors:        | 16.7 million colors                            |
| 8.  | Response Times:        | 5 ms   |
| 9.  | Backlight:             | LED  |
| 10. | Luminance:             | 250 cd/m Sq, anti-glare hard-coating treatment |



## Specifications

- 
- |     |                |                  |
|-----|----------------|------------------|
| 11. | Contrast:      | 1000:1           |
| 12. | Viewing angle: | 170 deg/160 deg  |
| 13. | Digital Input: | DVI-D, HDMI, VGA |

B. Acceptable Manufacturer

1. Bosch UML-223-90 video monitor.
2. Pelco
3. Panasonic
4. Vicon

### 2.5 LARGE FORMAT WALL MOUNT VIDEO SURVEILLANCE MONITOR

A. Specifications

- |    |                        |                              |
|----|------------------------|------------------------------|
| 1. | Display Type:          | LED                          |
| 2. | Viewable Picture Area: | 60" diagonal                 |
| 3. | Resolution:            | 1920 x 1080 pixels           |
| 4. | Aspect Ratio:          | 16:9                         |
| 5. | Frame Rate:            | 60 Hz                        |
| 6. | PC Input:              | DVI-D, HDMI, VGA             |
| 7. | Video Input:           | CVBS, Composite BNC, S-Video |

B. Acceptable Manufacturer

1. LG 60LA8600. Refer to plans for location.
2. Sony
3. Panasonic
4. Vicon

### 2.6 MONITOR WALL MOUNT

A. Specifications

- |    |                    |                       |
|----|--------------------|-----------------------|
| 1. | Lateral Shift:     | 12"                   |
| 2. | Maximum Extension: | 24.88"                |
| 3. | Minimum Depth:     | 3.38"                 |
| 4. | Mounting Pattern:  | 200x200mm – 862x517mm |
| 5. | Tilt:              | +5, -15 degrees       |
| 6. | Weight Capacity:   | 100 lbs               |

B. Acceptable Manufacturer

1. Chief Manufacturing. Provide all necessary hardware.
2. Peerless



## Specifications

### 2.7 VGA EXTENDER

#### A. Specifications

- |    |                    |              |
|----|--------------------|--------------|
| 1. | Gain:              | Unity        |
| 2. | Video Signal:      | 1 analog VGA |
| 3. | Recommended Cable: | Cat 5/5e/6   |
| 4. | Power Supply:      | 12 VDC       |

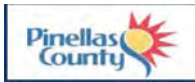
#### B. Acceptable Manufacturer

1. Extron VTT001 transmitter and VTR001 receiver. Provide power supply as needed.
2. Atlona
3. Kramer

### 2.8 VIDEO MANAGEMENT SYSTEM

#### A. Specifications

1. Enterprise-Class Client/Server based video management system.
2. System-wide user management, alarm handling, health monitoring, and configuration.
3. Full virtual matrix capabilities, including analog monitor support and CCTV keyboard control
4. Superior alarm handling with alarm priorities and selectable user group distribution.
5. Provide load balanced storage across multiple arrays with recording failover in the event of an array malfunction.
6. Workstations must be capable of displaying live video independent of management server in the event the management server is unavailable.
7. Advances user interface concepts for effective and efficient operation
8. Supports all ONVIF Profile S devices, Bosch H.264, Bosch MPEG-4 encoders, decoders, IP cameras, IP auto domes, Allegiant, DiBos, BRS, Bosch POS/ATM Bridge, and DiBos compatible ATM Bridge.
9. Provide support for iPad and iPhone.
10. Provide Transcoding support
11. Enterprise support for multiple management servers.
12. Video decoder support.
13. Support for camera call up using Bosch Allegiant CCL commands. No scripting shall be required for interfacing between the VMS and PLC system.
14. VMS must have capability to monitor all network devices using SNMP.
15. Software Maintenance Agreements shall not be *required* by the manufacturer but rather offered.
16. Minimum Client Workstation PC Requirements
  - a. HP Z420 Series
17. Minimum Central Server PC Requirements
  - a. HP R8 Series



**Specifications**

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B. Acceptable Manufacturer

1. Bosch MBV-BPRO-45 BVMS Professional Edition V4.5. Provide expansion modules as required for support of viewing stations identified on plans, as well as modules required for video recording, system configuration and management, and system monitoring. Provide software license as required. Provide Software Maintenance as required.
2. Panasonic
3. Vicon

2.9 CAMERA KEYBOARD CONTROLLER

A. Specifications

- |  |                                  |
|--|----------------------------------|
| 1. Mux/DVR Signal:   | RS-485: 2 wire, 19,200 baud      |
| 2. Terminal Mode Signal:                                     | RS-232; 3-wire, 9600 baud        |
| 3. Console Signal:   | RS-232 RS/CTS 19,200/57,600 baud |
| 4. Power Requirements:                                       | 12-15 VAC or VDC                 |
| 5. Joystick control  |                                  |
| 6. Pan/tilt, zoom, manual focus, open/close iris, start/stop |                                  |

B. Acceptable Manufacturer

1. Bosch KBD-UNIVERSAL Intuikey digital keyboard. Provide power supply as required.
2. Panasonic
3. Vicon

2.10 VIDEO MANAGEMENT SERVER

A. Specifications

1. 1RU Rack Mount
2. Windows Server 2012 standard, 64 bit OS
3. Intel Xeon E5-2603 Processor 1.8 GHz 4C 10M 6.4GT Hyper T 80 Watt
4. 16 GB 1RX4 RDIMM DDR3 1600
5. (4) 1TB 3.5" SATA enterprise hard drive 7.2K, 6 GB/s Hot Swap
6. Slim SATA DVD Optical
7. Mouse
8. Keyboard
9. Single monitor video card
10. Intel Pro/1000 PT Dual Port 1GB Ethernet Adapter
11. Dual 800 Watt Redundant PS
12. 3 Year onsite service

B. Acceptable Manufactures

1. Lenovo Thinkserver RD530
2. HP



## Specifications

3. Dell
4. Bosch
5. Vicon

### 2.11 VIDEO STORAGE ARRAY

#### A. Specifications

1. The IP Video Storage System shall be an embedded, all-in-one IP Video Storage subsystem that provides “plug-and-play” iSCSI-based recording and management.
2. The IP Video Storage Array shall be a 2 U rack-mount chassis with eight (8) hot swappable, 3 Gbps SATA-II hard disk drives with RAID-5 protection.
3. The IP Video Storage System shall be integrated with the Bosch Video Recording Manager (VRM) application.
4. The IP Video Storage Array shall be equipped with two (2) redundant 1 GbE network interfaces.
5. The IP Video Storage System shall contain a Disk-on-Module (DoM) solid-state memory module that contains a non-volatile backup image of all system software which can be used to initiate a full system recovery in the event the system partition is lost or corrupted.
6. The IP Video Storage Array shall be installed with the Microsoft Windows Storage Server 2012 operating system.
7. The IP Video Storage Array shall support the following:
  - a. SNMP
  - b. Remote Desktop
  - c. HTTP monitoring
8. The IP Video Storage Array processor shall include ECC Unbuffered memory protection.
9. The storage array is designed so that all data is protected even if one hard disk drive completely fails.
10. Each 2TB disk drive in the storage array is hot swappable, so that a failed drive can be easily replaced without cycling power or interrupting recording or data retrieval.

#### B. Acceptable Manufacturer

1. Bosch DLA-AIOXL1-08AT digital video storage array. Provide a quantity of digital storage arrays to support the number of cameras shown on the plans.
2. HP
3. Dell Storage Vault
4. Vicon

### 2.12 CCTV IP DECODER

#### A. Specifications

- |                          |   |
|--------------------------|---|
| 1. Video Outputs:        | DVI-D, HDMI, DP                           |
| 2. Video Standards:      | H.264, MPEG-4                             |
| 3. Data Rate:            | Up to 20mbps per stream                   |
| 4. Resolution:           | 1080P, 720P, 4CIF                         |
| 5. Stream Support:       | At least (2)1080P/30ips or (12)4CIF/30ips |
| 6. Total Stream Support: | 30 Video Streams displayed                |



## Specifications

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- |     |                    |                        |
|-----|--------------------|------------------------|
| 7.  | Output Resolution: | Up to 2560x1600@ 60 Hz |
| 8.  | GOP Structure:     | I, IP, IBBP            |
| 9.  | Overall IP Delay:  | 120 ms                 |
| 10. | Frame Rate:        | 1 to 60                |
| 11. | Power:             | 100-240VAC, 135W max   |

### B. Acceptable Manufacturer

1. Bosch VIP-HDXD series decoders. Provide software licensing as required.
2. Panasonic
3. Vicon

## 2.13 SECURITY NETWORK SWITCH

### A. Specifications

1. (24) Ethernet 10/100/1000 ports, (4) shared SFB/GBIC 1000ports
2. Switching fabric: 68 Gbps
3. Forwarding rate: 50 mpps
4. Memory: 64 MB DRAM & 32 MB flash
5. MAC addresses: Up to 10,000
6. IGMP groups/Multicast routes: Up to 255
7. Configurable MTU: 10000 Bytes with jumbo frames
8. 1000BaseT ports: RJ-45 connectors
9. Stacking: Minimum 16 switches
10. Stacking Backplane: 10gbps
11. Input power: 100 – 240 VAC auto-ranging
12. Indicators:
  - a. Port link integrity
  - b. Port disabled
  - c. Port speed
  - d. Port full duplex
  - e. System status
  - f. System RPS
  - g. System link status
  - h. System link duplex
  - i. System link speed
13. Operating Temp: 0 to 50 degrees C
14. Operating relative humidity: 10 – 85% non-condensing
15. Power consumption: 40 Watts max (120VAC)
16. Certifications: UL listed, FCC part 15 Class A
17. POE: IEEE 802.3af on all ports simultaneously

### B. Acceptable Manufacturers

1. IFS NS3601-24P/4S
2. Cisco
3. HP



## Specifications

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### 2.14 PTZ CAMERA

#### A. Specifications

1. Indoor/outdoor PTZ with HDTV 1080p30 video
2. Intelligent Video analytics
3. H.264 encoding
4. ONVIF conformant
5. Equipped with two alarm inputs and one open-collector alarm output
6. Built-in iSCSI support
7. Imager 1/2/8 in. – type CMOS
8. Number of Pixels
  - a. Effective Approximately 3.27 megapixels
  - b. Delivered Approximately 2 megapixels
9. Aspect Ratio HD: 16:9
10. Lens 20x optical zoom
11. Focus
  - a. One-push (default)
  - b. Automatic (normal, low)
  - c. Manual
12. Iris Automatic with Manual Override (F1.6 to F3.5)
13. Field of View
  - a. 1080p Mode 2.9° (tele) to 55.4° (wide)
  - b. 720p Mode 2.0° (tele) to 37.6° (wide)
14. Synchronization Internal
15. Aperture Correction Adjustable sharpness
16. Digital Zoon 12x
17. Tilt angle 18° above the horizon

#### B. Acceptable Manufacturers

1. Bosch – AutoDome 800 series HD PTZ
2. Pelco
3. Panasonic
4. Vicon

## PART 3 COMPLETION

### 3.1 INSTALLATION

- A. All system programming shall be done at the SECs facility prior to installation on site.
- B. Qualified personnel shall install the System in strict compliance with manufacturer's instructions.
- C. Wiring shall be color coded, uniform and in accordance with national electric codes and manufacturer's instructions.



**Specifications**

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- D. Equipment shall be firmly secured, plumb and level.
- E. All cable runs shall be tagged and identified.
- F. Coordinate all work with General Contractor - Advisor other Trades Contractors.

3.2 SOFTWARE SUPPORT

- A. Refer to Section 284620 for software support and programming requirements.

3.3 SYSTEM INITIALIZING AND PROGRAMMING

- A. All programming shall occur in the SEC's shop prior to installation on site.
- B. The System shall be programmed to function as specified.
- C. Any special programming shall be documented and a written copy given to the Owner/User.
- D. Coordinate integration of other electronic systems as called for in the contract documents.

3.4 SYSTEM TEST PROCEDURES

- A. Integration of the PLC/GUI with the VMS shall be completely tested to assure that all components are hooked up and in working order. Inspect system for defects. Correct all causes of such defects. If the cause is outside of the scope of the Division 28 series scope of work, promptly notify the Architect Engineer in writing, indicating the cause of the defect and suggested corrective procedures.
- B. The SEC is to verify the system is communicating with all controlled devices.

3.5 TRAINING

- A. Contractor is responsible for providing operational and maintenance training applicable to the entire control system. Training is to include, but not be limited to the following-
  - 1. Review all O+M manuals with Owner representatives present for training.
  - 2. Perform a tour of the entire facility. During the tour the trainer shall point out all surveillance equipment and provide a brief description of its purpose and use. This is to include but not be limited to cameras, monitors, control stations, recording devices, and devices controlled.

END OF SECTION 28 23 13





## **28 31 11 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

**A. Section Includes:**

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Nonsystem smoke detectors.
5. Heat detectors.
6. Notification appliances.
7. Magnetic door holders.
8. Remote annunciator.
9. Addressable interface device.
10. Digital alarm communicator transmitter.

#### **1.2 SYSTEM DESCRIPTION**

- A. Noncoded, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only. New system shall have ability to be networked to connect the existing systems in the Central Division and South Division buildings.
- B. All devices shall be suitable for use in institutional buildings.

#### **1.3 ACTION SUBMITTALS**

- A. Product Data and shop drawings shall comply with county requirements

#### **1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level IV technician.
- C. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.



## Specifications

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### 1.5 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
  - 1. Design Builder shall coordinate requirements with the county.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide
  - 1. NOTIFIER; a Honeywell company.

### 2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Smoke detectors.
  - 4. Duct smoke detectors.
  - 5. Automatic sprinkler system water flow.
  - 6. Heat detectors in elevator shaft and pit.
  - 7. Fire-extinguishing system operation.
  - 8. Fire standpipe system.
- B. Fire-alarm signal shall initiate the following actions:
  - 1. Continuously operate alarm-notification appliances.
  - 2. Identify alarm at the fire-alarm control unit and remote annunciators.
  - 3. Transmit an alarm signal to the remote alarm receiving station.
  - 4. Unlock electric door locks in designated egress paths.
  - 5. Release fire and smoke doors held open by magnetic door holders.
  - 6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
  - 7. Recall elevators to primary or alternate recall floors.
  - 8. Activate emergency lighting control.
  - 9. Activate emergency shutoffs for gas and fuel supplies.
  - 10. Record events in the system memory.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
  - 1. Valve supervisory switch.
  - 2. Low-air-pressure switch of a dry-pipe sprinkler system.
  - 3. Elevator shunt-trip supervision.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:

## Specifications

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1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal ac voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

### 2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
  - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
  - b. Include a real-time clock for time annotation of events on the event recorder and printer.
2. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
  - a. Initiating Device Circuits: Style D .
  - b. Notification Appliance Circuits: Style Z.
  - c. Signaling Line Circuits: Style 6.
  - d. Install no more than 50 addressable devices on each signaling line circuit.
2. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class B.
  - a. Initiating Device Circuits: Style A
  - b. Notification Appliance Circuits: Style Y.

## Specifications

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- c. Signaling Line Circuits: Style 4.
- d. Install no more than 50 addressable devices on each signaling line circuit.

D. Elevator Recall:

- 1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.
  - a. Elevator lobby detectors except the lobby detector on the designated floor.
  - b. Smoke detector in elevator machine room.
  - c. Smoke detectors in elevator hoistway.
- 2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
- 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
  - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

- E. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

### 2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
- 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
  - 2. Station Reset: Key- or wrench-operated switch.
  - 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
  - 4. Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.

### 2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
- 1. Comply with UL 268; operating at 24-V dc, nominal.
  - 2. Detectors shall be two-wire type.
  - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

## Specifications

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4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

C. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).
3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

## 2.6 HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F

1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

**Specifications**

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**2.7 NOTIFICATION APPLIANCES**

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
  - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- B. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- C. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- E. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
  - 1. Rated Light Output:
    - a. 15/30/75/110 cd, selectable in the field.
  - 2. Mounting: Wall mounted unless otherwise indicated.
  - 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  - 4. Flashing shall be in a temporal pattern, synchronized with other units.
  - 5. Strobe Leads: Factory connected to screw terminals.
  - 6. Mounting Faceplate: Factory finished, red

**2.8 REMOTE ANNUNCIATOR**

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
  - 1. Mounting: Surface cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

**2.9 ADDRESSABLE INTERFACE DEVICE**

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

## Specifications

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- B. Integral Relay: Capable of providing a direct signal **[to elevator controller to initiate elevator recall] [to circuit-breaker shunt trip for power shutdown]** <Insert functions>.

### 2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture **[one]** **[two]** telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
1. Verification that both telephone lines are available.
  2. Programming device.
  3. LED display.
  4. Manual test report function and manual transmission clear indication.
  5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
1. Address of the alarm-initiating device.
  2. Zone of the supervisory signal.
  3. Zone of the trouble-initiating device.
  4. Loss of ac supply or loss of power.
  5. Low battery.
  6. Abnormal test signal.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

## PART 3 - EXECUTION

### 3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Equipment Mounting: Install fire-alarm control unit on concrete base with tops of cabinets not more than 72 inches above the finished floor.
- C. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.

**Specifications**

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1. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
  1. Connect new equipment to existing control panel in existing part of the building.
  2. Connect new equipment to existing monitoring equipment at the supervising station.
  3. Expand, modify, and supplement existing monitoring equipment as necessary to extend existing monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.

**3.2 CONNECTIONS**

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08 Section "Door Hardware." Connect hardware and devices to fire-alarm system.
  1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- C. Install framed instructions in a location visible from fire-alarm control unit.

**3.3 GROUNDING**

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

END OF SECTION 28 31 11





## **28 46 19 - PLC HARDWARE FOR ELECTRONIC SECURITY**

### **PART 1 - GENERAL**

#### **1.1 SYSTEM DESCRIPTION**

- A. Furnish all materials and labor necessary to complete the installation of specific systems described herein and integration of all systems as indicated, specified herein or both. The work includes the following, as well as work not listed below but described elsewhere:
1. Graphical User Interface (GUI) shall integrate control and monitoring of major subsystems and devices indicated in Project Criteria Documents. The GUI shall act as an operator interface to the major security control and monitoring subsystems. Include programming that implements control and monitoring functions defined in project documents.
  2. System shall include a complete IEEE 802.3 100/1000 BASE-T Local Area Network (LAN) that interfaces the GUI computers and the Programmable Logic Controllers (PLC), Intercom Control and Digital Video Recorders. This network is closed, only used by the Security Control Systems.
  3. All electronic equipment furnished and installed by the SEC shall be protected by transient voltage surge suppression. See Specification Section 280526.
  4. Provide computer-based hardware and custom designed, application-specific, Microsoft Windows 7 or newer based software that operates in conjunction with Programmable Logic Controllers (PLC) specified below to integrate or interface to all devices and systems.
  5. Provide and install graphical control and annunciation icons on graphics mode video displays along with programming that provides the sequences of operation verified with the Owner and Architect Engineer during the software development process described in 284620-PLC Software for Electronic Security, Part - 3.1, Software Support.
  6. The GUI computer shall contain graphics and wavetable programs only. All control logic programs shall reside in the PLC.
  7. General Requirements of PLC System
    - a. Provide a Programmable Logic Controller (PLC) system that is the product of a single company, which has regularly manufactured PLC equipment for a period of 15 years.
    - b. Provide only components that are regularly used in industrial automation applications.
    - c. Components must be in stock from a distributor within 100 miles of this facility or be able to be shipped next day to this facility.
    - d. Provide only UL Listed components.
    - e. Provide PLC System that seamlessly integrates the Control system to the Private Security Control System Local Area Network.
    - f. Provide CPU(s) with a visual status indication of backup battery.
    - g. Provide alarm in the event of CPU low battery voltage before battery failure and for communication failure.
    - h. Provide 15% spare PLC system capacity at the completion of the project. This includes program memory, I/O memory allocation, register memory, user memory, etc.
    - i. Provide programming software memory usage summary with as-built documentation.
    - j. Provide 15% spare PLC I/O module capacity at the completion of the project. Calculate inputs and outputs separately when figuring capacities.
    - k. All Components must be mounted in a metal enclosure.

