



State of Utah

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GARY R. HERBERT
Lieutenant Governor

Department of Administrative Services

KIMBERLY K. HOOD
Executive Director

Division of Facilities Construction and Management

DAVID G. BUXTON
Director

ADDENDUM #2

Date: September 11, 2007

To: Contractors

From: Michael Ambre, Project Manager, DFCM

Reference: North Salt Lake Driver License Remodel
Department of Public Safety – North Salt Lake, Utah
DFCM Project No.07009370

Subject: Addendum No. 2

Pages	Addendum	1	page
	Revised Project Schedule	1	page
	Architects Addendum	117	pages
	Total	119	pages

Note: This Addendum shall be included as part of the Contract Documents. Items in this Addendum apply to all drawings and specification sections whether referenced or not involving the portion of the work added, deleted, modified, or otherwise addressed in the Addendum. Acknowledge receipt of this Addendum in the space provided on the Bid Form. Failure to do so may subject the Bidder to Disqualification.

- 1.1 **SCHEDULE CHANGES** – There has been a change to the Project Schedule. The bid date has been changed to Thursday, September 20, 2007 at 2:30 PM.
- 1.2 **GENERAL** – Axis Architects, Specifications and drawings.

End of Addendum #2



Stage II
PROJECT SCHEDULE – REVISED PER
ADDENDUM NO. 2 ISSUED SEPTEMBER 11, 2007

PROJECT NAME: NORTH SALT LAKE DRIVER LICENSE REMODEL				
DEPARTMENT OF PUBLIC SAFETY – NORTH SALT LAKE, UTAH				
DFCM PROJECT #: 07009370				
Event	Day	Date	Time	Place
Stage II Bidding Documents Available	Thursday	July 26, 2007	12:00 NOON	DFCM 4110 State Office Building SLC, UT and the DFCM web site*
Mandatory Pre-bid Site Meeting	Wednesday	August 1, 2007	10:00 AM	Conference Center (Bldg #33) Utah State Fairpark Salt Lake City, UT **
Deadline for Submitting Questions	Wednesday	August 15, 2007	12:00 NOON	Mike Ambre – DFCM E-mail mambre@utah.gov
Addendum Deadline (exception for bid delays)	Wednesday	August 22, 2007	12:00 NOON	DFCM web site*
Prime Contractors Turn in Bid and Bid Bond	Thursday	September 20, 2007	2:30 PM	DFCM 4110 State Office Building SLC, UT
Subcontractors List Due	Friday	September 21, 2007	2:30 PM	DFCM 4110 State Office Building SLC, UT Fax 801-538-3677
Substantial Completion Date	Friday	April 11, 2008	5:00 PM	

* **NOTE: DFCM's web site address is <http://dfcm.utah.gov>**

** <http://www.utah-state-fair.com/pn/index.php?module=Pagesetter&func=viewpub&tid=3&pid=113>

DFCM Driver License Office

Addendum 2

1. Drawings:

- 1.1 GI101: Modified Code Analysis indicating proper Applicable Codes and a revised occupancy analysis considering the waiting area as an Assembly occupancy and indicating the need for an Automatic Sprinkler System (see