## Specifications

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- l. All PLC interposing relays must be fused to protect relay and field device wiring from over-current caused by shorts or device failure.
  - m. EMC filter must be installed on the power supply lines
  - n. PLC racks and modules shall be Din Rail mountable.
  - o. Din Rail must be mounted on a metallic surface that is grounded to earth using screws with star washers every 6 inches.
  - p. All Safety and Reference grounds for PLC equipment shall be in compliance with IEEE 1100.
  - q. Expansion and Remote Cables must be 100% shielded. A 100% shield means that the braided cable shield is connected to the metal shell of the connector.
  - r. Termination Labeling
    - 1) Each wire shall be labeled with an industry standard thermal transfer wire marker.
    - 2) I/O wire number should reference wiring diagram and Software I/O list.
    - 3) Felt tip pen labels are unacceptable.
    - 4) Power wiring should reference wiring diagram.
    - 5) Communication cables should reference wiring diagram and node ID.
  - s. The control architecture shall use distributed control over Ethernet. Each controller will share selected memory with all other controllers via broadcast messages over Ethernet.
  - t. All Ethernet communication shall be configured using producer/consumer exchanges without requiring PLC logic to drive the communications.
  - u. All Remote I/O shall be connected over Ethernet.
  - v. Remote I/O shall use the exact same module types and same I/O module part numbers as those that are used at the PLC's CPU unit.
  - w. PLC racks and Remote I/O drops shall be expandable up to 64 modules per Ethernet drop using local expansion cables.
  - x. All I/O modules shall utilize terminal block style wire connections and support hot removal and insertion
  - y. Output modules shall be available with Electronic Short Circuit Protection. The diagnostic status of the Electronics Short Circuit Protection (ESCP), for those discrete output modules containing ESCP, shall be indicated by a green LED during normal operation per point and amber during a fault. The fault should be auto-corrective without the need to cycle power.
8. Touch Screen Control Workstations
- a. Provide touch screen control work stations as indicated on the criteria documents
  - b. Control associations between devices and control locations will be based primarily on geography and shall be confirmed by the design build team by meeting with the county to establish the control scheme and takeover hierarchy.
  - c. The touch screens located in central control shall be the final but not the only fail over/takeover control location. Hierarchy and sequence of fail over/takeover shall be as defined during the phase I software development meeting.
  - d. Each local touch screen station consists of a 26" LCD touch screen, computer CPU, wireless mouse, keyboard and UPS.
  - e. Each Central Control touch screen station consists of two 26" LCD touch screens, computer CPU, wireless mouse, keyboard and UPS.
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## Specifications

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9. Integration with Video Surveillance System

- a. Provide integration of the video surveillance system that allows VMS control to be accomplished through the GUI. Functions to include but not be limited to:
  - 1) Camera call up
  - 2) Camera to monitor assignments
  - 3) Video follow audio functionality
  - 4) Video follow alarm functionality
- b. Administrative level configuration and set up functions are not required to be accessible from the GUI

10. Integration with intercom system

- a. Provide integration of the intercom system to allow automatic video follow audio functionality.
- b. Provide programming that allows all intercom master control functions to be accomplished through the GUI including but not limited to:
  - 1) Answer
  - 2) Answer and zoom
  - 3) Page zone activation
  - 4) Clear call without answering
  - 5) Connect without a call being placed
  - 6) View Queuing log
  - 7) GUI shall annunciate a call placed at the station and by screen on the key plan.
- c. Administrative level configuration and set up functions are not required to be accessible from the GUI.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. Equipment specified is intended as a reference standard for level of quality.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the schedule bid time. Refer to Division 00 and Division 01..
- C. Provide materials listed by UL or ETL.



## Specifications

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### 2.2 GUI TOUCH SCREEN USER INTERFACE

#### A. GUI Touch Screen Monitor

##### 1. Specifications

- a. 26.0" diagonal
- b. 16:10 active matrix TFT LCD
- c. Usable screen
  - 1) 21.4" Horizontal
  - 2) 13.8" Vertical
- d. 1920 x 1200 native resolution
- e. 16.7 million colors
- f. 5ms Response time
- g. +/- 80 degree viewing angle horizontal or vertical
- h. 1000:1 contrast ratio
- i. 120 VAC 61 watts power consumption
- j. Two 2 watt internal speakers
- k. Audio input 3.5mm TRS jack
- l. Weight, 27.8 lbs
- m. 32 to 104 degree F operating temperature
- n. Surface acoustic wave touch technology

##### 2. Acceptable manufacturers

- a. ELO Touch 2600 LM
- b. Equal by HP
- c. Equal by NEC

#### B. GUI Touch Screen Computer

##### 1. Specifications

- a. Intel Xeon E5-1620, 10 Meg Cache, 3.6 GHz
- b. Windows 7 professional 64 bit
- c. 4GB ECC PC3 1333 MHz uDIMM
- d. NVIDIA NVS510 2GB DDR3 HP Win 7 Video Adaptor
- e. 3.5" internal SATA HDD 1 TB, 7200 RPM
- f. Integrated Ethernet Adaptor
- g. USB Keyboard and Mouse

##### 2. Acceptable manufacturer

- a. Lenovo S30
- b. Equal by HP
- c. Equal by Dell



## Specifications

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C. GUI Speakers

1. Integral to monitor

2.3 SECURITY SYSTEM MANAGEMENT COMPUTER (SSMC)

A. Computer

1. Specifications

- a. Intel Xeon E5-1620, 10 Meg Cache, 3.6 GHz
- b. Windows 7 professional 64 bit
- c. 4GB ECC PC3 1333 MHz uDIMM
- d. NVIDIA NVS510 2GB DDR3 HP Win 7 Video Adaptor
- e. 3.5" internal SATA HDD 1 TB, 7200 RPM
- f. Integrated Ethernet Adaptor
- g. USB Keyboard and Mouse
- h. ThinkVision LT1952P 16:9 19" LED Monitor

2. Acceptable Manufacturers

- a. Lenovo S30
- b. Equal by HP
- c. Equal by Dell

B. Printer

1. Specifications

- a. 21 ppm color or B/W
- b. 250 sheet input
- c. Network ready
- d. Standard 2.0 USB and Ethernet
- e. 128 MB RAM
- f. 417 MHz processor
- g. 500 to 1500 pages per month recommended usage
- h. 1200 x 1200 dpi printing
- i. Weight – 54 lbs

2. Acceptable Manufacturers

- a. Lexmark C540n
- b. Equal by Canon
- c. Equal by Epson



## Specifications

### 2.4 CONTROL SYSTEM LOCAL AREA NETWORK SWITCH

#### A. Specifications

1. Configuration: 48 Ethernet 10/100/1000 ports 4 of which are dual purpose
2. Catalyst 2960 software image
3. Switching fabric: 32 Gbps
4. Forwarding rate: 39 mpps
5. Memory: 64 MB DRAM & 32 MB flash
6. MAC addresses: Up to 8,000
7. IGMP groups/Multicast routes: Up to 255
8. Configurable MTU: 9000 Bytes with jumbo frames
9. 1000BaseT ports: RJ-45 connectors, 4 pair Cat 5 UTP
10. Input power: 100 – 240 VAC auto-ranging
11. Indicators:
12. Port link integrity
13. Port disabled
14. Port speed
15. Port full duplex
16. System status
17. System RPS
18. System link status
19. System link duplex
20. System link speed
21. Operating Temp: 32 – 113 deg F
22. Operating relative humidity: 10 – 85% non-condensing
23. MTBF: 167,606 hours
24. Power consumption: 140 watts max
25. Certifications: UL listed, FCC part 15 Class A

#### B. Acceptable Manufacturers

1. Cisco 2960G-48 TC
2. HP

### 2.5 PROGRAMMABLE LOGIC CONTROLLER

#### A. General requirements

1. Provide a Programmable Logic Controller (PLC) system that is the product of a single company, which has regularly manufactured PLC equipment for a period of 15 years.
2. Provide only components that are regularly used in industrial automation applications.
3. Components must be in stock from a distributor within 100 miles of this facility or be able to be shipped next day to this facility.
4. Provide only UL Listed components.
5. Provide PLC System that seamlessly integrates the Control system to the Local Area Network switches.
6. Provide CPU(s) with a visual status indication of backup battery.

## Specifications

7. Provide primary and secondary CPUs and provide redundant power supplies on all CPU and I/O racks.
8. Provide alarm in the event of CPU low battery voltage before battery failure.
9. Provide 15% spare PLC system capacity at the completion of the project. This includes program memory, I/O memory allocation, register memory, user memory, etc.
10. Provide programming software memory usage summary with as-built documentation.
11. Provide 15% spare PLC I/O module capacity at the completion of the project. Calculate inputs and outputs separately when figuring capacities.
12. All Components must be mounted in a metal enclosure.
13. All PLC interposing relays must be fused to protect relay and field device wiring from over-current caused by shorts or device failure.
14. PLC AC power supply must be supplied through an IEC-rated isolation transformer.
15. EMC filter must be installed on the power supply lines
16. PLC racks and modules shall be Din Rail mountable.
17. Din Rail must be mounted on a metallic surface that is grounded to earth using screws with star washers every 6 inches.
18. All Safety and Reference grounds for PLC equipment shall be in compliance with IEEE 1100.
19. Expansion and Remote Cables must be 100% shielded. A 100% shield means that the braided cable shield is connected to the metal shell of the connector.
20. Termination Labeling
  - a. Each wire shall be labeled with an industry accepted wire marker
  - b. I/O wire number should reference wiring diagram and Software I/O list.
  - c. Felt tip pen labels are unacceptable
  - d. Power wiring should reference wiring diagram.
  - e. Communication cables should reference wiring diagram and node ID
21. The control architecture shall use distributed control over Ethernet. Each controller will share selected memory with all other controllers via broadcast messages over Ethernet.
22. All Ethernet communication shall be configured using producer/consumer exchanges without requiring PLC logic to drive the communications.
23. All Remote I/O shall be connected over Ethernet.
24. Remote I/O shall use the exact same module types and same I/O module part numbers as the PLC's.
25. PLC racks and Remote I/O drops shall be expandable up to 64 modules per Ethernet drop using local expansion cables.
26. All I/O modules shall support hot removal and insertion.
27. Output modules shall be available with Electronic Short Circuit Protection. The diagnostic status of the Electronics Short Circuit Protection (ESCP), for those discrete output modules containing ESCP, shall be indicated by a green LED during normal operation per point and amber during a fault. The fault should be auto-corrective without the need to cycle power.

### B. Specifications

1. PLC Central Processor Units
  - a. Maximum 2048 inputs and 2048 outputs I/O capacity
  - b. Maximum 64K word instruction memory
  - c. RS-232 ASCII configurable auxiliary com port
  - d. Bit instruction execution time of 0.80µs max

## Specifications

- e. Built in real time clock and calendar
  - f. Built in 10BaseT 10Mb/sec Ethernet port
  - g. Battery backed EEPROM memory
  - h. Connectivity via Ethernet, Devicenet, Sysnet, Systlink, Mod Bus RTU master/slave over RS-485 and RS-232-C.
  - i. Shock rating, operating – 30.0g (3 pulses, 11 ms)
  - j. Vibration rating – 1.0g @ 5-2000 Hz
  - k. Operating Temperature range – 32 to 140 Degrees F
  - l. Operating Humidity range 5 – 95% RH non-condensing
2. PLC Digital DC Input Modules
    - a. 10 – 30 VDC operating range
    - b. Sourcing or Sinking type modules
    - c. Maximum on/off signal 0.5mS max with selectable 1 or 7mS filter
    - d. Maximum off state current 0.5mA
    - e. 32 point modules minimum
    - f. Maximum backplane current load – 50mA
  3. PLC Digital DC Output Modules
    - a. 10.2 - 30 VDC operating range
    - b. Sourcing or Sinking type modules
    - c. Maximum continuous current per output, .5 amp sourcing/1.0 amp sinking
    - d. Maximum continuous current per module, 8 amp sinking or sourcing @ 60 degrees C
    - e. 32 point modules minimum
    - f. Maximum backplane current load – 90mA @ 5 VDC
    - g. Removable terminal blocks
    - h. Gold plated contacts
  4. PLC Power Supplies
    - a. 120/220 VAC nominal input voltage
    - b. Maximum input power, 27 VA
    - c. Backplane output current, 1.5 amps total
    - d. Operating Temperature range – 0 to 60° C
    - e. Operating Humidity range 5 – 95% RH non-condensing

### C. Acceptable Manufacturers

1. Omron CS-1D Series
2. Allen Bradley
3. Mondicon Momentum Series

## 2.6 LINEAR POWER SUPPLY

### A. Specifications

1. AC Input: 120 VAC, +10%, -13%



## Specifications

2. DC Output: 24 VDC @ 12 amps
3. Line Regulation: +/- .05% for a 10% change
4. Load Regulation: +/- .05% for a 50% load change
5. Output Ripple: 3 mV peak-to-peak maximum.
6. Transient Response: 50 microseconds for 50% load change.
7. Short Circuit Protection: Automatic current limit/fold back
8. Stability: +/- .05% for 24 hours after warm up.
9. Efficiency: 55%
10. Provide back plates, mounting hardware and all appurtenances required to install the power supplies in the system equipment racks.
11. An individual homerun cable is required between each field device powered by the power supply.
12. The output of the power supply is to feed a series of fuses rated for the intended load one each per homerun cable/device load.

### B. Acceptable Manufacturer

1. SL Power F2412A+
2. Sola SMP B6
3. Power One F24-12A

## 2.7 GENERAL PURPOSE RELAYS (LOW CURRENT LOAD < 6 AMPS)

### A. Specifications

1. Switching Capacity: 6 Amp
2. Termination: Blade
3. Operating Indicator Light: Coil Rated Current: < 70 ma
4. Operating Voltage 24 VDC
5. Max. Cont. Applied Volt: 110%
6. Drop-out Voltage: 10%
7. DIN Rail Mountable Socket
8. Contacts Material Gold Plated Silver

### B. Acceptable Manufacturer

1. Idec RH1B
2. Potter and Brumfield R\_10
3. Finder 44 Series

## 2.8 GENERAL PURPOSE HIGH POWER CONTROL RELAYS (HIGH CURRENT LOADS < 10 AMP)

### A. Specifications

1. The control relays shall do the actual switching of the power to high current devices - locks, receptacles, etc.
2. Relays contacts shall be U.L. listed for a continuous current of 10 amps (inrush of 16 amps)

## Specifications

3. Each relay contact to the control device shall be individually fused externally with an indicating fuse holder.
4. Termination: Screw compression
5. Operating Indicator Light
6. Coil Rated Current: < 70 ma
7. Operating Voltage 24 VDC
8. Max. Cont. Applied Volt: 110%
9. Drop-out Voltage: 10%
10. DIN Rail Mountable Socket
11. Relays shall be pluggable with diode protection across coils and LED indication of activated coil circuit.
12. Low voltage wiring in relay cabinet shall be separated from high voltage wiring and all wiring shall be color-coded and marked with approved wire markers.
13. Control wiring shall be routed through plastic wire duct and landed on terminal strips.
14. Relays shall be controlled directly by the PLC.
15. Peripheral interface cards with active circuitry shall not be approved.
16. Relays shall have integral manual activation switch to override PLC for circuit testing and troubleshooting.
17. 24 VDC coil 1.2 watts or less
18. SPST or DPDT as required.

### B. Acceptable Manufacturer

1. Idec RH1B
2. Potter and Brumfield KUP
3. Finder 55 Series
4. FUSED TERMINAL BLOCKS

### C. Specifications

1. Din Rail mountable IEC style
2. dead front safety (ie. touch safe)
3. Screw clamp and Spring Clamp are acceptable
4. All Fuse terminal blocks shall be sized according to the wire gauge and currents load required for the application.
5. All Fuse Holders shall have a blown fuse indicator
  - a. DC circuits shall have LED
  - b. AC circuits shall have Neon or Trip lever
6. Provide lever disconnect type IEC fuse blocks.

### D. Acceptable Manufacturer

1. Allen Bradley 1492-H5
2. Phoenix Contact UK-5 HESI
3. Square D AB1SF520



## Specifications

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### 2.9 MODULAR TERMINAL BLOCKS

#### A. Specifications

1. Din Rail mountable IEC style
2. dead front safety (ie. touch safe)
3. Screw clamp and Spring Clamp are acceptable
4. All terminal blocks shall be sized according to the wire gauge and currents load required for the application.
5. Safety grounds should be identified with yellow/green color.
6. One wire per termination point unless Ferrules are used for Special Applications
7. All Ferrules are to be Crimped using the manufacturer's recommended Crimping tool.

#### B. Acceptable Manufacturer

1. Allen Bradley 1492-J4
2. Phoenix Contact UT-4
3. Square D AB1VV

2.10 Guard Tour Push Button with LED. Similar to Harding MicroComm CSE-210 with LED.

2.11 Panic buttons.

- A. Wall mount.
- B. Millwork/Furniture mount

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. All initial system programming shall be done at the SEC's facility prior to installation on site.
- B. The System shall be installed by qualified personnel in strict compliance with manufacturer's instructions.
- C. Upon completion of system programming enable the write protect function of the PLC CPU
- D. Prevent unauthorized communications with the PLC CPUs by restricting the PLC to respond only to specific IP addresses. IE: "OMRON IP to FINS table set up."
- E. Wiring shall be color coded, uniform and in accordance with national electric codes and manufacturer's instructions.
- F. Equipment shall be firmly secured, plumb and level.



## Specifications

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- G. All cable runs to the main equipment rack shall be tagged and identified.
- H. Coordinate all work with Design Builder - other Trades Contractors.
- I. Grounding of electronics control cables, and peripheral equipment shall be installed per section 280526 and manufacturer's direction to eliminate noise induction and achieve optimum system performance.
- J. Install and configure Security local area network as required for control and communication between system devices. When required, provide necessary coordination, termination, and programming associated with integrating Security local area network with facility network.
- K. Equipment cabinets shall be assembled in the SECs shop prior to delivery to the job site.
- L. All cabling shall be continuous between field device and equipment cabinet. Terminations shall be to terminal boards with punch down blocks, or on screw terminals. Twisted and taped splices are unacceptable.

### 3.2 SOFTWARE SUPPORT

- A. Refer to Section 284620 – Software for Electronic Security for software support and programming requirements.

### 3.3 SYSTEM INITIALIZING AND PROGRAMMING

- A. All programming shall occur in the SEC's shop prior to installation on site.
- B. The System shall be turned on and adjustment made to meet requirements of the specification and on-site conditions.
- C. The System shall be programmed to function as specified.
- D. Any special programming shall be documented and a written copy given to the Owner.
- E. Coordinate integration of other electronic systems as called for in the contract documents.

### 3.4 SYSTEM TEST PROCEDURES

- A. The system shall be completely tested to assure that all components are hooked up and in working order.
- B. The System shall be pre-tested by the SEC and certified, in writing, to function in accordance with the plans and specification.
- C. The SEC is to verify the system is communicating with all controlled devices.



## Specifications

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- D. Testing to be performed in the SEC's shop prior to delivery-
  - 1. Test 120VAC power equipment and hardware internal to all equipment racks. Test all conductors for shorts, opens, and polarity.
  - 2. Fully charge all UPS systems. Test unit by removing power thereby causing the unit to switch to battery reserve.
  - 3. Utilizing a test jig, simulate the operation of every circuit required.
- E. Testing to be performed at the job site prior to delivery of the system
  - 1. Verify all field wiring is free of shorts and opens prior to termination of head end electronics.
  - 2. Test all 120VAC power sources for correct polarity and voltage. Test grounding system for continuity. Notify Design Builder – and Electrical trade contractor of any problems.
- F. Additional job site testing
  - 1. After installation of head end electronics, verify proper operation of all field devices including locks, door position switches, card readers, push buttons, and intercom stations.
  - 2. Verify proper integration between control system and
    - a. Door control system
    - b. Video surveillance system
    - c. Intercom/Paging system
    - d. Overhead door controls
    - e. Vehicular gates
- G. The System shall be completely tested to assure that all components are hooked up and in working order. Inspect system for defects. Correct all causes of such defects. If the cause is outside of the scope of the Division 28 series scope of work, promptly notify the Design Builder – and the Architect Engineer in writing, indicating the cause of the defect and suggested corrective procedures.
- H. Provide written documentation showing all test results.
- I. The System shall be final tested in the presence of the Architect Engineer. SEC is to provide all required testing equipment.

### 3.5 FIELD QUALITY CONTROL

- A. Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.



## Specifications

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- C. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at SEC's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

### 3.6 TRAINING

- A. Provide the facility personnel with training in the use and maintenance of the entire control system. Coordinate the training sessions with the Owner. Completed classroom sessions shall be documented by the SEC, certified by the attending Owner representatives, and approved by the Architect Engineer. Instruction shall take place during normal working hours (Monday through Friday, 8:00 a.m. to 5:00 p.m.). Instruction shall not begin until all systems are operational as designed.
- B. The training sessions shall cover the operation and the maintenance manuals and the control console operators manuals and service manuals in detail, stressing all important operational and service diagnostic information necessary for the maintenance and operations personnel to efficiently use and maintain the control system.
- C. SEC is responsible for providing operational and maintenance training applicable to the entire control system. Training is to include, but not be limited to the following-
  - 1. Review all O+M manuals with Owner representatives present for training.
  - 2. Perform a tour of the entire facility. During the tour the trainer shall point out all control equipment and provide a brief description of its purpose and use. This is to include but not be limited to control panels (graphic and pushbutton), all control system hardware, and devices controlled.

END OF SECTION 28 46 19



## **28 46 20 - PLC SOFTWARE FOR ELECTRONIC SECURITY**

### **PART 1 -GENERAL**

#### **1.1 SYSTEM DESCRIPTION**

- A. Furnish all software and programming labor necessary to complete the installation of specific systems described herein and integration of all systems as indicated, specified herein or both. The work includes the following, as well as work not listed below but described elsewhere:
1. Programming of Security Systems Management Computer (SSMC). Include programming that implements system transaction logging, access control functions, and database retrieval functions.
  2. Programming of Graphical User Interface Consoles (GUI). Include programming that implements Touch-screen control and monitoring functions defined in project documents.
  3. Programming that implements video surveillance system and integration with the GUI.
  4. Programming of Intercom systems. Include programming that implements Intercom internal functions and integration with the GUI.
  5. Computers shall be programmed such that any computer can be placed at any Touch Screen Location and reboot to that specific operator application without reprogramming.

#### **1.2 GUI SOFTWARE/GRAPHICS**

- A. Basis of design
1. These specifications are written using the Omron IWS or Omron Indusoft product. Any product by another manufacturer must include the same features and functions to those listed below. The Omron products referenced are for basis of design purposes only.
- B. Specifications
1. Include the most recent PLC protocols from the PLC manufacturer and allows direct communication with ALL current, future and legacy OMRON networks (SYSNET, SYSLINK, ControllerLink, Ethernet and EthernetIP)
  2. Provide software that is all-inclusive for communications, graphics, alarming, databasing, etc. No need for "add-on" software modules to provide these features.
  3. Provide software that allows global changes to system icons
  4. Provide software that allows changes to workstations/runtime licenses "on the fly"; software that requires a workstation to be shut down to make a change shall not be considered.
  5. Software that includes third party I/O drivers shall not be considered.
  6. Systems that utilize polling to determine the status of I/O points shall not be considered.
  7. Provide displays utilizing accurately depicted, properly aligned floor plans. Floor plans must be displayed as seen from the GUI console operator's perspective (i.e.; rooms and doors in front of the operator at the top of the display, rooms and doors behind the operator at the bottom of the display). GUI consoles facing different directions must display accordingly different floor plans.

**Specifications**

8. Provide displays that optimize the use of screen resolution and color to enhance and simplify the information displayed. Provide a textured, dull, light gray background for all displays. Provide displays that minimize the unnecessary use of highly saturated colors. Provide displays that utilize contrasting colors. Utilize color to clarify annunciation, highlight choices and indicate correct operator input. Saturated colors shall be used to annunciate conditions of devices other than their normal or secure state. Use red for alarm conditions, yellow for cautionary conditions and information such as the depiction of interlock groups, use green for intercom and blue for video surveillance devices.
9. Provide properly sized control icons that are a minimum 1/2" square. Control icons must be large enough to facilitate proper and easy operation. Where screens are congested and placement of icons becomes difficult, divide the screens and increase the scale of the background so that the icons can be properly placed.
10. Provide control icons and annunciation icons that provide an intuitive depiction of their purpose. Control icons and annunciation icons shall utilize color to indicate abnormal or "on" conditions only. Control icons and annunciation icons associated with devices that are in a normal or off state shall utilize muted, desaturated colors.
11. Provide programming that uses a cursor to depict the control icon that has the current focus. Provide programming that allows the user to place a cursor on the screen and "drag" the cursor over the desired control icon, activating the associated function when the cursor is released ("activation on liftoff"). As the cursor moves over a control icon, the icon should "highlight" to indicate that if the cursor is released the icon shall activate. Annunciation only icons should not function in this fashion. Using the touch capability of the system, the operator shall be able to "drag" the cursor across the screen to the desired icon with the same effect as moving the mouse to control the cursor.
12. Provide a mouse for each GUI. Moving the cursor with the mouse shall provide the same highlighting function as described above. Touching or left clicking the mouse shall activate the highlighted device..
13. Provide programming that ensures that any screen can be displayed in a maximum of two (2) touches. Provide "pan" function icons to display adjacent areas. Provide "zoom" function icons to display enlarged views of areas.
14. Screen display redraw/update/remote device response time thru-put shall be held to 0.5 seconds maximum. Activating a control icon shall cause the associated field device to operate within 0.5 seconds maximum. A field device that changes state must cause an annunciation icon to change state within 0.5 seconds maximum.
15. Provide the number of graphic "screens" that supports the sequences of operation verified with the Owner and Architect Engineer during the software development process described in Part - 3.1, Software Support. Any screen that the user or architect determines is too densely packed or too "busy" shall be subdivided at no expense to the Owner.
16. Locate global control function icons in a "tool bar" configuration. Users shall have the ability to locate the tool bar on the top, bottom, right or left of the screen.
17. Tool bar functions may be divided into global functions and miscellaneous functions at the integrators discretion. Display of global and miscellaneous tool bars may be configured independently.
18. Place icons for "high traffic" functions on multiple screens as verified with the Owner and Architect Engineer during the software development process described in Part - 3.1, Software Support. Any icon that the user or security consultant determines is necessary on more than one screen shall be provided on more than one screen at no cost to the Owner.



**Specifications**

19. Provide software that annunciates alarms until they are acknowledged, independent of screen displayed. Provide prioritization of alarms as verified with the Owner and Architect Engineer during the software development process described in Part - 3.1, Software Support.
20. Provide a method for unanswered alarms to move to a designated GUI as verified with the Owner and Architect Engineer during the software development process described in Part - 3.1, Software Support.
21. Graphical User Interface operators consoles are intended to operate in concert with each other, i.e.; Silencing an alarm on one screen causes the alarm to be silenced on all other screens displaying the same alarm. Multiple operations on multiple screens to silence the same alarm are not acceptable.
22. Hierarchy of Control - During the software development process described in Part - 3.1, designated GUI takeover scenarios shall be confirmed and provided by the integrator under Base Bid.
23. During the software development process described in Part - 3.1, interlock groups shall be confirmed and provided by the SEC under Base Bid.
24. Provide a "Supervisors Utility Screen", protected by a pin code to allow updating of modifiable system parameters as verified with the Owner and Architect Engineer during the software development process described in Part - 3.1, Software Support.
25. Provide for instant connection of the intercom system master station to the calling station selected from the GUI.
26. Provide instant display or manual selection of the screen showing the alarm location or the calling intercom location graphically as verified with the Owner and Architect Engineer during the software development process described in Part - 3.1, Software Support.
27. In addition to manual camera call up by touching a camera icon, provide for automatic video surveillance camera call-up to a designated monitor from the GUI. Provide automatic call-up of the nearest video surveillance camera upon intercom connection ("Video follow Audio") or alarm "seek" display (Video follow Alarm") as verified with the Owner and Architect Engineer.
28. Provide automatic GUI calibration during System "boot-up" without operator input and manual calibration accessible from the Supervisors Utility Screen.
29. Provide user selectable audible feedback on all icon commands. This audible feedback shall be selectable between male voice, female voice, or a tone. This shall be selected from the miscellaneous function icons as described above. Menu of tones shall be reviewed and tones shall be selected by the Owner during the phase I software development process described in Part 3.1, Software Support.
30. Provide unauthorized entry alarm for monitored or controlled door going unsecured with no corresponding unlock command from system; on GUI, provide visual and unique audible annunciation and location information on message text line.
31. Provide 2 step operations for activations of devices that reduce the security or safety of the facility. These operations include, but are not limited to unlocking doors, holding doors open, group release, isolating doors or intercoms, etc.
32. Provide 3 step operations for critical changes to secure status such as interlock overrides, emergency release, etc.
33. Provide single step operations for operations that increase or have no impact on secure status such as locking doors, camera call up, intercom select, etc.
34. Provide architectural labeling of rooms and spaces, Owner defined labeling of rooms and spaces, and the ability for the operator to switch between the two labeling schemes.
35. Provide the ability to do hard copy and archival logging of all system events and transactions.
36. Provide programming that disables all methods of switching from the security control application to the operating system except with appropriate supervisory level password.

## Specifications

37. The development tools used for the graphical interface shall be that of a nationally recognized industrial applications software development package with a national support network.
38. Implement programming that initiates "video follow" functions for intercom devices and alarms. All intercoms and alarms within the field of view of a camera shall be automatically routed to the appropriate monitors when the alarm or intercom becomes active.

### 1.3 Software design and implementation

1. All monitoring and login logic shall be programmed within the Cimplicity, Omron Indusoft or Wonderware application. The security management system software and the Input/Output Data Access Servers shall be Cimplicity, Omron Indusoft or Wonderware brand; no other approach shall be considered.
2. The finished software product shall be examined by the manufacturer and the Architect Engineer for compliance with this specification. Should the examination reveal that proprietary code was created; the integrator shall remove such code and replace it at no additional cost to the owner. The process shall be repeated until the Owner and Architect Engineer are satisfied that the system as developed contains no proprietary content that would prevent the system being maintained by another service provider.
3. The system integrator shall turn over all programming passwords, source code and programming schedules at the end of the project. Prior to final payment all software shall be authenticated as being non-proprietary by the Owner or the Owner's designated representative as described above.
4. All PLC I/O addresses from the Cimplicity, Indusoft or Wonderware environment shall have continuous communication with the PLC. No Cimplicity, Indusoft or Wonderware programming tag PLC addresses shall be changed during runtime.

### 1.4 GUI CONTROL STATION ICON (SWITCH) FUNCTION AND DESCRIPTION

#### A. Specifications

1. GUI Switch Functions
  - a. Door Control Icons
  - b. Utility Control Icons (Lighting, Power, Water, Phone)
  - c. Log In/Out, Satellite GUI Takeover and GUI Disable Icons
  - d. Intercom Control and Call Disable Icons
  - e. Key Plan Zoom Window
  - f. Alarm Silence and Reset Icons
  - g. Monitor Selection/Camera call-up Icons
  - h. Other functions as defined during the software development process described in Part - 3.1, Software Support.
2. Provide animation of actual control and annunciation icon as verified with the Owner and Architect Engineer during the software development process described in Part - 3.1, Software Support.

**Specifications**

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3. Throughout the software design process linking of “follow” functions shall be accommodated as part of the basic scope of services. Follow functions shall be defined as camera calls to specified monitors based on intercom, alarm or door control functions; or, intercom talk paths automatically being established based on alarm functions. Automated “follow” functions shall be limited to camera and intercom functions. No automated door release functions shall be allowed.
4. Door Control Icons
  - a. Door Unlock
    - 1) Touch or left click the Unlock global function icon.
    - 2) Touch or left click the associated door icon.
    - 3) The security system momentarily applies power to the lock or electrically operated door to start the lock or door through its unlock or open cycle.
    - 4) The unlock function remains enabled for 3 seconds after each door icon is touched. If the timer lapses and no icon is selected, the unlock global must be selected again to reactivate the function.
  - b. Group Unlock
    - 1) Touch or left click the Unlock global function icon.
    - 2) Touch or left click the associated door group icon.
    - 3) The security system momentarily applies power to the locks or electrically operated doors in the group one at a time to start them through their unlock or open cycles.
    - 4) During a group unlock, an isolated door shall not be powered.
    - 5) The unlock function remains enabled for 3 seconds after each door icon is touched. If the timer lapse and no icon is selected, the unlock global must be selected again to reactivate the function.
  - c. Door Hold Open
    - 1) Touch or left click the Hold Open global function icon.
    - 2) Touch or left click the associated door icon.
    - 3) The security system applies power to the lock or electrically operated door to maintain the lock or electrically operated door in the unlock or open position.
    - 4) The held open function remains enabled for 3 seconds after each door icon is touched. If the timer lapses and no icon is selected, the hold open global function must be selected again to reactivate the function.
    - 5)
  - d. Door Lock
    - 1) Touch or left click the associated door icon.
    - 2) If necessary, the security system momentarily applies power to or removes power from the lock or electrically operated door to start the lock or door through its lock or close cycle.

**Specifications**

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- e. Door Stop
  - 1) Touch or left click the Stop global function icon.
  - 2) The security system shall stop all powered moving doors being controlled by the initiating GUI.
- f. Isolate
  - 1) Touch or left click the Isolate global function icon.
  - 2) Touch or left click the associated device icon. (doors or intercoms)
  - 3) The security system isolates the device from normal operation.
  - 4) The isolate function toggles each time a device is selected. The isolate global function remains active for 3 seconds after the last device selected.
  - 5) Provide group "synchronization." Selecting the isolate global function and a group button the first time shall un-isolate any door in the group that is currently isolated. Selecting the group button the second time, shall isolate all doors in the group.
- g. Emergency Door Release
  - 1) Touch or left click the EMERGENCY DOOR RELEASE miscellaneous function icon.
  - 2) When the EMERGENCY DOOR RELEASE icon is selected, a red pop up message box shall be displayed with a written warning and the audible annunciation shall warn the operator of the danger associated with an Emergency Door Release. The audible warning must reiterate the displayed text and must play in its entirety before the first level confirmation icon is displayed.
  - 3) A second, red EMERGENCY DOOR RELEASE warning box shall then appear on the current screen with a written warning.
  - 4) The function can be canceled at any time by selecting the CANCEL button.
  - 5) After the second confirmation is selected, the background around the EMERGENCY DOOR RELEASE icon shall flash and the audible annunciation shall continuously announce "EMERGENCY DOOR RELEASE".
  - 6) All emergency release doors shall be unlocked. Those doors that are unlocked under the emergency door release, shall display as if opened via the control system. These doors are equipped with half cycle locks. See detention hardware section for lock function description to be incorporated into the controls system.
  - 7) Other control stations also monitoring or controlling the same doors as the panel initiating the release shall have an EMERGENCY DOOR RELEASE ACTIVE indication located on their screen and will alarm and flash as described previously.
  - 8) Emergency Relock. Provide EMERGENCY DOOR RELEASE RELOCK miscellaneous function icon. This icon releases the affected door to relock.

## Specifications

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- h. Interlock Override Icon
  - 1) Touch or left click the Interlock Override miscellaneous function icon.
  - 2) A yellow pop up message box shall be displayed with a written warning and the audible annunciation shall warn the operator of the danger associated with interlock override. The audible annunciation warning must reiterate the displayed text and must be capable of playing in its entirety before the second level confirmation icon is displayed. Delay must be adjustable and confirmed during phase I and II.
  - 3) A second yellow interlock override warning box shall then appear with a written warning. The audible feedback warning must reiterate the displayed text and must be capable of playing in its entirety before the first level confirmation icon is displayed. Delay must be adjustable and confirmed during phase I and II.
  - 4) Only after the second confirmation is made shall the interlock indications be removed from the screen.
  - 5) Once any door icon is selected, the interlock override function shall cancel. If no door icons are selected within 10 seconds of the second confirmation, the interlock override function shall cancel. Also, the function can be canceled at any time by selecting the "CANCEL" icon.
  - 6) Attempting to unlock a door that is interlocked shall cause the voice annunciation system to state, "Function not allowed. Door is interlocked."
- 5. Utility Control: Lighting, Power Receptacles, and Water.
  - a. Utility control icons are to be located on the utility control screen. The utility control screen shall segregate the utility icons from security icons such as door locks, intercom and video surveillance. Selection of the utility screen shall be via the global function tool bar.
  - b. Touch or left click the global utility icon, the normal icons are hidden and the utility icons are displayed.
  - c. Touch or left click the associated control icon.
  - d. The security system removes power from the coil of the low voltage relay associated with the device to be controlled, and the utility comes on.
  - e. Touch or left click the icon a second time.
  - f. The security system applies power to the coil of the low voltage relay and maintains power until the icon is clicked again. When the relay is engaged the utility is off.
  - g. Provide group control of cell lights.
  - h. Provide group "synchronization." Selecting the group button the first time shall turn any utility in the group that is currently on to its off state. Selecting the group button the second time, shall turn all utilities in the group on.
  - i. Utility control shall be configured such that failure of the PLC/GUI control systems renders the utility "on".
  - j. An icon shall be provided in central control for manual activation of the smoke evacuation system. The manual activation shall be used to provide a means of evacuating tear gas in the event it is used on a unit. The icon shall function as described above and shall activate the sequence of operation just as if it were started by the fire alarm system.
  - k. TV Receptacle.

**Specifications**

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## 6. Log In, Satellite GUI Takeover and GUI Disable

## a. Log In/Out

- 1) Touch or left click the Log in/out icon.
- 2) Login validation shall be integrated with the SSMC's database to allow the tracking of the operators name for all functions at each GUI until it is logged off.
- 3) The GUI displays a "scrambled" numeric keypad for the operator to enter a PIN code.
- 4) If the PIN code is valid the operator is logged in as the current operator of the station.
- 5) An operator remains the current operator until a new operator is logged in or until the GUI is taken over or disabled (see below).

## b. Satellite GUI Takeover

- 1) Touch or left click the Satellite GUI Takeover icon.
- 2) The security system disables all control and monitoring functions at the Satellite GUI, blocks all attempts to log in at the Satellite GUI and transfers control and monitoring responsibility to the initiating GUI. Icon shows "Off Line".
- 3) Touch or left click the icon a second time.
- 4) The security system allows attempts to log into the Satellite GUI, but retains control and monitoring until an operator logs into the Satellite GUI.
- 5) When an operator is logged in to the Satellite GUI the control system returns all previous control and annunciation to the Satellite GUI. Central Control shall still have the ability to view the locally controlled screens. Central Control's icons in these locally controlled areas shall appear to be "sunken" into the screen with a passive or muted video color. The status of the DPS and LSS shall be dynamically displayed. The intent is to allow Central Control to be aware of door movement throughout the building, while leaving control of devices with the Satellite GUIs.
- 6) Failure of the workstation or software at the satellite locations shall cause control to be transferred to the designated takeover station. A pop up window annunciating the failure and transfer shall be provided to alert the operator of the takeover station as to the transfer.

## c. GUI Disable

- 1) Touch or left click the Disable icon.
- 2) The security system immediately logs out the current station operator and transfers responsibility for control and annunciation to central control. Satellite GUI shall still have the ability to view the locally controlled screens. The icons in these locally controlled areas shall appear to be "sunken" into the screen with a passive or reverse video color. The status of the DSS and LSS shall be dynamically displayed. The intent is to allow the Satellite GUI to be aware of door movement in their areas, while control is transferred to the designated control point.
- 3) Attempts to log into the station are not allowed until central control enables the satellite station.

## Specifications

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### 7. Intercom Control

#### a. Intercom Control

- 1) Call-in from field device causes associated Intercom Station icon to flash and tone/VAS to sound.
- 2) Selecting the Intercom Station icon connects the Master Intercom to the associated intercom station in listening mode, turns the icon solid color and silences the call in tone/VAS.
- 3) Selecting the same icon a second time disconnects the call, and turns off the solid icon color.
- 4) Selecting a second intercom icon while connected to another station causes the connected station to disconnect and connects the selected station.
- 5) When a call is designated to route to more than one master, the establishing of a talk path by the first to answer the call, cancels the call at the other stations.
- 6) Implement video follow audio for adjacent cameras. When an intercom talk path is established, the associated camera (if any) shall be displayed on the Intercom Monitor, and the associated camera icon shall indicate it has been activated.
- 7) The intercom system incoming shall be routed through the GUI Audio System.

#### b. Communications Window

- 1) A portion of each screens tool bar, without obstruction to the floor plan, shall be allocated for intercom que. This window shall contain a "Pending List" of the next (7) pending calls.
- 2) Call Control Icons and Indicators include:
  - a) ACTIVE STATION containing the text name of the active intercom call
  - b) Master to Master call (Caller ID)
  - c) Master call waiting/busy
  - d) CALL ANSWER button
  - e) CALL ANSWER AND ZOOM button,
  - f) ZOOM ACTIVE button
  - g) CALL DISCONNECT button
- 3) This window shall allow the operator to answer calls without having to go to a particular screen (answer) unless it is desired to do so. (answer and zoom)

#### c. Pending List

- 1) The list of incoming pending calls designated for the particular GUI shall show the Owner-assigned text names for the oldest seven pending calls that have not been answered and in the order that they were initiated.
- 2) As a call is answered it shall be removed from the list and the list shall be automatically updated with any new incoming calls.
- 3) If a call-in is isolated, it should not be displayed in the Pending List.
- 4) If a master to master call is placed, and the receiving master is busy, the calling master receives a busy prompt and is held in queue until call is accepted by the master being called.

**Specifications**

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- d. Call Answer Button
  - 1) Touch or left click the Call Answer Button
  - 2) Each time this button is selected, the active station shall automatically cancel and the first station on the pending list shall automatically connect.
  - 3) If there are no pending calls, this button shall be muted on the tool bar.
- e. Call Answer and Zoom Button
  - 1) Touch or left click the Call Answer and Zoom Button
  - 2) Each time this button is selected, the active station shall automatically connect to the first station in the call queue.
  - 3) The GUI shall automatically go to the screen where the answered intercom station is located.
  - 4) If there are no pending calls, this button shall be muted on the tool bar.
- f. Zoom Active Button
  - 1) Touch or left click the Zoom Active Button.
  - 2) When this button is selected, the GUI shall automatically go to the screen where the connected intercom station is located.
  - 3) If there is no active call, this button shall be muted on the tool bar.
- g. Call Disconnect Button
  - 1) Touch or left click the Call Disconnect Button
  - 2) When this button is selected, the active intercom call is disconnected.
  - 3) If no station is connected, this button shall be muted on the tool bar.
- h. Call Isolate
  - 1) Selecting the isolate button from the global function tool bar and then selecting an intercom station icon shall place the intercom station in isolate mode.
  - 2) In the isolate mode, calls placed from the station shall annunciate visually only and not via the tone/VAS.
  - 3) When placed in the isolate mode, the icon shall change state to reflect the mode.
  - 4) When placing an icon in the isolate mode, the operator shall be prompted to enter the reason the station was isolated using the occurrence log.
  - 5) All isolated icons shall reset to normal mode at a time selected by the Owner; the duration of an isolation shall not exceed 24 hours.
- i. Paging. Provide icons associated with the paging zones.



## Specifications

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### 8. Key Plan and Zoom Window

#### a. Zoom Window

- 1) A portion of the tool bar on each screen, without obstruction to the floor plan, shall be allocated for the key plan. This window shall contain a whole site plan and be located on every screen.
- 2) All screens shall be accessible with no more than two touches of the site plan.
- 3) Any screen can be accessed from any other screen with no more than two touches. A screens outlined area on the site plan shall highlight when the curser is placed over the associated section of the key plan.
- 4) Each control screen shall be geographically outlined on the Zoom Window. The highlighted outline shall follow the shape and pattern of the zoom screen area.
- 5) The Zoom Window shall contain -
  - a) Zoom Area
  - b) Site Plan Location Indicator
  - c) Site Plan Pending Call Indicator
  - d) Site Plan Alarm Indicator

#### b. Zoom Area

- 1) Touch or left click outlined area of the site plan.
- 2) Activation shall cause the GUI to go directly to the screen that controls the selected area or a more detailed zoomed area.
- 3) A distinctive audible sound shall annunciate when this action is performed.

#### c. Site Plan Location Indicator

- 1) The area on the site plan that represents the current screen shall be highlighted in white to indicate exactly what screen is active in relation to the whole facility.
- 2) The other areas shall be gray unless pending calls or alarms are active as explained in the Site Plan Pending Call Indicator and the Site Plan Alarm Indicator.

#### d. Site Plan Pending Call Indicator

- 1) When calls are pending from areas other than the current screen, then the area of the call shall flash on the site plan.
- 2) If both an alarm and a pending call are active at the same time in an area, then the respective area shall flash alternating colors.

#### e. Site Plan Indicator

- 1) When alarms are active from areas other than the current screen, then the area of the alarm shall flash on the site plan.
- 2) If both an alarm and a pending call are active at the same time in an area, then the respective area shall flash alternating colors.

**Specifications**

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- f. Plan Navigation Arrows.
  - 1) Provide arrows on each map as an additional means to navigate through the facility.
- 9. Alarm Silence and Reset Icons
  - a. Alarm Silence
    - 1) When an audible alarm annunciation is sounding; touch or left click the Alarm Silence icon.
    - 2) The audio alarm stops.
    - 3) The audio alarm starts again if alarm conditions exist on other screens, or if new alarms are received on the same screen.
  - b. Alarm Reset
    - 1) Provide the Reset Icon to reset all alarmed icons to normal conditions if they are not of the self-resetting type.
    - 2) Touch or left click the Reset icon when the alarm conditions no longer exist.
    - 3) Reset function shall only operate on those alarms annunciated on the active screen. No global alarm reset icons shall be allowed.
- 10. Camera Selection
  - a. Camera Selection via icons
    - 1) In addition to automatic call up, Cameras can be selected via the GUI.
    - 2) Touch or left click the camera icon.
    - 3) Selecting the camera icon causes the icon to change color, and displays the CCTV image on the active monitor.
    - 4) Selecting the same icon a second time disconnects the camera and returns the active monitor to its default scene.
    - 5) Selecting a second camera icon while another camera is active causes the active camera to deactivate and activates the selected camera.
    - 6) Camera selection is to the default "call up" monitor at the touch screen work station. Provide a means of selecting cameras to the overhead monitors by changing from the default monitor to a selected monitor from the tool bar. Only monitors within direct view of a touch screen location shall be selectable from the tool bar.
- 11. Occurrence Log
  - a. Entry of New Occurrence Logs
    - 1) User can enter text via the attached keyboard.
    - 2) As characters are selected on the keyboard they should be displayed on the appropriate field.

## Specifications

- 3) Select the submit button to save the entered text into the SSM computer.
- 4) After submitted, status should indicate that the text has been sent and saved successfully, and the title and log fields should be cleared. If the text is not sent and saved successfully, the status should indicate "Log Entry Failed", and the title and log fields should not be cleared.
- 5) Select clear button to clear title and log fields.
- 6) Select view logbook button to view previous entries within the last 24 hours.
- 7) Occurrence log entry shall be as illustrated herein.
- 8) Title field shall be capable of 100 characters.

b. Viewing Previous Entries

- 1) Shall be capable of viewing 100 logged entries.
- 2) The retrieval time shall be less than 10 seconds.
- 3) Select the view log entry button to return to the new occurrence log entry screen.
- 4) All data is stored on the SSM computer.

### 1.5 GUI CONTROL STATION INDICATOR CONDITONS

- A. Door Status - Provide red and gray (or white) animated graphic indicators on the screen at each door to be monitored, to indicate the status of the door. Monitor the Door Position Switch (DPS) and the Latch Bolt Monitor (LBM) switch independently. Secure indication should only be displayed when both switches are in the secure condition. Differentiate between doors that are open, and doors that are closed but unlocked. Alarm is generated for unauthorized opening of doors; doors opened via unlock commands and doors left open too long. Timer for door open too long must be adjustable via supervisor's utility screen.
1. Flashing Red - alarm
  2. Red - unsecured
  3. Gray or white – secured
- B. Utility Status – Provide yellow and gray animated graphic indicators on the screen at each utility location to indicate the utility status.
1. Yellow – Utility On
  2. Gray - Utility Off
- C. Log In/Out, Satellite GUI Takeover, and GUI Disable – Provide a gray animated graphic indicator that contains the appropriate text.
- D. Intercom Control and Inmate Call Disable – Provide green, yellow, and gray animated graphic indicators on the screen at each intercom location, to indicate the intercom status.
1. Flashing Green – Intercom call-in
  2. Green – Intercom active
  3. Yellow "X" - Intercom call-in isolated
  4. Gray – Intercom inactive
  5. "Sunken" – Intercom station calls to another master.

## Specifications

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- E. Alarm Silence and Reset – Provide a gray animated graphic indicator that contains the appropriate text.
- F. Camera Selection - Provide a blue green red and gray animated graphic indicator on the screen at each camera location to indicate the camera status.
  - 1. Blue – Camera manually activated and CCTV image displayed on active monitor.
  - 2. Purple – Video follow audio activated and CCTV image displayed on intercom monitor.
  - 3. Red – Video follow alarm activated and CCTV image displayed on alarm monitor.
  - 4. Gray - Camera deactivated.
- G. Interlock Status - Provide yellow color indicators at each door in an interlock group.
  - 1. When a door in an interlocked group becomes un-secure, illuminate yellow indicators on all other doors in the interlock group.
  - 2. VAS shall annunciate that door cannot be unlocked if interlock condition exists (see below)
- H. Uninterruptible Power System Alarm and System Trouble Icon
  - 1. UPS Power System Alarm
    - a. Upon loss of primary AC power, the UPS icon shall appear and begin to flash red “Inverter On”, accompanied by a unique tone.
    - b. Activating the alarm silence Icon shall silence the tone and cause the Icon to glow steadily. Upon return of primary AC power, activating the alarm reset Icon shall extinguish the red indication and hide the icon.
  - 2. Similar function for Trouble indication. Flashing yellow “UPS Trouble” indication.
- I. Duress Alarm/Panic Alarm - Provide red animated graphic indicators on the screen at each duress/panic switch on alarm only. Inactive or “normal” condition of the duress alarms hides the icon in lieu of muting it. Implement video follow alarm for cameras adjacent to duress or panic buttons. Duress or panic alarms with video follow alarm function shall call the camera to the alarm monitor at the associated GUI Operators post.
  - 1. Flashing Red - alarmed
  - 2. Red – acknowledged
- J. Provide access to a system status screen with text display of the following:
  - 1. Name of operator logged on to each console
  - 2. List of all pending, silenced, and acknowledged alarms currently indicated through the entire system.



## Specifications

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### 1.6 VOICE ANNUNCIATION SYSTEM

- A. Provide a Voice Annunciation System (VAS) as an additional interface between personnel and the computer system. The VAS shall use speech from a stored vocabulary to provide alert and annunciation messages, special direction or information to facility staff in staff areas (intercom speakers) and control rooms. Verify message requirements and locations during Phase-1 software meeting.
  - 1. The VAS shall be entirely electronic, no tapes, and meet the following minimum requirements
  - 2. The VAS shall speak individual words, phrases and sentences in addition to tones.
  - 3. VAS shall provide output to audio amplifiers, speakers and intercom speakers that are also part of system.
  - 4. The VAS shall be selectable between male voice, female voice, and a tone. This shall be selected from the miscellaneous function icons as described above.

### 1.7 SECURITY SYSTEM MANAGEMENT COMPUTER (SSMC) OPERATIONAL REQUIREMENTS:

- A. Specifications
  - 1. The Security System Management Computer (SSMC) shall perform functions including, but not limited to, the following:
    - a. Programming of PLC.
    - b. PLC system remote diagnostic capabilities.
    - c. Recording all security control system transactions and events.
    - d. Recording of incident reports.
    - e. The SSMC shall generate reports of the recorded transactions and events within the system. All data shall be recorded into a database and the SSMC shall have the capability to generate reports through selection of any data field or timeline. The SSMC shall have advanced search capabilities for any combination of data and can search the incident logs independently.

## PART 2 PRODUCTS

### 2.1 NOT USED

## PART 3 EXECUTION

### 3.1 SOFTWARE SUPPORT

- A. Phase I
  - 1. Provide screen shots. The SEC shall request, in writing, scheduling of the Phase I meeting within one (1) week of receiving the approved shop drawing submittal. A proposed agenda shall be included with the request. The Phase I meeting shall be held within thirty (30) working days of receiving the approved shop drawing submittal.

**Specifications**

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2. The purpose of the Phase I meeting is to define the project specific functions and operational procedures of the control system with the Owner & Architect Engineer. The SEC shall present proposed operational procedures for every function specified in the Contract Documents or recognized as industry standard or convention for a correctional facility Control System. The SEC will present proposed operational schemes to the Owner & Architect Engineer, and modify those schemes based on the Owner's policies and procedures.
  3. The SEC shall address integration of the components and subsystems making up the control system when presenting the proposed operational procedures. The SEC shall provide an operating GUI at the Phase I meeting (of an operating facility or this facility) that demonstrates every control and annunciation function described in the specifications to help with Owner's design decisions. This demo shall not include any operational procedures that are not included in the Base Bid for this project. This operating GUI shall demonstrate all data capture and reporting features of the SSMC.
  4. The SEC shall prepare and present 4 sets of color screen drawings at this meeting. As a minimum, these screen drawings shall depict the following:
    - a. Overall building layout screen.
    - b. Area control screens. (These area screens should be drawn to represent actual orientation with control officer's view). Different orientation views should be created per each control post and the control officer's orientation view.
    - c. All special control and transition screens. (Utility, Administration, help, etc.)
    - d. Each sheet should be numbered for easy reference.
    - e. Actual size to show detail and all text legible.
  5. The SEC shall prepare a detailed report summarizing the operation of all icons. The report is to be submitted for approval by the Owner and Architect Engineer no later than two (2) weeks after the date of the Phase I meeting. The software systems that make up the control system shall be designed specifically from this document.
- B. Phase II
1. At least thirty (30) working days prior to the scheduled date for job site delivery of the first control system head end components, the SEC shall request a Second meeting with the User (maximum of 4 representatives) and the Architect Engineer (2 representatives) at the SEC's manufacturing facility. The SEC shall provide a full demonstration of the completed control system with fully functional control software. The SEC shall provide means to simulate all real world conditions necessary to demonstrate each function and operating procedure agreed to in the Phase 1 meeting. The design and function of the software shall match the exact performance as specified in the revised Phase I report. The SEC shall be responsible for the cost of travel expenses incurred by the Owner and Architect Engineer representatives for this trip. Travel expenses shall include airfare (if applicable), hotel accommodations, ground transportation, and meals.
  2. All performance deviations and necessary changes identified at this meeting shall be documented by the Architect Engineer on a "pre-punch list". The pre-punch list shall be 100% corrected by the SEC prior to delivering the equipment to the job site.
  3. During this time period the SEC shall perform all shop testing as defined in the approved testing plan.

**Specifications**

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**C. Phase III**

1. Immediately following the installation and testing of the control system, the SEC shall provide a formal demonstration of all systems to the Owner and Architect Engineer that includes all operational elements covered in the Phase II meeting. The SEC shall work with the Owner, facility personnel and the Architect Engineer to correct any problems or operational deviations from the original Phase I and Phase II design documents. Deficiencies will be identified during the Architect Engineer's punch list inspection, and documented to the SEC. The SEC shall perform all hardware and software modifications necessary to correct any problems or operational deviations resulting from engineering, programming or installation services provided by the SEC.
2. Upon achieving a 100% functional control system as determined by the Architect Engineer, a documented release form provided by the SEC shall be signed by the Owner, and retained on file with the Architect Engineer. The SEC shall continue to work on the installed system at no cost to the Owner until the Architect Engineer has determined the Phase I and Phase II documents have been met and the system has been 100% field tested as defined in the approved testing plan, regardless of substantial completion. The system warranty shall begin after the Architect Engineer has verified 100% compliance has been met.

**3.2 INSTRUCTION PERIOD**

- A. Provide the facility personnel with training in the use and maintenance of the entire control system. The first sessions to be prior to system turnover, the Second at turnover and the third immediately after turnover. Coordinate the training sessions with the Owner. Completed classroom sessions will be documented by the SEC, certified by the attending Owner representatives, and approved by the Architect Engineer. Instruction shall take place during normal working hours (Monday through Friday, 8:00 a.m. to 5:00 p.m.). Instruction shall not begin until all systems are operational as designed. See section 28 05 00 – Common Work Results For Electronic Security for additional information regarding training.
- B. The training sessions shall cover the operation and the maintenance manuals and the control console operators manuals and service manuals in detail, stressing all important operational and service diagnostic information necessary for the maintenance and operations personnel to efficiently use and maintain the control system.
- C. SEC is responsible for providing operational and maintenance training applicable to the entire control system. Training is to include, but not be limited to the following-
  1. Review all O+M manuals with Owner's representatives present for training.
  2. Perform a tour of the entire facility. During the tour the trainer shall point out all control equipment and provide a brief description of its purpose and use. This is to include but not be limited to touch screen control stations, all control system hardware, and devices controlled.

END OF SECTION 28 46 19







**Specifications**

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**28 51 23 - INTEGRATED INTERCOM/PAGING SYSTEM FOR ELECTRONIC SECURITY**

**PART 1 - GENERAL**

**1.1 SYSTEM DESCRIPTION**

- A. Furnish all materials and labor necessary to complete the installation of specific systems described herein and integration of all systems as indicated, specified herein or both. The work includes the following, as well as work not listed below but described elsewhere:
- B. Provide Intercom System that meets the following functional requirements
  - 1. The purpose of the intercom system shall be to provide clear, two-way, remote reply intercommunication between intercom master stations and remote intercom substations.
  - 2. System shall also accommodate zoned overhead paging to the areas identified throughout the facility with talk back capabilities provided. Source input is limited to the intercom push to talk master stations at the various control consoles.
  - 3. The extent, size, locations, and layout of the various systems shall be shown on the plans.
  - 4. The system is configured to allow for visual and audible notification to the operator of intercom call in and active intercom channels on the graphical user interface associated with each control console.
  - 5. Intercom substations shall be programmed to call a designated master based on the location of the station and the area of influence for each control console.
  - 6. System shall be capable of audio monitoring and of initiating an alarm when the voice being monitored at a certain location exceeds preset audio parameters.
  - 7. The intercom/paging system shall be a major sub-system of the overall integrated control system. Controlling the system, selecting stations, and integration with other sub-systems shall be accomplished through a communications interface (Ethernet) to the graphical user interface.
  - 8. Paging system shall be capable of routing to individual or groups of defined speaker zones. All call paging is also required.
  - 9. Manufacturer-approved personnel shall perform installation and maintenance.]
- C. System Configuration
  - 1. Microprocessor based, network centric controllers and expanders are required. Controllers and expanders shall support 2 master stations each and be capable of fully independent talk paths for each.
  - 2. Ethernet communications and a separate audio trunk shall provide the capability to network individual exchanges with each other creating an integrated system. Transfer of station call between exchanges shall be accommodated via the network.
  - 3. Standard 25-volt output amplifiers shall provide audio power to IC stations.
  - 4. Tamper resistant substations shall be flush mounted as shown on the drawings or specified.
  - 5. Intercom master stations are required for control locations. Connection of the master stations shall be via Ethernet.
  - 6. Controller software shall allow for individual level control, sensitivity, and equalization of each station.
  - 7. Intercom system shall interface with video surveillance system via Ethernet and vendor specific API programming



## Specifications

8. When intercom station talk path is established, the video surveillance system shall display image of the nearest camera on call up monitor associated with the console establishing the talk path.
9. The ability to suspend a stations capability to call in shall be provided via integration with the graphical user interface shall be provided. This ability is necessary to prevent inmates from harassing console operators with continuous calls.
10. Console master stations shall be capable of listening to intercom stations or talk back page zones without privacy tones announcing that a console is listening.
11. Pages shall originate from the various consoles and shall include talkback capabilities.

## PART 2 PRODUCTS

### 2.1 GENERAL

- A. Equipment specified is intended as a reference standard for level of quality.
- B. Substitutions of equal quality will be accepted. All substitutions are to be approved prior to bid and listed by addenda. Substitutions will not be accepted after the schedule bid time. Refer to Division 00 and Division 01.
- C. Provide materials listed by UL or ETL.
- D. Basis of Design
  1. Drawings and specifications included in these contract documents are based on the Harding Instruments DXL product.
  2. Equal by Telecor is acceptable
  3. Equal by Stentofon is acceptable
  4. All other manufacturer's products must be submitted for approval per 2.1.B above

### 2.2 DIGITAL COMMUNICATION CONTROLLERS (DCC's)

- A. Digital Communication Controllers to each form an intercom exchange capable of independent local operation. Exchange capacity to be increased by connecting up to four Digital Communication Expanders to each DCC.
- B. Multiple DCC's to be networked together via digital audio trunks and Ethernet data networks to form the larger system. VoIP enabled systems shall utilize IEEE 802.1p/Q Quality of Service (QoS) compliant Ethernet networking equipment.
- C. Each DCC to include:
  1. A Process Control Card (PCC).
  2. A Master Control Card (MCC).
  3. Two Station Control Cards (SCCs).
  4. An internal PCI card (Lonworks or VoIP accelerator card).



## Specifications

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5. A front panel keypad/display for system setup and maintenance.
6. A 110 VAC, 60 Hz power supply for internal functions.

D. Process Control Card:

1. Process Control Card to contain system configuration and data, control exchange operations and switching, and provide exchange network ports.
2. Process Control Card to include:
  - a. USB network ports for exchange expansion.
  - b. Ethernet network ports for system expansion and external control by touch screen computers and graphic control panels.
  - c. Fiber optic or copper digital audio trunk ports. (not required for VoIP over Ethernet audio trunking)
  - d. Two serial ports.
  - e. An internal modem for transmitting and receiving data over a telephone line.

E. Master Control Cards:

1. Include ports for any combination of two intercom or telephone set master stations.
2. Include two line level audio inputs with status and control.
3. Include two line level audio outputs with status and control.
4. Convert incoming audio signals to digital format and outgoing signals to analog format.
5. Intercom master station audio, press-to-talk and hook switch status transmitted over two single shielded pair cables with wiring supervision to detect open circuit and short circuit faults.
6. Telephone set master station functions transmitted over a single wiring pair.

F. Station Control Cards:

1. Each provide sixteen half-duplex intercom station ports which can be employed in adjacent pairs for full duplex devices.
2. Provide an interface for intercom stations. Units to convert incoming audio signals to digital format and outgoing signals to analog format. Each channel to monitor the status of up to two (2) switches associated with each intercom station.
3. Each card interfaces with 16 half-duplex channels. Each channel includes a separate audio power amplifier for non-blocking call operation and sixteen (16) independent software controlled volume settings.
4. All station audio, switch, and power functions on 400-Series and 401-Series cards to be transmitted over a single shielded pair cable with supervision to detect open circuit and short circuit faults.
5. Audio and switch functions on 300 Series (Generic Intercom) station control cards to be transmitted on separate wiring pairs.

### 2.3 DIGITAL COMMUNICATION EXPANDERS (DCE's)

- A. Digital Communication Expanders to provide master station and intercom features similar to the DCCs to facilitate exchange expansion.



## Specifications

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B. Each DCE to include:

1. A Process Control Card (PCC) without exchange control or network functions.
2. A Master Control Card (MCC)
3. two Station Control Cards (SCCs)
4. A 110 VAC, 60 Hz power supply for internal functions.

### 2.4 TALKBACK EXPANDERS (TBEs)

A. Talkback Expanders to provide 8 amplified paging outputs that can drive 25 Vrms loudspeaker circuits.

B. Each TBE is to;

1. Provide 5 watts output per channel
2. Allow adjacent channels to be bridged to obtain higher power.
3. Provide talkback capability on all channels.
4. Include audio level alarm capability on all channels.

### 2.5 PAGE ZONE EXPANDERS (PZEs)

A. Page Zone Expanders to provide 3 page inputs (from an audio amplifier) with each input having 6 selectable relay controlled outputs

B. Each PZE input to include

1. 1 relay controlled output for each input that can be used to key an audio amplifier.

### 2.6 ADMINISTRATOR SOFTWARE

A. Administrator Software to function on a standard PC to support system configuration, diagnostics, maintenance, and logging but not be required for system operation.

B. Administrator Software to employ Windows features including views of system tree structure, tables of devices, screens for system settings and adjustments, and tables of operational data.

C. Configuration features to include:

1. Creation of overall system architecture.
2. Creation of multiple device templates.
3. Copy and paste functions with auto-numbering and auto-assignment to create device schedules.
4. Configuration error detection and alerts.
5. Device naming and call routing functions.
6. Device setting and performance functions.

**Specifications**

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- D. Diagnostic and Maintenance features to include:
1. Verification of system configuration and installation.
  2. Verification of system networks.
  3. Verification of device connections.
  4. Verification of system operation.
  5. Diagnostics via modem or ethernet ports.

- E. Logging features to include:
1. Display of system activity with filtering options.
  2. Search by time and date.
  3. Search by device.
  4. Search by parameter.

## 2.7 NETWORK REPEATERS

- A. Network repeaters are to extend LonWorks network cable limits or increase node limits. Each unit is to include four network ports. Data received on any port to be re-transmitted on the other ports.
- B. Units to be surface wall mounted and include depluggable screw terminal connectors, redundant power supply connections and internal fuse to protect circuitry.
- C. Six (6) LED's to indicate receiving port, network activity, and power supply status.

## 2.8 TOUCHSCREEN CONSOLE INTERCOM MASTER STATION PTT MICROPHONES

- A. Desktop intercom master stations in cast aluminum housing
- B. Dynamic, cardioid polar pattern
- C. Lockable push to talk button
- D. Dual input impedance settings; 19 to 300 ohms and high impedance
- E. 60 Hz to 11kHz frequency response
- F. 4 conductor shielded un-terminated line cord for connection to master audio interface
- G. Control, station selection and other necessary functions on the integrated master station shall be accomplished via the touch screen.
- H. Talk back audio and annunciation queues for the intercom system shall be routed through the touch screen console speaker. See section 284619 – PLC Hardware For Electronic Security.
- I. Basis of design for the desk top push to talk microphone is the Shure 522



## Specifications

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### 2.9 VoIP MASTER AUDIO INTERFACE MODULE

- A. External master audio interface module to consist of:
  - 1. Network and power supply interface, audio amplification and processing module, network and operating status LED's, ribbon cable header for connection to display module.
  - 2. External microphone interface with phantom power capability.
  - 3. External loudspeaker interface.
  - 4. Telephone handset with press-to-talk switch interface.
  - 5. Headset jack interface.
  - 6. External buzzer contact closure interface.
  - 7. Surface wall mount enclosure nominally 9" H x 6.5" W x 1.8" D.

### 2.10 ANALOG INTERCOM STATIONS

- A. Intercom stations are to be designed for mounting on standard 2-gang back boxes. Faceplates to be constructed of 11-gauge brushed stainless. Internal steel offset grille to restrict inserting objects through speaker grille. Stations to be ruggedly constructed and resistant to damage from soil and sprays.
- B. Each intercom station is to incorporate an internal loudspeaker, microphone preamplifier and function multiplexing circuitry. One pushbutton is to be provided on each station. Pushbutton to be software assignable for placement of call request.
- C. Pushbuttons to be vandal resistant and of stainless steel. Switch to have positive tactile action with 1 million-operation lifetime. (*Pushbuttons to be solid metal piezo-electric type with no moving parts and a 50 million operation lifetime*).
- D. Loudspeakers to be waterproof mylar cone type.
- E. All intercom station functions to be transmitted over a single shielded pair cable. Stations to be provided with MTA type insulation displacement connector that requires no wire stripping for installation.
- F. Outdoor intercom stations are to be identical in all respects to standard intercom stations except that all metal plates and hardware to be stainless steel, and internal circuitry and components to be conformally coated.

### 2.11 ANALOG INTERCOM STATIONS WITH PRIVACY

- A. Intercom stations are to be designed for mounting on standard 2-gang back boxes. Faceplates to be constructed of 11-gauge brushed stainless. Internal steel offset grille to restrict inserting objects through speaker grille. Stations to be ruggedly constructed and resistant to damage from soil and sprays.
- B. Each intercom station is to incorporate an internal loudspeaker, microphone preamplifier and function multiplexing circuitry. Two pushbuttons are to be provided on each station. Pushbuttons to be software assignable for placement of call request and privacy.



## Specifications

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- C. Pushbuttons to be vandal resistant and of stainless steel. Switch to have positive tactile action with 1 million-operation lifetime. (*Pushbuttons to be solid metal piezo-electric type with no moving parts and a 50 million operation lifetime*).
- D. Loudspeakers to be waterproof mylar cone type.
- E. All intercom station functions to be transmitted over a single shielded pair cable. Stations to be provided with MTA type insulation displacement connector that requires no wire stripping for installation.
- F. Outdoor intercom stations are to be identical in all respects to standard intercom stations except that all metal plates and hardware to be stainless steel, and internal circuitry and components to be conformally coated.

### 2.12 PAGING AMPLIFIERS

- A. Provide paging amplifiers and zone switching as required to perform the functions described herein and indicated on the drawings.
- B. Paging amplifiers to be the constant voltage output type with power output capacities to drive the loudspeakers connected at sufficient levels with no more than 90% amplifier loading.

### 2.13 WIRE AND CABLE

- A. Factory manufactured field interface cables to be provided, as required, for all:
  - 1. CBL-MST-A male DB-15 connector with 6 individually shielded twisted pairs for connecting to master station ports.
  - 2. CBL-STN-A male DB-37 connector at one end with 16 individually shielded twisted pairs for connecting from station control card audio port to terminal blocks.
  - 3. CBL-STQ-A with male DB-37 connectors at both ends and with 16 individually shielded twisted pairs. For connecting from station control card audio ports to QCB-120-1 Quick Connect Board.
  - 4. CBL-SWT-A male DB-25 connector at one end with 16 individually unshielded twisted pairs for connecting from SCC- 300 station control card switch port to a terminal block.
  - 5. CBL-SWQ-A with male DB-37 connectors at both ends and with 16 unshielded twisted pairs. For connecting from SCC- 300 station control card switch port to QCB-120-2 Quick Connect Board.
- B. Field wiring to conform to manufacturer's recommendations.

### 2.14 QUICK CONNECT BOARDS

- A. Quick Connect Boards are designed with a female DB connector to connect a cable from the station control card ports to screw clamp terminals that terminate the field wiring.
  - 1. QCB-120-1 connects the audio port of either the SCC-300 or SCC-400/401 station control card to the field wiring.
  - 2. QCB-120-2 connects the switch ports of an SCC-300 station control card to the field wiring.



## Specifications

### 2.15 STATION PORT ADAPTER

- A. Station Port Adapter provides a line-level output for use with external paging amplifiers.
  - 1. Provides a single line-level output.
  - 2. Provides a single control output (when connected to a 400 or 401 series station card audio port).
  - 3. Screw terminal connections.

### 2.16 RECESSED CEILING PAGING SPEAKERS, NON-DETENTION AREAS

- A. Specifications
  - 1. Speaker
    - a. Continuous Power Rating: 25 watts
    - b. Frequency: 110 - 20KHz
    - c. Impedance: 8 ohms
    - d. Sensitivity: 88 dB, Avg./ 92 dB, Peak
    - e. Coaxial: ½' post mounted domed tweeter, 4 inch paper cone speaker with poly-ether foam surround and a 10 oz magnet.
  - 2. Transformer
    - a. Primary Voltage: 70.7 volts
    - b. Frequency Response: +/- 1 dB, 50-15 kHz
    - c. Primary Taps: 1, 2, 4, and 8 watts
    - d. Secondary Impedance: 4 and 8 ohms
    - e. Insertion Loss: .6 dB
  - 3. Back Box
    - a. Enclosure Diameter: 5-3/8"
    - b. Enclosure Depth: 7-5/8"
    - c. Flange Diameter: 7-9/16"
    - d. Internal Volume: .1 cubic feet
    - e. Tile Bridge: 24 gauge electro-galvanized steel
  - 4. Baffle: Perforated steel with welded/serrated studs for push on installation
- B. Acceptable Manufacturers
  - 1. Soundolier FAP42T Strategy Series II speaker system package.
  - 2. Lowell
- C. Package to include speaker, back box enclosure, baffle, and tile bridge.

### 2.17 RECESSED CEILING PAGING SPEAKERS, DETENTION AREAS

- A. Specifications
  - 1. Speaker
    - a. Continuous Power Rating: 25 watts



## Specifications

- 
- |    |    |                      |  |
|----|----|----------------------|--|
|    | b. | Frequency:           | 110 - 20KHz  |
|    | c. | Impedance:           | 8 ohms   |
|    | d. | Sensitivity:         | 88 dB, Avg./ 92 dB, Peak   |
|    | e. | Coaxial:             | ½' post mounted domed tweeter, 4 inch paper cone speaker with poly-ether foam surround and a 10 oz magnet. |
| 2. |    | Transformer          |  |
|    | a. | Primary Voltage:     | 70.7 volts   |
|    | b. | Frequency Response:  | +/- 1 dB, 50-15 kHz  |
|    | c. | Primary Taps:        | 1, 2, 4, and 8 watts   |
|    | d. | Secondary Impedance: | 4 and 8 ohms   |
|    | e. | Insertion Loss:      | .6 dB  |
| 3. |    | Back Box             |  |
|    | a. | Enclosure Diameter:  | 5-3/8"   |
|    | b. | Enclosure Depth:     | 7-5/8"   |
|    | c. | Flange Diameter:     | 7-9/16"  |
|    | d. | Internal Volume:     | .1 cubic feet  |
|    | e. | Tile Bridge:         | 24 gauge electro-galvanized steel  |
| 4. |    | Baffle:              | Atlas VP-161 or equal  |

### B. Acceptable Manufacturers

1. Soundolier FAP42T Strategy Series II speaker system package.
2. Lowell

### C. Package to include speaker, back box enclosure and baffle.

## 2.18 SURFACE MOUNT PAGING SPEAKER, NON-DETENTION AREAS

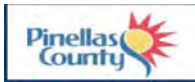
### A. Specifications

- |    |   |                                |
|----|---|--------------------------------|
| 1. | Power Rating:                           | 25 watts (transformer limited) |
| 2. | Tap Settings:                           | 70V .25, .5, 1, 2, and 4 watts |
| 3. | Frequency Response:                     | 85 Hz – 20 k Hz                |
| 4. | Sensitivity:                            | 92 dB 1W/1M                    |
| 5. | Cone:                                   | 8" dual cone                   |
| 6. | Magnet:                                 | 10 oz.                         |
| 7. | Dimensions:                             | 11 ½" x 11 ½" x 5 ½"           |
| 8. | Assembly:                               | CRS constructed enclosure      |
| 9. | Provide with steel cage for protection. |                                |

### B. Acceptable Manufacturer

1. Atlas Sound SBMS series speaker system.
2. Lowell

### C. Typical of locations where page speaker is mounted to exposed structure.



## Specifications

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### 2.19 WALL MOUNT PAGE SPEAKER, NON-DETENTION AREAS

#### A. Specifications

- |                        |                                 |
|------------------------|---------------------------------|
| 1. Power Taps:         | 1, 2, 3.8, 7.5, 15 watts at 70V |
| 2. Frequency Response: | 400 Hz to 14 kHz                |
| 3. Dispersion:         | 70 degrees                      |
| 4. Sensitivity:        | 106 dB                          |
| 5. Power Rating:       | 15 watts                        |

#### B. Acceptable Manufacturer

1. Atlas Sound AP-15T loudspeaker.
2. Lowell

### 2.20 SURFACE MOUNT VANDAL PROOF CEILING SPEAKER, DETENTION AREA

#### A. Specifications

- |  |                  |
|--|------------------|
| 1. Speaker Type:                           | 8" dual cone     |
| 2. Magnet Weight:                          | 10 oz            |
| 3. Sensitivity:                            | 97 dB            |
| 4. Frequency Response:                     | 65 Hz to 20 kHz  |
| 5. Insertion Loss:                         | 1.5 db           |
| 6. Transformer:                            | 25/70 volt       |
| 7. Primary Taps:                           | .25, .5, 1, 2, 5 |
| 8. Provide with steel cage for protection. |                  |

#### B. Acceptable Manufacturer

1. Atlas Sound SD72 speaker transformer package with VP161A-R8 recessed square baffle and 161SES surface stainless steel enclosure.
2. Lowell

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. All system programming shall be done at the SEC's facility prior to installation on site.
- B. Qualified personnel shall install the System in strict compliance with the manufacturer's instructions.
- C. Wiring shall be color coded, uniform, and in accordance with national electric codes and manufacturer's instructions.
- D. Equipment shall be firmly secured, plumb, and level.



## Specifications

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- E. All cable runs to the main equipment rack shall be tagged and identified.
- F. Coordinate all work with Design Builder and other Trades Contractors.
- G. Grounding of cables and peripheral equipment shall be installed per manufacturer's direction to eliminate noise induction and achieve optimum system performance.
- H. Install and configure Security local area network as required for control and communication between system devices. When required, provide necessary coordination, termination, and programming associated with integrating Security local area network with facility network.
- I. Equipment cabinets shall be assembled in the SECs shop prior to delivery to the job site.
- J. All cabling shall be continuous between field device and equipment cabinet. Terminations shall be to terminal boards with punch down blocks, or on screw terminals. Twisted and taped splices are unacceptable.
- K. Carefully match input and output impedance's and signal levels at signal interfaces. Provide matching networks where required.

### 3.2 SOFTWARE SUPPORT

- A. Refer to Section 284620 – PLC Software for Electronic Security for software support and programming requirements.

### 3.3 SYSTEM INITIALIZING AND PROGRAMMING

- A. All programming shall occur in the SEC's shop prior to installation on site.
- B. The System shall be turned on and adjustment made to meet requirements of the specification and on-site conditions.
- C. The System shall be programmed to function as specified.
- D. Any special programming shall be documented and a written copy given to the Owner.
- E. Coordinate integration of other electronic systems as called for in the contract documents.

### 3.4 SYSTEM TEST PROCEDURES

- A. The System shall be completely tested to assure that all components are hooked up and in working order. The System shall be adjusted for optimum intelligibility at peak amplifier output before audio signal clipping occurs. Inspect communications quality between each remote device and master station for buzzes, rattles and audio distortion. Correct all causes of such defects. If the cause is outside of the intercom system, promptly notify the Architect Engineer in writing, indicating the cause of the defect and suggested corrective procedures.

**Specifications**

- 
- B. The System shall be pre-tested by the Security Equipment SEC and certified, in writing, to function in accordance with the plans and specification.
  - C. The SEC is to verify the system is communicating with all controlled devices.
  - D. Testing to be performed in the SECs shop prior to delivery-
    - 1. Test 120VAC power equipment and hardware internal to all equipment racks. Test all conductors for shorts, opens, and polarity.
    - 2. Fully charge all UPS systems that apply to this system. Test unit by removing power thereby causing the unit to switch to battery reserve.
    - 3. Perform impedance sweeps on all speakers. Verify results fall within manufacturer's specifications.
    - 4. Adjust all source level control components and signal processing for optimal gain structure. All components shall be set so they clip simultaneously.
  - E. Testing to be performed at the job site prior to powering the system
    - 1. Verify correct polarity of all microphone inputs, line level inputs, and speaker cables.
    - 2. Verify all microphone inputs, line level inputs, and speaker cables are free of shorts and opens prior to termination of head end electronics.
    - 3. Repeat impedance sweeps on all speaker systems after they are installed and terminated. Include speaker cable in testing.
    - 4. Test all 120VAC power sources for correct polarity and voltage. Test grounding system for continuity. Notify the Design Builder and Electrical trade contractor of any problems.
  - F. Additional job site testing
    - 1. After installation of head end electronics, verify polarity of signal throughout system.
    - 2. Finalize gain structure of system. Adjust system gain and level so that all components clip at the same time. Adjust so system noise is minimized.
    - 3. Adjust all speaker components for consistency in sound pressure level.
  - G. Prior to termination of head-end electronics, verify that all speaker lines are free from shorts and opens.
  - H. Utilizing an impedance meter run test tone through speaker system verifying that all speakers are functioning properly.
  - I. Terminate head end electronics. Run test tone through system verifying adequate gain structure through electronic signal path.
  - J. Using a sound level meter, confirm variation in sound pressure level is not more than +/-5 db in all areas. Adjust speaker taps to insure consistency in sound pressure levels throughout the facility.
  - K. Adjust overall sound pressure level so minimum level is 10 dB above ambient noise level for facility during normal operating conditions.
-



## Specifications

- L. The System shall be completely tested to assure that all components are hooked up and in working order. The System shall be adjusted for optimum intelligibility at peak amplifier output before audio signal clipping occurs. Inspect system for defects. Correct all causes of such defects. If the cause is outside of the scope of the Div 28 series scope of work, promptly notify the Design Builder – and the Architect Engineer in writing, indicating the cause of the defect and suggested corrective procedures.
- M. The system shall be capable of operating free of hums, buzzes, and rattles under normal operating conditions.
- N. Provide written documentation showing all test results.
- O. The System shall be final tested in the presence of the Architect Engineer. SEC is to provide all required testing equipment.

### 3.5 FIELD QUALITY CONTROL

- A. Provide services of a duly factory authorized service representative for this project location to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Make observations to verify that units and controls are properly labeled, and interconnecting wires and terminals are identified. Provide a list of final tap settings of paging speaker line matching transformers.
- C. Rectify deficiencies indicated by tests and completely re-test work affected by such deficiencies at SEC's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards.

### 3.6 OCCUPANCY ADJUSTMENTS

- A. When requested by the Architect Engineer within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide up to three (3) visits to the site for this purpose.

### 3.7 TRAINING

- A. SEC is responsible for providing operational and maintenance training applicable to the entire control system. Training is to include, but not be limited to the following-
  - 1. Review all O+M manuals with Owner's representatives present for training.
  - 2. Perform a tour of the entire facility. During the tour the trainer shall point out all intercom/page equipment and provide a brief description of its purpose and use. This is to include but not be limited to intercom substations, intercom master stations, paging speakers, equipment cabinets, and graphic control panels.
  - 3. Typical of graphical user interface consoles-
    - a. Demonstrate basic functionality of console.



**Specifications**

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- b. Demonstrate devices/systems controlled by console.
  - c. Review navigation of console screens.
  - d. Review control functions of each type.
- 4. Typical of desktop push to talk microphones-
  - a. Demonstrate basic functionality of microphone.
  - b. Demonstrate devices/systems associated with microphone.
  - c. Review control functions of all push buttons.
- 5. Explain functionality and operation of integrated systems-
  - a. Video follow audio
  - b. Answer and zoom, answer no zoom, queuing, etc.

END OF SECTION 28 51 23

## **31 21 10 - SITE CLEARING**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Remove surface debris.
- B. Remove paving and curbs.
- C. Clear site of plant life and grass.
- D. Remove trees and shrubs.
- E. Remove root system of trees and shrubs.
- F. Topsoil excavation

#### **1.2 REGULATORY REQUIREMENTS**

- A. Conform to the applicable governmental agency code for disposal of debris or burning debris on site.
- B. Coordinate clearing work with utility companies.
- C. Provide and maintain necessary erosion and sedimentation control measures per local code, construction permits and plan requirements.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Suitable materials for fills shall be classified as A-1, A-3, or A-2-4 in accordance with AASHTO Designation M145 and shall be free from vegetation and organic material. (Not more than 12 percent by weight of fill material shall pass the No. 200 sieve).
- B. Suitable material for fills to be placed in water shall be classified as A-1 or A-3 in accordance with ASTM A145.
- C. Unsuitable materials are classified as A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7 and A-8 in accordance with AASHTO M145.

### **PART 3 - EXECUTION**

#### **3.1 PREPARATION**

- A. Verify that existing plant life designated to remain, is tagged or identified.

#### **3.2 PROTECTION**

- A. Locate, identify, and protect utilities that remain, from damage.
- B. Protect trees, plant growth, and features designed to remain, as final landscaping.
- C. Protect bench marks (and existing structures) from damage or displacement.

## Specifications

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### 3.3 CLEARING AND GRUBBING

- A. Clearing and grubbing shall consist of the complete removal and disposal of all trees, brush, stumps, roots, grass, weeds, rubbish, asphalt, concrete and all other obstructions resting on or protruding through the surface of the existing ground and the surface of the excavated areas.
- B. Unless otherwise shown on the plans, clearing and grubbing shall be accomplished within all areas of the property, except where otherwise designated on plans, or directed by the Owner. Areas designated for site grading shall also be cleared and grubbed; however, selective clearing will be performed in some areas by retaining selected trees. The trees selected by the Owner for saving shall be protected from construction equipment in a manner approved by the Owner and meeting the criteria for such protection as required by the applicable governmental agency.
- C. Where excavation is required within the roadway area, all stumps, roots, etc., protruding through or appearing on the surface of the completed excavation shall be removed to a depth of not less than one foot below the excavated surface. All stumps within building site areas shall be grubbed to a depth of one foot below existing grade and replaced with compacted backfill before the area is filled.
- D. Within all other areas where clearing and grubbing is required, all stumps, roots, and other debris projecting through or appearing on the surface of the ground shall be removed to a depth of one foot below the completed surface, or bottom of pavement base.
- E. As an exception to the above provisions, where so directed by the Owner, desirable trees shall be trimmed, root-pruned, protected and left standing.

### 3.4 REMOVAL

- A. All trees, shrubs, and other material unsuitable for reuse, becomes the property of the Installer and shall be disposed of by him outside the limits of the contract area at his cost and expense. No additional payment will be made but the cost for disposal shall be included in the appropriate prices bid.
- B. All excess suitable material removed from all classes of excavation embraced in these specifications which are not required for the formation of embankments, grading, refilling and other uses indicated on the plans, shall be considered as excess material and shall be disposed of by one of the following methods, as determined by the Owner:
  - 1. Disposed of in spoil areas where directed by the Owner.
  - 2. Disposed of by the Installer at his own cost and expense outside the limits of the contract area.

### 3.5 TOPSOIL EXCAVATION

- A. On all areas to be excavated or to receive embankment material within the lines of parking lot construction, the topsoil shall be carefully removed and spread either on areas already graded and prepared for topsoil or in stockpiles conveniently located on the areas which are subsequently to receive application of topsoil. The depth to which topsoil is to be stripped shall be as directed by the Geotechnical Engineer, except that the depth of stripping shall not exceed nine inches.
- B. The topsoil shall consist of friable loam, reasonably free of subsoil, clay lumps, brush roots, weeds or other objectionable vegetation; stones or similar objects, litter, or other material unsuitable or harmful to plant growth. The topsoil shall contain not less than two percent (2%) nor more than ten percent (10%) organic matter.





### Specifications

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- C. Topsoil not meeting the above requirements may be used as suitable backfill material if approved by the Geotechnical Engineer. Topsoil, which does not meet either of the above requirements, shall be removed from the site at no additional cost to the Owner.

END OF SECTION 31 21 10



## **31 22 11 - ROUGH GRADING**

### **PART 1 - GENERAL**

Grading consists of entire site both sub grade and finish grades. (see plans)

#### **1.1 SECTION INCLUDES**

- A. Removal of topsoil and subsoil.
- B. Cutting, grading, filling and rough contouring the site.

#### **1.2 RELATED SECTIONS**

- A. Information Available to Bidders: Soil investigation report; bore hole locations and findings of subsurface materials.
- B. Section 312110 - Site Clearing.
- C. Section 312222 - Excavation.

#### **1.3 REFERENCES**

- A. ANSI/ASTM D698 (AASHTO-T-99) Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1557 (AASHTO T-180) - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 Kg) Rammer and 18 inch (457 mm) Drop.

### **PART 2 - EXECUTION**

#### **2.1 EXAMINATION**

- A. Verify that survey benchmark and intended elevations for the work are as indicated.

#### **2.2 PREPARATION**

- A. Identify required lines, levels, contours, and datum.
- B. Identify known underground, above ground, and aerial utilities. Stake and flag locations.
- C. Notify applicable utility companies to remove or relocate utilities.
- D. Protect above and below grade utilities which are to remain.
- E. Protect plant life, lawns, rock outcropping and other features remaining as a portion of final landscaping.
- F. Install erosion and sedimentation control materials including silt fences, hay bales as required by construction permits, local code, and where shown on the plans.

#### **2.3 SUBSOIL EXCAVATION**

- A. Excavation shall conform to the limits indicated on the plans or specified herein. This work shall include shaping, sloping, stabilizing and other work necessary in bringing the excavation to the required grade, alignment and cross section.

## Specifications

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- B. All suitable materials removed from the excavation shall be used as far as practicable in the formation of the embankments, sub-grades, shoulders, building sites and other places as directed. No excavated material shall be wasted without permission, and where necessary to waste such material it shall be disposed of as directed by the Owner.
- C. Any material deemed unsuitable shall be removed to the required depth and replaced to the satisfaction of the Owner with suitable material. Unsuitable material existing in areas outside project units may remain and these open areas may be used for disposal areas for the unsuitable material as directed by the Geotechnical Architect. Open areas shall be those areas that do not include building sites, paved areas or street right-of-ways.
- D. All waste excavated material shall be considered property of the Installer and disposed of offsite in a legal manner.

### 2.4 FILLING

- A. Suitable materials for fills shall be a non-cohesive, non-plastic granular mixture of local sand and rock and shall be free from vegetation, organic material, marl, silt or muck. The Installer shall provide the necessary material to meet final grades.
- B. Fills shall be formed of suitable material placed in layers of not more than 8-inches in depth measured loose and rolled and/or vibrated with suitable equipment until compacted.
- C. Thickness of layers may be increased provided the equipment and methods used are proven by field density testing to be capable of compacting thicker layers to specified densities. Layer thickness shall be decreased if equipment and methods used are proven to be incapable of compacting layers to specified densities.
- D. Rock that will not pass through a 6-inch diameter ring shall not be placed within the top 12 inches of the surface of the completed fill. Rock that will not pass through a 3-inch diameter ring shall not be placed within the top 8 inches of the completed fill.
- E. Fill material which must be placed in water standing at the normal water table, which cannot be removed by gravity after ditching, shall be spread in a uniform layer of a thickness not in excess of that necessary to support the hauling, placing and compacting equipment. Material above this lift shall be compacted as specified above.
- F. Muck or other unsuitable material may be used only in areas designated in the drawings or as directed by the Owner. Muck material used as fill shall be placed in layers of not more than 12 inches in depth measured loose. When dry or as directed by the Owner, this layer shall be disked and harrowed to break up large pieces of the material. The above density requirements shall not apply to unsuitable material placed.
- G. Maintain optimum moisture content of fill materials to attain required compaction density.
- H. Slope grade away from building minimum 6 inches in 10 feet, unless noted otherwise.
- I. Make grade changes gradual. Blend slope into level areas.

### 2.5 TOLERANCES

- A. Top Surface of road and parking area Sub-grade: Plus one-tenth (0.1) foot above grade and no tolerance below grade.
- B. Finish grade for field: Grade to be within (0.05) foot.
- C. Finish grade for other open areas: Plus one tenth (0.1) foot above grade and no tolerance below grade.

## Specifications

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### 2.6 FIELD QUALITY CONTROL

- A. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D698 and D1557.
- B. Compaction testing will be performed in accordance with ANSI/ASTM D1556 ANSI/ASTM D698 unless otherwise shown on drawings.
- C. Fill within the roadway right-of-way under all pavements, and on building sites shall be compacted to a density of not less than 95% percent of its maximum density as determined by AASHTO Method T-180. Fill within open areas shall be compacted to a density of not less than 95% percent of its maximum density as determined by AASHTO Method T-99.
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner.
- E. Frequency of Tests: Frequency of testing shall be at least one test for every 500 linear feet of roadway or one test for every 10,000 square feet of paved surface, evenly dispersed. A minimum of three tests shall be required. Testing procedures shall be in accordance with governmental agency requirements. Test results shall be reported in writing to the Owner, Architect, Installer or Construction Manager, and local governmental agencies (if required).

END OF SECTION 31 22 11



## Specifications

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### 31 22 22 - EXCAVATION

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

- A. Excavation for paving, drainage, lakes and landscaping.

##### 1.2 SITE CONDITIONS

- A. Traffic: Do not interfere with or close public ways without permission of governing authorities. Do not interfere with adjacent private facilities.
- B. Site Utilities:
  - 1. Advise utility companies of excavation activities before starting excavations. Locate and identify underground utilities passing through work area before starting work.
  - 2. If underground utilities are encountered in locations other than indicated, immediately advise utility owners before proceeding. Amend project record documents to show actual locations.
  - 3. Protect existing utilities indicated to remain.
  - 4. Do not interrupt existing utilities without advance notice to and written approval from the owner.

##### 1.3 RELATED SECTIONS

- A. Section 312211 - Rough Grading

##### 1.4 FIELD MEASUREMENTS

- A. Verify that survey benchmark and intended elevations for the Work are as indicated.

#### PART 3- EXECUTION

##### 3.1 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Provide markers indicating limits of work and clear identification of items and areas requiring protection.
- C. Provide barricades, warning signs, and warning lights around open excavations as necessary to prevent injury to persons.
- D. The installer is solely responsible for determining the potential for injury to persons and damage to property.

##### 3.2 EXCAVATION

- A. Underpin adjacent structures which may be damaged by excavation work, including utilities and pipe chases.
- B. Excavate subsoil required to accommodate lakes, building foundations, slabs-on-grade, paving, site structures and construction operations per the contract documents.
- C. The Installer shall perform all excavation of every description and of whatever substances encountered, to the dimensions required for construction and as specified herein.

## Specifications

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- D. Excavation Stabilization: Slope faces of excavations to maintain stability in compliance with requirements of governing authorities. Excavation for the structures shall be sufficient to provide a clearance between their outer surfaces and the face of the excavation, sheeting, or bracing (if required), of not less than two (2) feet. Materials encountered in the excavation which have a tendency to slough or flow into the excavation, undermine the banks, weaken the overlying strata, or are otherwise rendered unstable by the excavation operation shall be retained by sheeting, stabilization, grouting or other approved methods. Excavation for precast or prefabricated structures will not be required to be dewatered.
- E. Excavation for the precast or prefabricated structures shall be carried to an elevation one (1) foot lower than the proposed outside bottom of the structure to provide space for the select backfill material. Prior to placing the select backfill, the excavation shall be sounded, if not dewatered, using a rigid pole to indicate to the satisfaction of the Architect that the excavation has been carried to the proper depth and is reasonably uniform over the area to be occupied by the structure.
- F. Excavation for structures constructed or cast in place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with Class B concrete (refer to Section 03000).
- G. Footings: Cast-in-place concrete footing sides shall be formed immediately after excavation. Forming for footing sides is specified elsewhere.
- H. Machine slope banks to angle of repose or less, until shored.
- I. Excavation cut not to interfere with normal bearing splay of building foundation.
- J. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- K. Notify Architect of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- L. Unnecessary Excavation: The expense of excavation of materials outside of limits indicated or ordered in writing by the Architect and the correction thereof to the satisfaction of the Architect shall be borne by the Installer.
  - 1. Unnecessary excavation under footings: Either deepen footings to bear on actual subgrade elevation without changing top elevations or place concrete fill up to required elevation, as required by the Architect.
  - 2. Unnecessary excavation other than under footings:
    - a. Either place compacted fill or otherwise correct conditions, as required by the architect.
- M. Excavation for Structures:
  - 1. Excavate beyond footings and foundations so as to allow proper construction and inspection of concrete formwork and other materials. Excavate to the required elevation.
    - a. Tolerance: Plus or minus 1 inch.
- N. Excavation for Lakes:
  - 1. Remove subsurface materials to the plan location, depth and dimensions. Do not disturb the bottom of the completed excavation.
  - 2. Sod exposed lake banks to the design normal water level in the lake. Provide sufficient water to keep sod viable until firmly established.



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**Specifications**

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- O. Approval of Subgrade: Notify the Architect when required elevations have been reached.
    - 1. When required by the Architect due to the unforeseen presence of unsatisfactory materials or other factors, perform additional excavation and replace with approved compacted fill material in accordance with the Architect's instructions.
    - 2. Payment for unforeseen additional work will be made in accordance with established unit prices or, if none, in accordance with provisions for changes in the work. No payment will be made for correction of subgrades improperly protected against damage from freeze-thaw or accumulation of water, or for correction of otherwise defective subgrades.
  - P. Dewatering: Any water which accumulates in the excavations for structures, pipes, and utilities, shall be removed promptly by well point system or by other means satisfactory to the Architect in such a manner as to not create a nuisance to adjacent property or public thoroughfare. Pumps and engines for well point systems shall be operated with mufflers and at a minimum noise level suitable to a residential area. The Installer shall be responsible for any nuisance created due to the disposal of water from his dewatering system.
  - Q. Stockpiled Materials: Materials removed from the excavation shall be stored and disposed of in a manner which will not interfere with traffic at the site. Material suitable for backfill not needed for backfill at the structure, but needed elsewhere shall be stockpiled until moved and used elsewhere. Material unsuitable for use in backfill shall become the property of the Installer and shall be removed and disposed of by the Installer at the Installer's expense immediately after backfill is placed.
- 3.3 FIELD QUALITY CONTROL
- A. Testing Laboratory Services:
    - 1. The owner will secure and pay for the services of a Geotechnical Architect to classify existing soil materials, to recommend and to classify proposed borrow materials when necessary, to verify compliance of materials with specified requirements, and to perform required field and laboratory testing.
- 3.4 PROTECTION
- A. Protect excavations by methods required to prevent cave-in or loose soil from falling into excavation.

END OF SECTION 31 22 22



## Specifications

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### 31 22 23 - BACKFILLING

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

- A. Parking lot site backfilling.
  - 1. Fill under paving and landscape areas.
  - 2. Consolidation and compaction.

##### 1.2 RELATED SECTIONS

- A. Section 312222 - Excavation
- B. Section 312225 - Trenching.

##### 1.3 REFERENCES

- A. ANSI/ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.
- B. ANSI/ASTM D698 (AASHTO T-99) - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 kg) Rammer and 12 inch (304.8 mm) Drop.
- C. ANSI/ASTM D1557 (AASHTO T-180) - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 kg) Rammer and 18 inch (457 mm) Drop.
- D. Florida Department of Transportation Standard Specifications for Roads and Bridge Construction, latest edition.

#### PART 2 - PRODUCTS

##### 2.1 FILL MATERIALS

- A. Suitable materials for filling shall be noncohesive, nonplastic granular mixture of local sand and rock and shall be free from vegetation, organic material, marl, silt or muck.
- B. Where sufficient approved materials are not available from required excavations on site, obtain and pay for materials from approved sources off site without additional charge to the Owner.
- C. For each soil material proposed for use as fill or backfill, whether obtained on or off site, testing laboratory shall classify soil materials, develop Proctor curve, and perform any other tests required.
- D. Obtain approval of the Owner for each soil material.
- E. Backfill and Fill Materials: Materials classified as satisfactory (AASHTO M 145).
- F. Unsatisfactory Soil Material (AASHTO M 145):
  - 1. A-1 (stone fragments, gravel, and sand)
  - 2. A-2-4 (silty or clayey gravel and sand)
  - 3. A-2-5 (silty or clayey gravel and sand)
  - 4. A-2-6 (silty or clayey gravel and sand)
  - 5. A-2-7 (silty or clayey gravel and sand)
  - 6. A-4 (silty soils)
  - 7. A-5 (silty soils)
  - 8. A-6 (clayey soils)
  - 9. A-7-6 (clayey soils)
  - 10. A-8 (peat)

## Specifications

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Capillary Water Barrier: Clean, crushed rock or gravel or uncrushed gravel; 100 percent passing a 1-1/2 inch sieve; not more than 2 percent passing a No. 4 sieve.

### 2.2 ACCESSORIES

- A. Geotextile Fabric: Where specified.

## PART 3 - EXECUTION

### 3.1 VERIFICATION

- A. Installer must review Geotechnical Report.
- B. Verify fill materials to be reused as acceptable.

### 3.2 PREPARATION

- A. Generally, compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of insitu compaction. Backfill and compact to density equal to or greater than requirements for subsequent backfill material.
- C. Demuck any organic soils encountered within the work limits until suitable materials are reached and replace demucked areas with clean suitable fill material.
- D. Prior to placement of subbase and base course material at paved areas, compact subsoil to 95 percent of its maximum dry density in accordance with Section I60-8 of the Florida Department of Transportation Specifications for Road and Bridges, latest edition.

### 3.3 BACKFILLING

- A. Preparation: Backfill excavations as soon as practicable. Complete the following operations before backfilling:
  - 1. Inspection and acceptance of below-grade construction.
  - 2. Inspection, testing, and approval of underground utilities.
  - 3. Surveying of underground utilities for record documents.
  - 4. Concrete form work removal
  - 5. Removal of loose material, muck, debris, and trash from excavation.
  - 6. Installation of temporary or permanent horizontal bracing for structures to receive backfill.
  - 7. Do not place material on muddy surfaces.
- B. Installation: Place satisfactory soil materials in layers to required subgrade elevations.

### 3.4 FILLING

- A. Preparation: Verify that area has been stripped of vegetation including roots below grade. Remove and dispose of any unsatisfactory soils.
  - 1. Should density of subgrade to receive fill be less than specified for fill, break up and pulverize subgrade to a depth of at least 6 inches, modify moisture condition if necessary, and recompact to required density at optimum moisture content.
- B. Installation: Place fill materials to required elevations in lifts of required depth. Provide fill materials beneath each area as indicated.
  - 1. Planted areas: Satisfactory soil materials.
  - 2. Paved areas: Satisfactory soil materials.

## Specifications

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3. Building slabs: Capillary water barrier materials.

### 3.5 BUILDING SLAB AREAS

- A. Place fill or backfill lifts per the geotechnical and structural engineer's recommendations such that compaction true to grade and level is accomplished with a minimum of surface disturbance and segregation or degradation of materials.

Maintain grade control and cross section by means of line and grade stakes. Maintain moisture content within prescribed limits during placing and compacting.

- B. When the total thickness of materials to be placed is less than the maximum lift thickness permitted, place material in a single lift. When the total thickness of materials to be placed is greater than the maximum lift thickness permitted, place materials in two (2) or more lifts of uniform thickness with no lift less than 3 inches in thickness.

1. Capillary water barrier: Under slabs on grade, place capillary water barrier material directly on subgrade, shape surface to within the required tolerances and compact.

### 3.6 COMPACTION

- A. Place materials used in backfilling and filling in layers not exceeding loose depths as follows:
  1. Heavy equipment compaction: 6 inches.
  2. Hand-operated tampers: 3 inches.
- B. Place materials simultaneously on opposite sides of walls, small structures, utility lines, etc. to avoid displacement or overstressing.
- C. In-Place Density Requirements: Compact soil to not less than the values given below, expressed as a percentage of maximum density at optimum moisture content.
  1. Unpaved areas: top 6 inches of subgrade and subsequent lifts:
    - a. 90 percent.
  2. Paved areas: Top 8 inches of subgrade and subsequent lifts:
    - a. 98 percent on site
    - b. 100 percent within right-of-way

Moisture Control: During compacting, control moisture of subgrades and subsequent lifts to within tolerances from optimum moisture content as recommended by testing laboratory. Wet surface with water when additional moisture is required. Aerate soil to aid in drying or replace soil when excessive moisture is present.

### 3.7 GRADING

- A. General: Smooth grade to a uniform surface that complies with compaction requirements and required lines, grades, and cross sections and is free from irregular surface changes.
- B. Provide smooth transition between existing adjacent grades and changed grades. Cut out soft spots, fill low spots, and cut down high spots to conform to required surfaces tolerances.
- C. Slope grades to direct water away from structures and to prevent ponding. Finish subgrade to required elevations within the following tolerance:
  1. Unpaved areas: Plus or minus 1 inch.
  2. Paved areas: Plus or minus 1/2 inch.
  3. Inside building lines: 1/2 inch as measured with a 10-foot straight edge.

## Specifications

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### 3.8 FIELD QUALITY CONTROL

- A. Geotechnical Architect retained by the Owner will provide testing services as are deemed advisable. The Installer shall schedule the work to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress.
- B. Provide for visual inspection of bearing surfaces.
- C. The Construction Manager shall make available all materials to the Geotechnical Architect for the purpose of performing routine tests as specified. In-place density tests shall be made in the subsoils. Frequency of testing shall be at least one test for every 500 linear feet of roadway or 10,000 square feet of paved surface. A minimum of three (3) tests shall be required. Test results shall be reported in writing to the Owner, Architect, Construction Manager and local authority, as required.
- D. Testing Laboratory Services: Provide timely notice to testing laboratory. Do not proceed with construction until testing of each subgrade and lift of fill or backfill has been performed and required inspections and approvals have been obtained. Testing frequency shall be in accordance with geotechnical report recommendations or if not specified as listed below as a minimum.
- E. Maximum Density at Optimum Moisture Content: Determine in accordance with ASTM D 1557, Method D.
  - 1. For each subgrade, fill, and backfill material, perform one moisture-density relationship test for each 1,500 cubic yards, or fraction thereof, of material used.
- F. In-Place Density Tests: ASTM D 1556 (sand cone method), ASTM D 2167 (rubber balloon method), or ASTM D 2922 (nuclear method), as applicable.
  - 1. When ASTM D 2922 is used, check and adjust calibration curves using ASTM D 1556 only. ASTM D 3017 shall be performed to measure water content of soil at the time in-place density tests are conducted. Calibrate density and moisture gauges at the start of testing on each type of material encountered and at intervals as directed.
- G. Footing Subgrades: Test footing subgrades to determine bearing capacity of each soil stratum encountered. At the option of the owner, visual inspection of subsequent similar subgrades and comparison with tested strata may be allowed.
- H. Areas under Slabs and Pavements: Conduct not less than one (1) in-place density test of subgrade and one (1) in-place density test of each compacted fill or backfill layer for every 10,000 square feet of overlying paved area, but in no case less than three (3) tests per lift.
- I. If testing service reports indicate that subgrade or fills are below specified density, scarify or remove and replace to the required depth, recompact, and retest at no cost to the owner.

### 3.9 MAINTENANCE

- A. Completed Areas: Protect from damage by pedestrian or vehicular traffic, freezing, erosion, and contamination with foreign materials.
  - 1. Repair and re-establish grades to specified tolerances in settled, eroded, or rutted areas.
- B. Damaged Areas: Where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction and whether due to subsequent construction operations or weather conditions, restore materials to required conditions: Scarify or remove and replace to the required depth, return to optimum moisture content, and compact materials to the required density before continuing construction.



### **Specifications**

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- C. Correction: Should settling occur within the project construction period, remove finished surfacing, add additional approved material, compact material, and reconstruct surfacing. Construct surfacing to match and blend in with adjacent surfacing as nearly as practicable.

#### **3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS**

- A. Remove any material not required for use on the project (including unsatisfactory soil, excess satisfactory soil, trash, and debris) and legally dispose of it off the owner's property.

END OF SECTION 31 22 23





## Specifications

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### 31 22 25 - TRENCHING

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

- A. Excavate trenches for utilities from building to municipal utilities or service connection.
- B. Compacted bedding under fill over utilities to subgrade elevations.
- C. Backfilling and compaction.

##### 1.2 RELATED SECTIONS

- A. Section 312222 - Excavation
- B. Section 312223 - Backfilling
- C. Section 312722 - Site Storm Sewerage Systems.

##### 1.3 REFERENCES

- A. ANSI/ASTM D698 (AASHTO T-99) - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1557 (AASHTO T-180) - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb (4.54 kg) Rammer and 18 inch (457 mm) Drop.
- C. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

##### 1.4 FIELD MEASUREMENTS

- A. Verify that survey benchmark and intended elevations for the work are as shown on drawings.

#### PART 2 - PRODUCTS

##### 2.1 BED MATERIALS

- A. Pipe bedding material shall be select granular material consisting of pea rock, drainfield limerock, limerock screenings, sand or other fine inorganic material when pipe is installed above the natural water table.
- B. Subsoil Material: As specified in Section 312223.

#### PART 3 - EXECUTION

##### 3.1 EXAMINATION

- A. Verify fill materials to be reused, are acceptable.

##### 3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Cut out soft areas of subgrade not capable of insitu compaction. Backfill and compact to density equal to or greater than requirements for subsequent backfill material.

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**Specifications**

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**3.3 EXCAVATION**

- A. Excavate subsoil required for storm sewer, sanitary sewer, water, gas and other piping to municipal utilities, or service connection.
- B. Trenches shall be of necessary widths for the proper laying of the pipe, and the banks shall be as nearly vertical as practical.
- C. Excavation shall not interfere with normal 45 degree bearing splay of foundations.
- D. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.
- E. Correct unauthorized excavation at no cost to Owner.
- F. Correct areas over-excavated by error in accordance with Section 312222.
- G. Stockpile excavated material in area designated on site and remove excess material not being used, from site.

**3.4 BEDDING**

- A. The bottom of the trenches shall be excavated to a depth 6 inches below the outside bottom of the pipe barrel. The resulting excavation shall be backfilled with pipe bedding material up to the level of the lower one-third of the proposed pipe barrel. This backfill material shall be tamped and compacted to provide proper bedding for the pipe and shall then be shaped to receive the pipe.
- B. Bell holes and depressions for joints shall be dug after the trench bottom has been graded and in order that the pipe rest upon the prepared bottom for as nearly its full length as practicable, shall be only of such length, depth, and width as required for properly making the particular type of joint.

**3.5 BACKFILLING**

- A. After the bedding has been prepared and the pipe installed, approved selected material from excavation at a moisture content which will facilitate compaction, shall be placed along side the pipe in layers not exceeding 6 inches loose measure in depth. Care shall be taken to insure thorough compaction of the fill under the haunches of the pipe.
- B. Each layer shall be thoroughly compacted by rolling or tamping with mechanical rammers. This method of filling and compacting shall be continued until the fill is 12 inches above the pipe, then the remainder of the backfill shall be placed in lifts not exceeding 9 inches.
- C. Backfill for drainage structures shall be placed in lifts not exceeding 9 inches and compacted.
- D. Maintain optimum moisture content of backfill materials to attain required compaction density.
- E. Leave fill material stockpile areas completely free of excess fill materials or shape and blend area into landscaping as directed by Owner.
- F. Removal of Unstable Material: Soft, spongy, or otherwise unstable material (A-8 Material) encountered below the established grade of the excavation which will not provide a firm foundation for subsequent work, shall be removed and replaced as directed. Unless otherwise directed, all such unstable materials shall be removed for the full width of the excavation replaced with approved fill material.

**3.6 REMOVAL OF WATER**

- A. It is a basic requirement that the excavations shall be free from water before pipe or structures are installed.

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**Specifications**

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- B. The Installer shall provide all necessary pumps, underdrains, well-point systems, and other means for removing water from trenches and other parts of the work. The Installer shall continue dewatering operations to prevent flotation or movement of the pipe in the trench and above the natural water table.
- C. Water from the trenches and excavation shall be disposed of in such a manner not to cause injury to public health or property, or surface of streets. The Installer shall submit the methods of handling trench water and locations at which water will be disposed of to the Architect for approval before commencing the work.

**3.7 TOLERANCES**

- A. Top Surface of Backfilling: Under Paved Areas Plus two tenths (0.2) of a foot above grade, and no tolerance below grade.

**3.8 FIELD QUALITY CONTROL**

- A. Tests for density of compaction may be made at the option of the Architect unless required by appropriate governmental agency. Any deficiencies shall be corrected by the Installer without additional cost to the Owner. The operation of heavy equipment shall be conducted so that no damage to the pipe will result. Backfill material shall be compacted as shown on the plans. Selected material for backfill shall not contain any stones or rock larger than 3 inches.
- B. Tests and analysis of fill material will be performed in accordance with ANSI/ASTM D698 and D1557.
- C. Compaction testing will be performed in accordance with ANSI/ASTM D1557 and ANSI/ASTM D698.
- D. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

**3.9 PROTECTION OF FINISHED WORK**

- A. Trenches will be backfilled and compacted or appropriate barricades and restrictions shall be placed to prevent access to the trench.

END OF SECTION 31 22 25



## Specifications

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### 31 22 30 - BASE COURSES

#### PART 1 GENERAL

##### 1.1 DESCRIPTION

- A. Scope - This Section includes base courses constructed by the following method:
1. Limerock Base - The work specified in this Section consists of the construction of a base course composed of limerock. It shall be constructed on the prepared subgrade, in accordance with these specifications and in conformity with the lines, grades, notes and typical cross section shown in the plans.
  2. Crushed Concrete Road Base - The work specified in this Section consists of the construction of a base course composed of crushed concrete. It shall be constructed on the prepared subgrade, in accordance with these specifications and in conformity with the lines, grades, notes and typical cross section shown in the plans.
  3. Asphaltic Base Course - Asphaltic Base Courses included in the Work of this Contract shall be furnished and installed in accordance with the FDOT Standard Specifications for Road and Bridge Structures, latest edition, and all Supplemental Specifications. Except where the Contract Documents include more stringent requirements or noted deviations, the applicable specification sections by reference shall have the same force and effect as if bound directly.

##### 1.2 QUALITY ASSURANCE

- A. Reference Standards - Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:

ASTM - American Society of Testing and Materials

AASHTO - American Association of State Highways and Transportation Officials

FDOT - Florida Department of Transportation

- B. Allowable Tolerances

1. Base Courses - The finished surface shall be shaped to conform to within a tolerance of 2 inches in ten (10) feet to the cross section and grades called for on the Plans.

##### 1.3 Submittals

- A. Test Reports

1. Thickness - The testing lab shall provide the ARCHITECT with two (2) copies of the test results. The sampling and testing shall be performed by a testing laboratory approved by the OWNER. Test results shall be signed and sealed by a Professional Architect.

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**Specifications**

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**1.4 PRODUCT DELIVERY, STORAGE AND HANDLING**

The base course material shall be transported to the point where it is to be used, over material previously placed if practicable, and dumped on the end of the preceding spread. Hauling over the subgrade and dumping on the subgrade will be permitted when, in the ARCHITECT's opinion, these operations will not be detrimental to the base.

**1.5 JOB CONDITIONS****A. Environmental Requirements**

1. Temperature - Comply with the requirements for aggregate base course installations due to outside ambient air temperatures specified under Article 3.03 of this Section.

**PART 2 - PRODUCTS****2.1 MATERIALS**

- A. Limerock Base - The limerock material shall meet the requirements of FDOT Section 911. At the Construction Manager's option limerock of either Miami or Ocala formation may be used, but limerock of only one (1) formation may be used on any contract. (Limerock may be referred to hereinafter as "rock".)
- B. Crushed Concrete Road Base - The crushed concrete material shall consist of only crushed concrete. Any added materials to facilitate construction and achieve desired characteristics of the finished in-place product must be submitted for approval by the ARCHITECT. The road base material shall conform with the gradation requirements for graded aggregate base specified in FDOT Section 204. The minimum LBR value shall be 150 percent.

**PART 3 - EXECUTION****3.1 INSTALLER'S VERIFICATION**

- A. Excavation - Prior to the placing of any base material, examine the excavation for the grades, lines, and levels required to receive the new work. Ascertain that all excavation and compacted subgrades are adequate to receive the new work. Correct all defects and deficiencies before proceeding with the Work.
- B. Subgrade Conditions - Prior to the placing of any base material, examine the subgrade to ascertain that it is adequate to receive the base to be placed. If the subgrade remains wet after all surface water has been removed, the ARCHITECT may require the installation of edge drain.
- C. Existing Improvements - Investigate and verify locations of existing improvements, including structures, to which the new will be in contact.

Necessary adjustments in line and grade, to align the new work with the existing improvements must be approved by the ARCHITECT, prior to any changes.

**3.2 PREPARATION**

- A. Subgrade - The subgrade shall be fine graded to the cross section indicated on the Plans, and shall be thoroughly compacted prior to the placing of the base material.

## Specifications

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### 3.3 INSTALLATION

- A. General - The width, thickness and type of base materials shall be indicated on the Plans or as directed by the ARCHITECT.

No base material shall be placed until the subgrade, or subbase, or existing surface has been approved by the ARCHITECT.

- B. Limerock Road Base - The base course shall be placed by a mechanical spreader or other approved means, in uniform layers to such a depth that when compacted, the base course will have the thickness shown on the Plans.

The depth of any one (1) layer, when compacted, shall not be more than six (6) inches. If the required compaction cannot be obtained for the full depth of the base course spread, the thickness of each course shall be reduced or at the approval of the ARCHITECT, adequate equipment shall be used to compact the aggregate to the required unit weight.

The subgrade shall be shaped to the specified crown and grade and maintained in a smooth condition. If hauling equipment causes ruts or holes in the subgrade, the hauling equipment will not be permitted on the subgrade, but shall be operated on the base course behind the spreader.

The base course shall be compacted to at least 98% of maximum unit weight as determined by AASHTO T 180, by the use of approved pneumatic-tired compaction equipment or vibratory compactors.

The optimum moisture content shall be maintained until the prescribed unit weight is obtained and each layer shall be compacted until the maximum unit weight is attained before placing the succeeding layer.

When approved by the ARCHITECT, additional water may be applied by an approved means, to the base course to aid in the compaction and shaping of the material.

Motor graders or other approved equipment shall be used to shape the base course and maintain it until the surface course is placed.

When hauling material over the base course or subgrade, the Installer shall limit the weight and speed of his equipment to avoid damage to the subgrade or base course. If the subgrade or base course becomes rutted due to the Installer's operation, the subgrade or base course shall be removed and replaced, acceptable to the ARCHITECT, at the Installer's expense.

- C. Crushed Concrete Road Base

1. Placement - The material shall be transported to the point where it is to be used, over crushed concrete previously placed where possible, and dumped at the end of the preceding spread. Hauling over the subgrade, or dumping on the subgrade for further placement operations, will be permitted only when, in the opinion of the ARCHITECT, such procedures will not adversely affect the integrity of the completed base and subgrade.
2. Thickness - Crushed concrete base constructed under this contract shall have a minimum thickness of six inches (6").
3. Compacting and Finishing Requirements - After spreading is completed, the crushed concrete shall be compacted, with water being added as required, until the required density has been obtained. During final compaction operations, if the blading of any area is necessary to obtain the true grade and cross section, the compacting operations for such area shall be completed prior to the performance of density tests on the finished base.

## Specifications

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4. Priming and Maintaining - The prime coat shall be applied only when the base meets the specified moisture and density requirements. At that time of priming, the base shall be firm, unyielding, in such condition that no undue distortion will occur. The Installer will be responsible for insuring that the true crown and template of the base are maintained, with no rutting or other distortion, and that the base meets all requirements at the time the surface course is applied.
- D. Correction of Defects - All defects in materials and construction shall be corrected by the Installer, at his expense, and to the satisfaction of the Architect, as the work progresses.
- E. Maintenance During Construction - The base course shall be continuously maintained in a smooth and firm condition during all phases of the construction operation.  
The Installer, at his expense, shall provide additional materials to fill depressions or bind the aggregate, when directed by the ARCHITECT.
- F. Temperature Limitations - Base course materials shall not be placed when there are indications that the mixtures may become frozen before the maximum unit weight is obtained.

In no case shall the base course be placed on a frozen subgrade or subbase unless otherwise directed by the ARCHITECT.

- G. Cleanup - Immediately following the compacting of the base course, the voids on both sides of the base course shall be backfilled with sound earth of topsoil quality.

The backfill shall be compacted, leveled and left in a neat, workmanlike condition.

At a seasonally correct time approved by the OWNER, the disturbed area shall be raked, have topsoil placed thereon, fertilizer and seeded per the requirements of Section 02930, Seeding, or sodded in accordance with Section 02940, Sodding.

### 3.4 FIELD QUALITY CONTROL

- A. Testing - During the course of the work, the OWNER may require testing for compaction or density and for thickness of material. The testing and coring required shall be performed by a testing laboratory approved by the OWNER. The cost for testing shall be at the expense of the Installer.
  1. Thickness - A minimum of one depth (thickness) measurement will be made every 400 linear feet per traffic lane. The lane width shall be as indicated on the Plans or as determined by the ARCHITECT. If two (2) lanes are constructed simultaneously, only one (1) test is necessary to represent both lanes. For areas such as intersections, entrances, cross-overs, ramps, widening strips, acceleration and deceleration lanes, at least one depth measurement will be taken for each 1,200 square yards of such areas or fraction thereof. The location of the depth measurement will be at the discretion of the ARCHITECT.
  2. Compaction - Testing procedures shall conform to AASHTO T-180, Method D, and to current FDOT Specifications. Field density tests (AASHTO T-180) shall be performed each 300 lf per lift at staggered locations. Minimum acceptable density shall be 98%.





## Specifications

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B. Defective Work

1. Thickness - Measurements of base course thickness will be made to the nearest 1/4 inch. Depths may be 2 inches less than the thickness indicated on the Plans provided that the average of all measurements taken at regular intervals shall be equal to or greater than the specified thickness. In determining the average in place thickness, measurements which are more than 2 inches in excess of the thickness indicated on the Plans will be considered as the specified thickness plus 2 inches.

Locations of the depth measurements will be as specified herein unless otherwise directed by the ARCHITECT. Sections found to be deficient in depth shall be corrected by the Installer using methods approved by the ARCHITECT.

Failed compaction tests shall be retested upon re-compaction by Installer. Re-testing and re-compaction shall be at the Installer's expense.

END OF SECTION 31 22 30



## Specifications

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### 31 22 42 - STABILIZED SUBGRADE

#### PART 1 - GENERAL

##### 1.1 SECTION INCLUDES

- A. Stabilization of roadway subgrade where indicated on the Drawings. Construction shall be to the uniformity, density and bearing ratio specified hereinafter. Roadways and street shall be stabilized to the depths and dimensions indicated on the Drawings or as required by the Municipality.
- B. Definitions: The stabilizing shall be FDOT Type B as described hereinafter. The required bearing ratio value shall be obtained either by constructing the subgrade or selected materials from the roadway and borrow area(s), or by stabilizing the subgrade material by the addition and mixing in of suitable stabilizing material. Such work shall be done in accordance with these Specifications, lines, grades, thicknesses and notes shown on the Drawings.

##### 1.2 RELATED SECTIONS

- A. Section 312110 - Site Clearing
- B. Section 312211 - Rough Grading.
- C. Section 312222 - Excavation.
- D. Section 312231 - Base Course
- E. Section 321216 - Asphaltic Concrete Surface Course

##### 1.3 REFERENCE

- A. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

##### 1.4 SUBMITTALS

- A. Submit mix design and materials mix ratio that will achieve specified requirements.
- B. Submit mix design and results of site testing to regulatory agency, Owner and Architect.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. When the utilization of materials from an existing base is called for, (as all, or a portion, of the stabilizing additives) the Architect will direct the locations, placing and distribution of such materials, and this work shall be done prior to the spreading of any additional commercial or local materials. The utilization of materials from an existing base may be called for in combination with the designated type of stabilizing.
- B. Materials which are designated as Commercial Materials which are to be used for this stabilizing may be either commercial limerock, limerock overburden or crushed shell.
- C. Limerock and limerock overburden: For limerock and limerock overburden,, the percentage of carbonates of calcium and magnesium shall be at least 70, and the plasticity index shall not exceed 10. The gradation of both commercial limerock and limerock overburden shall be such that 97 percent of these materials will pass a 1-1/2 inch sieve.

## Specifications

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- D. Crushed shell for this use shall be mollusk shell (i.e., oysters, mussels, clams, cemented coquina, etc.). Steamed shell will not be permitted. Crushed shell shall meet the following requirements:
- At least 97 percent by weight of the total material shall pass a 1-inch screen and at least 50 percent by Weight of the total material shall be retained on the No. 4 sieve.
  - Not more than 7.5 percent by weight of the total material shall pass the No. 200 sieve. The determination of the percentage passing the No. 200 sieve shall be made by washing the material over the sieve.
  - In the event that the shell meets the above requirements without crushing, crushing will not be required.
- E. Local materials used for this stabilizing may be high-bearing-value soils or sand-clay material. The material passing the 40-mesh sieve shall have a liquid limit not greater than 30 and a plasticity index not greater than 10.
- F. No blending of materials to meet these requirements will be permitted unless authorized by the Architect. When blending is permitted, the blended material shall be tested and approved before being spread on the roadway.

### 2.2 EQUIPMENT

- A. Mixing shall be done with rotary tillers or other equipment meeting the approval of the Architect.

### 2.3 TYPE B STABILIZATION

- A. The type of materials, Commercial or Local, shall be at the Installer's option.
- B. No separate payment for stabilizing materials will be made.
- C. Bearing Value determination will be made by the Limerock Bearing Ratio Method.
- D. Under this method, it shall be the Installer's responsibility that the finished roadbed section meets the bearing value requirements, regardless of the quantity of stabilizing materials necessary to be added. Full payment will be made for any areas where the existing sub-grade materials meet the design bearing value requirements without the addition of stabilizing additives, as well as areas where the Installer may elect to place select high-bearing materials from other sources within the limits of the stabilizing.
- E. After the roadbed grading operations have been substantially completed, the Installer shall make his own determination as to the quantity (if any) of stabilizing material, of the type selected by him, necessary for compliance with the bearing value requirements. The Installer shall notify the Architect of the approximate quantity to be added, and the spreading and mixing in of such quantity of materials shall meet the approval of the Architect as to uniformity and effectiveness.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify fill materials to be reused are acceptable.

## Specifications

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### 3.2 PREPARATION

- A. Prior to the beginning of stabilizing operations, the area to be stabilized shall have been constructed to an elevation such that upon completion of stabilizing operations the completed stabilized subgrade will conform to the lines, grades and cross section shown in the plans. Prior to the spreading of any additive stabilizing material, the surface of the roadbed shall be brought to a plane approximately parallel to the plane of the proposed finished surface.
- B. The subgrade to be stabilized may be processed in one course, unless the equipment and methods being used do not provide the required uniformity, particle size limitation, compaction, and other desired results, in which case, the Architect will direct that the processing be done in more than one course.

### 3.3 APPLICATION

- A. Stabilizing materials where required, shall be spread uniformly over the area to be stabilized.
- B. When materials from an existing base are to be utilized in the stabilization of an area, all of such materials shall be placed and spread prior to the addition of other stabilizing additives.
- C. Commercial stabilizing material shall be spread by the use of mechanical material spreaders except that where use of such equipment is not practicable other means of spreading may be used, but only upon written approval of the proposed alternate method.

### 3.4 MIXING

- A. The mixing shall be done with rotary tillers, or other equipment meeting the approval of the Architect. The area to be stabilized shall be thoroughly mixed throughout the entire depth and width of the stabilizing limits.
- B. The mixing operations, as specified, will be required regardless of whether the existing soil, or any select soils placed within the limits of the stabilized sections, have the required bearing value without the addition of stabilizing materials.
- C. As an exception to the above mixing requirements, when the subgrade is of rock, the Architect may direct that the mixing operations (and the work of stabilization) be waived and no payment for stabilization will be made for such sections of the roadway.
- D. Maximum Particle Size of Mixed Materials: At the completion of mixing, all particles of material within the limits of the area to be stabilized shall pass a 3-1/2 inch ring. Any particles not meeting this requirement shall be removed from the stabilized area or shall be broken down so as to meet this requirement.
- E. Compaction: After the mixing operations have been completed and requirements for bearing value, uniformity and particle size have been satisfied, the stabilized areas shall be compacted, in accordance with Paragraph hereinafter. The materials shall be compacted at a moisture content permitting the specified compaction. If the moisture content of the material is improper for attaining the specified density, either water shall be added or the material shall be permitted to dry until the proper moisture content for the specified compaction is reached.
- F. Finish Grading: The completed stabilized subgrade shall be shaped to conform with the finished lines, grades and cross-section indicated in the Drawings. The subgrade shall be checked by the use of elevation stakes, or other means approved by the Architect.
- G. After the stabilizing and compacting operations have been completed, the subgrade shall be firm and substantially unyielding, to the extent that it will support construction equipment and will have the bearing value required by the Drawings.

## Specifications

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- H. All soft and yielding material, and any other portions of the subgrade which will not compact readily, shall be removed and replaced with suitable material and the whole subgrade brought to line and grade, with proper allowance for subsequent compaction.

### 3.5 MAINTENANCE

- A. After the subgrade has been completed as specified above, the Installer shall maintain it free from ruts, depressions and any damage resulting from the hauling or handling of materials, equipment, tools, etc. It shall be the Installer's responsibility to maintain the required density until the subsequent base or pavement is in place. Such responsibility shall include any repairs, replacement, etc., of curb and gutter, sidewalk, etc., which might become necessary in order to recompact the subgrade in the event of underwash or other damage occurring to the previously compacted subgrade. Any such work required for recompaction shall be at the Installer's expense. Ditches and drains shall be constructed and maintained along the completed subgrade section.

### 3.6 FIELD QUALITY CONTROL

- A. Bearing value samples will be obtained and tested by the Installer at completion of satisfactory mixing of the stabilized area. For any area where the bearing value obtained is deficient from the value indicated in the Drawings, in excess of the tolerances established herein, additional stabilizing material shall be spread and mixed in accordance with 3.4 A and B. This reprocessing shall be done for the full width of the roadway being stabilized and longitudinally for a distance of 50 feet beyond the limits of the area in which the bearing is deficient.
- B. Tolerances in Bearing Value Requirements: The following under tolerances from the specified bearing value will be allowed as based on tests performed on samples obtained after mixing operations have been completed:

<u>Specified Bearing Value</u>		<u>Under tolerances</u>
LBR	40	5.0

- C. Within the entire limits of the width and depth of the areas to be stabilized, the minimum density acceptable at any location will be 98 percent of the maximum density as determined by AASHTO T180, Test Method D.

END OF SECTION 31 22 42

## **31 22 80 - EROSION AND SEDIMENTATION CONTROL**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. Provision of hay bales, siltation fence, stones, structures, settling and filtration basins as required to protect onsite work and improvements as well as prevention of damage and pollution of adjacent properties.
- B. Maintenance and repair of properties due to damage from weather or construction operations.
- C. Maintenance and repair of erosion and sedimentation control structures and devices during the construction contract period.

#### **1.2 RELATED SECTIONS**

- A. Section 312222 - Excavation
- B. Section 334100 - Site Storm Sewerage Systems

#### **1.3 REFERENCES**

- A. Construction permit conditions for Environmental Resource Permit.
- B. Local ordinances and construction permit conditions.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

Materials shall conform to Section 104, Prevention, Control, and Abatement of Erosion and Water Pollution of the FDOT Standard Specifications for Road and Bridge Construction, latest edition.

### **PART 3 - EXECUTION**

- A. Determine the location and extent of installation of protection measures and install prior to commencing any work item in a manner to comply with permit requirements and local ordinances.
- B. Maintain and restore protection measures as required after storms or work which damages or reduces the capacity of the protection system.

END OF SECTION 31 22 80





## 32 12 16 - ASPHALTIC CONCRETE SURFACE COURSE

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Asphaltic concrete surface course composed of a mixture of aggregates, mineral filler and asphalt cement properly laid upon a prepared base, or a newly constructed binder course, in accordance with these specifications and in conformity with the lines, grades, thickness and typical cross section shown on the Drawings. Asphaltic concrete pavement for around drain inlets and catch basins shall conform to the following provisions, except placing material may be by hand methods.

#### 1.2 QUALITY ASSURANCE

- A. Laboratory analysis by a Certified Testing Laboratory on all materials shall be complete and the materials accepted by the Architect prior to placement.

#### 1.3 RELATED SECTIONS

- A. Section 312211 - Rough Grading.
- B. Section 312230 - Base Course
- C. Section 312242 - Stabilized Subgrade

#### 1.4 REFERENCES

- A. Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Paving: FDOT S-111.

#### 1.6 QUALITY ASSURANCE

- A. Perform work in accordance with Florida Department of Transportation Standard Specifications.
- B. Mixing Plant: Conform to Florida Department of Transportation requirements for Plant Methods.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Florida Department of Transportation Specifications.

#### 2.2 SOURCE QUALITY CONTROL

- A. Testing: All materials shipped to the asphalt plant will be sampled at their destination and materials not meeting the requirements of these Specifications will be rejected.
- B. Stability of Mix: As specified by Florida Department of Transportation Specifications.
- C. Size and Percentage of Aggregate:
  - 1. Florida Department of Transportation Specifications.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Verify base conditions.
- B. Verify that stabilized subgrade is ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.

**3.2 BASE COURSE**

- A. Section 312230 - Base Course forms the base construction for work of this Section.

**3.3 PREPARATION - PRIMER**

- A. Apply primer in accordance with regulatory requirements and in accordance with Section 300 of the Florida Department of Transportation Specifications.

**3.4 PREPARATION OF APPLICATION SURFACES**

- A. Prior to the laying of the mixture, the surface of the base or pavement to be covered shall be cleaned of all loose and deleterious material by the use of power brooms or blowers, supplemented by hand brooming where necessary.
- B. Where a surface course is constructed on an existing pavement or old base which is irregular, and wherever so indicated on the Drawing, the existing surface shall be brought to proper grade and cross section by the application of patching or leveling courses.
- C. Where a surface course is to be placed over a newly constructed surface treatment, all loose material shall be swept from the paving area and disposed of by the Installer.
- D. All structures which will be in actual contact with the asphalt mixture, with the exception of the vertical faces of existing pavements and curbs or curb and gutter, shall be painted with a uniform coating of asphalt cement (tack coat) to provide a closely bonded, watertight joint.
- E. Tack Coat:
  - 1. Tack Coat Required: A tack coat will be required on the following surfaces:
    - a. Between successive surface courses
    - b. Between successive leveling courses
    - c. Between the leveling and surface courses
    - d. Old pavements to be patched or leveled
  - 2. Tack Coat at Architect's Option: A tack coat will be required on the following surfaces only when so directed by the Architect.
    - a. Freshly primed bases
    - b. Surface treatment

**3.5 PLACING MIXTURE**

- A. Construction of the Asphaltic Concrete shall be in accordance with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

**3.6 COMPACTING MIXTURE**

- A. Construction of the Asphaltic Concrete shall be in accordance with Florida Department of Transportation Specifications.

**3.7 TESTING**

- A. Testing of the asphaltic concrete shall be in accordance with Florida Department of Transportation Specifications.

**3.8 FIELD QUALITY CONTROL**

- A. For the purpose of testing the finished surface, a 10 foot straightedge and a standard template cut to the true cross section of the road shall at all times be available on the work. The Construction Manager shall provide or designate some employee whose duty it is to handle the straightedge and template in checking all rolled surfaces, under the direction of the Architect.
- B. The finished surface shall be such that it will not vary more than 1/4 inch from the template cut to the cross section of the road, nor more than 1/4 inch from the 10 foot straightedge applied parallel to the centerline of the pavement. Any irregularity of the surface exceeding the above limits shall be corrected. Depressions which may develop after the initial rolling shall be remedied by loosening or removing the mixture and adding new material to bring the areas to a true surface. No skin patching shall be done. Such portions of the completed pavement as are defective in surface compaction or in composition, or that do not comply with all other requirements of these Specifications, shall be taken up and replaced with suitable mixture, properly laid in accordance with these Specifications and at the expense of the Installer.
- C. Thickness Requirements: The thickness of the asphaltic concrete surface course shall be not less than that shown on the Drawings as determined by coring. Any surface course found to be less than thickness shown shall be removed and replaced.
- D. Protection of Pavement: After the completion of the pavement, no vehicular traffic of any kind shall be permitted on the pavement until it has set sufficiently to prevent rutting or other distortion.

END OF SECTION 32 12 16



## **32 25 12 - PAVEMENT MARKING AND ACCESSORIES**

### **PART 1 - GENERAL**

- A. This division of the specifications includes furnishing all labor, materials, services, equipment and appliances required for pavement marking and accessory work indicated on the drawings. All construction shall be in accordance with the requirements of the governing municipality. In the event there is a conflict between these specifications and the requirements of the governing municipality, specifications of the municipality shall prevail.

### **PART 2 - MATERIALS**

#### **2.1 WHEEL STOPS**

Precast concrete, in accordance with the detailed cross section in the plans, or the governing municipality.

#### **2.2 STRIPING**

- A. All stop bars, stop pavement markings, and arrows are to be painted white. Handicap striping and signs to be done according to detail on plans and according to State and ADA Standards. All other lines and marking are to be painted white. Instead of painted striping, a thermo plastic alternate may be used. All curbing to be left without paint. Installer to verify with Owner or his representative.
- B. All pavement striping is to comply with both the Manual on Uniform Traffic Control Devices and Section 710, Painting Traffic Stripes, of the latest edition of FDOT Standard Specification for Road and Bridge Construction.

#### **2.3 SIGNAGE**

All signage to be in conformance with the Manual on Uniform Traffic Control Devices.

### **PART 3 - METHOD OF CONSTRUCTION**

#### **3.1 INSTALLATION**

- A. Install wheel stops in parking locations and in accordance with the details shown on the site plan drawings.
- B. Countersink 12" steel dowels to a point  $\frac{1}{2}$ " to  $\frac{3}{4}$ " below the top surface of the wheel stop and set in such a manner as to avoid chipping or cracking the concrete during installation.

END OF SECTION 32 25 12





## Specifications

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### 32 31 13.53 - HIGH-SECURITY CHAIN LINK FENCES AND GATES

#### PART 1 GENERAL

##### 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

##### ASTM INTERNATIONAL (ASTM)

ASTM A116	(2011) Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
ASTM A392	(2011a) Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A491	(2011) Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric
ASTM A780/A780M	(2009) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM C94/C94M	(2013) Standard Specification for Ready-Mixed Concrete
ASTM F1083	(2010) Standard Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, for Fence Structures
ASTM F1184	(2005; R 2010) Industrial and Commercial Horizontal Slide Gates
ASTM F567	(2011a) Standard Practice for Installation of Chain Link Fence
ASTM F626	(2008; R 2013) Standard Specification for Fence Fittings
ASTM F900	(2011) Industrial and Commercial Swing Gates

##### 1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

##### SD-02 Shop Drawings

Fence Installation Drawings  
Location of gate, corner, end, and pull posts  
Gate Assembly  
Gate Hardware and Accessories

##### SD-03 Product Data

Fence  
Gate Assembly  
Gate Hardware and Accessories

##### SD-04 Samples

## Specifications

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Fabric  
Gate Hardware and Accessories

SD-06 Test Reports  
Zinc coating  
Aluminum alloy coating

SD-07 Certificates

Chain Link Fence Reports  
Zinc Coating  
Aluminum alloy coating

SD-08 Manufacturer's Instructions

Fence Installation  
Gate Assembly Hardware  
Assembly Accessories

SD-10 Operation and Maintenance Data

Operating and Maintenance instructions

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Required Report Data

Submit reports, signed by an official authorized to certify on behalf of the manufacturer, of chain-link fencing listing and accessories regarding weight in ounces for zinc coating, thickness of PVC coating, and chemical composition and thickness of aluminum alloy coating.

#### 1.3.2 Assembly and Installation Drawings

Submit Manufacturer's instructions and complete Fence Installation Drawings for review and approval by the Contracting Officer prior to shipment.

Drawing details shall include, but are not limited to: Fence Installation, Location of gate, corner, end, and pull posts, Gate Assembly, Turnstiles, and Gate Hardware and Accessories.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

## PART 2 PRODUCTS

### 2.1 FENCE FABRIC

#### 2.1.1 General

Provide ASTM A392, Class 2, zinc-coated steel wire with minimum coating weight of 2.0 ounces of zinc per square foot of coated surface, ASTM A491, Type I, aluminum-coated steel wire. Fabricate fence fabric of 9 gauge wire mesh conforming to ASTM A116. Set fabric height as shown. Secure fabric to posts using manufacturer's brackets. Install fabric on opposite side of posts from area being secured.



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**Specifications**

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**2.1.2 Security Mesh**

Infill panels to be welded wire at 3 inch by 1/2 inch spacing.

**2.2 POSTS****2.2.1 Metal Posts for Fence**

- a. Diameter as shown on drawing.

**2.2.2 Accessories**

- a. Provide accessories conforming to ASTM F626. Ferrous accessories shall be zinc or aluminum coated.
- b. Furnish rail attachments and brackets of stainless steel with stainless steel fasteners.
- c. Furnish post caps in accordance with manufacturer's standard accessories.

**2.3 BRACES AND RAILS**

- a. Diameter as shown on drawings.

**2.4 CONCRETE**

- a. For post footings: ASTM C94/C94M, using 3/4 inch maximum size aggregate, and having minimum compressive strength of 3000 psi at 28 days. Grout shall consist of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.
- b. For continuous grade beam: Concrete Slurry

**2.5 GATES****2.5.1 Gate Assembly**

Provide gate assembly conforming to ASTM F900 and/or ASTM F1184 of the type and swing shown. Provide gate frames conforming to strength and coating requirements of ASTM F1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Provide gate frames conforming to strength and coating requirements of ASTM F1043, for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size (NPS) 1-1/2. Gate fabric shall be as specified for fence fabric.

**2.5.2 Gate Leaves**

For gate leaves, more than 8 feet wide, provide either intermediate members and diagonal truss rods or tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8 feet wide shall have truss rods or intermediate braces. Provide intermediate braces on all gate frames with an electro-mechanical lock. Attach fabric to the gate frame by method standard with the manufacturer except that welding will not be permitted.

**2.5.3 Gate Hardware and Accessories**

Submit manufacturer's catalog data. Furnish and install latches, hinges, stops, keepers, rollers, and other hardware items as required for the operation of the gate. Arrange latches for padlocking so that the padlock will be accessible from both sides of the gate. Provide stops for holding the gates in the open position. For high security applications, each end member of gate frames shall be extended sufficiently above the top

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**Specifications**

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member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.

**2.5.4 PRE-HUNG PEDESTRIAN GATE**

Tymetal 2150 Pedestrian Swing gate or equal. Stand alone frame is independent of the fence system. ¼" x 2" mesh woven rod infill. Prepare jamb for type 50, surface mounted detention electro mechanical lock provided by the Detention Lock contractor. Refer to section 11 19 53. Prepare jamb for flush mounted detention grade intercom stations to include factory installed internal conduit and backboxes. Provide with closer and door position switch. After fabrication, gate and frame are to be galvanized.

**PART 3 EXECUTION****3.1 FENCE INSTALLATION**

Perform complete installation conforming to ASTM F567 and refer to drawings.

**3.1.1 Line and Grade**

Clear the area on either side of the fence line to the extent indicated. Space line posts equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Provide fabric continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet. Repair any damage to galvanized surfaces, including welding, with paint containing zinc dust in accordance with ASTM A780/A780M.

**3.1.2 Excavation**

Clear all post holes of loose material. Spread waste material where directed. Eliminate ground surface irregularities along the fence line to the extent necessary to maintain a 1 inch clearance between the bottom of the fabric and finish grade.

**3.2 POST INSTALLATION****3.2.1 Earth**

- a. Set posts plumb and in alignment. Set posts in concrete to the depth indicated on the drawings.
- b. Posts set in concrete shall be set in holes not less than the diameter shown on the drawings. Thoroughly consolidate concrete and grout around each post, free of voids and finished to form a dome. Allow concrete and grout to cure for 72 hours prior to attachment of any item to the posts.
- c. Test fence post rigidity by applying a 50 pound force on the post, perpendicular to the fabric, at 5 feet above ground. Post movement measured at the point where the force is applied shall be less than or equal to 3/4 inch from the relaxed position. Test every tenth post for rigidity. When a post fails this test, make further tests on the next four posts on either side of the failed post. All failed posts shall be removed, replaced, and retested at the Contractor's expense.

**3.2.2 Concrete Slabs and Grade beam**

See concrete paving section.

**3.3 RAILS**

Bolt bottom rail to double rail ends and securely fasten double rail ends to the posts. Peen bolts to prevent easy removal. Install bottom rail before mesh fabric.

**3.4 FABRIC INSTALLATION**

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**Specifications**

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- a. Install mesh fabric on the side of the post indicated. Attach fabric to terminal posts with stretcher bars and tension bands. Space bands at approximately 15 inch intervals. Install fabric and pull taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fasten fabric to line posts at approximately 15 inch intervals and fastened to all rails and tension wires at approximately 12 inch intervals.
- b. Cut fabric by untwisting and removing pickets. Accomplish splicing by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 1 plus or minus 1/2 inch above the ground.
- c. After the fabric installation is complete, exercise the fabric by applying a 50 pound push-pull force at the center of the fabric between posts; the use of a 30 pound pull at the center of the panel shall cause fabric deflection of not more than 2.5 inches when pulling fabric from the post side of the fence; every second fence panel shall meet this requirement; resecure and retest all failed panels at the Contractor's expense.

**3.5 GATE INSTALLATION**

- a. Install gates at the locations shown. Mount gates to swing as indicated. Install latches, stops, and keepers as required. Install gates as recommended by the manufacturer.
- b. Weld or otherwise secure hinge pins, and hardware assembly to prevent removal.

**3.6 CLEANUP**

Remove waste fencing materials and other debris from the work site each workday.

-- End of Section --



## **33 41 00 - SITE STORM SEWERAGE SYSTEMS**

### **PART 1 - GENERAL**

#### **1.1 SECTION INCLUDES**

- A. The work covered and described in this Section includes the furnishing and construction of culverts, storm sewers, inlets and other drainage structures as shown on the Drawings and specified herein.

#### **1.2 RELATED WORK**

- A. Section 312222 - Excavation

#### **1.3 SUBMITTALS**

- A. Shop Drawings: Shop drawings for the following items shall be submitted for approval.
  - 1. Grates and castings
  - 2. Precast structures.
- B. Pipe certification of quality by producer shall be delivered to Architect ten days prior to installation.

#### **1.4 JOB CONDITIONS**

- A. Existing Drainage System: Maintain operational, prevent siltation.
- B. Cleanup: Maintain surface grade within 400 feet of pipe laying operation.

#### **1.5 REFERENCES**

- A. AASHTO T-180 - Moisture-Density Relations of soils using a 10-lb (4.54 kg) Rammer and an 18-inch (457 mm) drop.
- B. ANSI/ASTM D698 - Test Methods for Moisture-Density Relations of soils and Soil-Aggregate Mixtures, using 5.5 lb. (2.49 kg) Rammer and 2-inch (304.8 mm) drop.
- C. ANSI/ASTM D1557 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 10 lb. (4.54 kg) Rammer and 18-inch (457 mm) drop.
- D. ASTM D2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- E. ASTM D3017 - Test Methods for Moisture Content of soil and Soil-Aggregate Mixtures.

#### **1.6 DEFINITIONS**

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

#### **1.7 PROJECT DOCUMENTS**

- A. Accurately record actual locations of pipe runs, connections, catch basins, cleanouts and invert elevations, and structure top elevations.

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**Specifications**

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**PART 2 - PRODUCTS****2.1 MATERIALS**

- A. Concrete Pipe: Concrete pipe shall be reinforced concrete culvert pipe conforming to ASTM Designation C 76, Table III, except when otherwise indicated. Reinforced concrete horizontal elliptical pipe shall conform to the requirements of ASTM Designation C 507, Class HE III. Pipe joints shall be rubber gasket joints and the pipe joint shall be manufactured to meet the requirements of the approved type of gasket to be used. Pipe joints and rubber gaskets shall conform to the requirements of Sections 94I and 942 of the FDOT Standard Specifications.
- B. Polyvinyl-Chloride Pipe: Polyvinyl chloride pipe shall be in accordance with Section 948 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.
- C. Brick: Brick for drainage structures shall be dense, hard burned, shale or clay brick conforming to ASTM Designation C 32, Grade MM or C 62, Grade MW, except that brick absorption shall be between five and twenty-five grams of water absorbed in one minute by dried brick, flat face down, in 1/8-inch of water.
- D. Cement Mortar: Cement mortar for manhole construction shall be one part cement and two parts clean sharp sand to which may be added lime in the amount of not over twenty-five percent volume of cement. It shall be mixed dry and then wetted to proper consistency for use. No mortars that have stood for more than one hour shall be used.
- E. Concrete: Concrete shall conform to the requirements of the Technical Specification for Concrete and unless otherwise specified all concrete shall be Class B.
- F. Precast Concrete Units: Precast concrete inlets shall conform to applicable requirements of the Technical Specification for Concrete. Concrete for use in precast units shall be Class A.
- G. Castings: Castings for inlets and other items shall conform to the ASTM Designation A 48, Class 25. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength or otherwise make them unfit for the service intended. No plugging or filling will be allowed. Casting patterns shall conform to those shown or indicated on the drawings.
- H. Plastic Filter Fabric: Plastic filter fabric shall conform to Section 985 of the FDOT Standard Specifications. Carthage Mills Filter X is an acceptable plastic filter fabric.

**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Verify that trench and bedding have been prepared to receive work and that excavations and dimensions are as indicated on drawings.

**3.2 PREPARATION**

- A. Pipe trenches shall be of necessary widths for the proper laying of the pipe and the banks shall be as nearly vertical as practicable. In paved areas, the trench shall be vertical and sheeted, if required; the clearance between the pipe and trench wall or back of sheeting shall not exceed 18-inches. The bottom of the trenches shall be excavated to a depth of the outside bottom of the pipe barrel. Any over excavation shall be replaced with suitable compacted material. Excavation for inlets and other appurtenances shall be sufficient to provide a clearance between their outer vertical surfaces and the face of the excavation or sheeting, if used, of not less than 12 inches.

**Specifications**

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- B. Soft, spongy, or otherwise unstable material encountered below the established grade of the excavation which will not provide a firm foundation for subsequent work shall be removed and replaced as directed. Unless otherwise directed, all such unstable materials shall be removed for the full width of the excavation and replaced with approved fill materials.
- C. Where sheeting and bracing are necessary to prevent caving of the trench sidewalls or sidewalls of excavation for other structures and to safeguard the workmen, the trench or excavation for other structures shall be dug to such width that the proper allowance is made for the space occupied by the sheeting and bracing to provide clearance as specified above.

**3.3 INSTALLATION**

- A. All pipe shall be carefully laid true to the line and grade shown on the drawings. Any
- B. deviation from true alignment or grade which would result in a displacement from the normal position of the gasket of as much as 1/4-inch or which would produce a gap exceeding 1/2-inch between sections of pipe for more than 1/3 of the circumference or the inside of the pipe, will not be acceptable and where such occurs, the pipe shall be relayed without additional compensation. No mortar, joint compound or other filler which would tend to restrict the flexibility of the basket joint shall be applied to the gap. Pipes having defects that have not caused their rejection are to be so laid that these defects will be in the upper half of the sewer.
- C. Before installation of the pipe gasket, the gasket and the surface of the pipe joint, including the gasket recess shall be clean and free from grit, dirt, or other foreign matter at the time the joints are made. In order to facilitate closure of the joint, application of an approved vegetable soap lubricant immediately prior to closing of the joint will be permitted.
- D. All pipes shall be laid with bells or grooves uphill. As the pipes are laid throughout the work, they must be thoroughly cleaned and protected from dirt and water. No length of pipe shall be laid until the two preceding lengths have been thoroughly embedded in place so as to prevent any movement or disturbance of the finished joint. No walking on or working over the pipes after they are laid, except as may be necessary in tamping earth and refilling, will be permitted until they are covered to a depth of 1 foot. No pipe shall be laid except in the presence of the authorized inspector. Fill placed around the pipe shall be deposited on both sides simultaneously to approximately the same elevation and uniformly compacted. Whenever the pipe laying is discontinued, as at night, the unfinished end is to be securely protected from displacement due to caving of the banks or from other injury and a suitable stopper is to be inserted therein.
- E. Fill placed around the pipe shall be deposited on both sides simultaneously to approximately the same elevation and uniformly compacted. Whenever the pipe laying is discontinued, as at night, the unfinished end is to be securely protected from displacement due to caving of the banks or from other injury and a suitable stopper is to be inserted therein.
- F. Concrete inlets or other structures shall be constructed in conformity with the drawings. Forms shall be designed and constructed so that they may be removed without injury to the concrete and shall be left in place for at least 24 hours after concrete is poured. Concrete shall be thoroughly tamped and shall be cured for at least 5 days after removal of forms. Honeycomb places shall be thoroughly cleaned, saturated with water and pointed up with mortar. Precast inlets or other structures may be used in lieu of cast-in-place structures. Grates are to be set in place in mortar to the proper line and grade.

**Specifications**

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- G. After the pipe has been installed, approved selected material from excavation at a moisture content which will facilitate compaction shall be placed along side the pipe in layers not exceeding 6-inches loose measure in depth. Care shall be taken to insure thorough compaction of the fill under the haunches of the pipe. Each layer shall be thoroughly compacted by rolling or tamping with mechanical rammers. This method of filling and compacting shall be continued until the fill is 2-inches above the pipe, then the remainder of the backfill shall be placed in lifts not exceeding 9-inches. The operation of heavy equipment shall be conducted so that no damage to the pipe will result. Backfill material 12-inches and above the top of the pipe shall be compacted to not less than 95 percent of maximum density as determined by AASHTO Designation T-180, unless in public right-of-way; in which case it should be compacted to 100% maximum density. Selected material for backfill shall not contain any stones or rock larger than 3-inches. Tests for density of compaction shall be provided at one (1) test per every 300 feet of pipe laid, for each lift, and deficiencies shall be corrected by the Construction Manager without additional cost to the Owner.
- H. Backfill for drainage structures shall be placed and compacted in the same manner as specified above for pipe, except the concrete shall be permitted to cure for not less than five days before the backfill is placed.

END OF SECTION 33 41 00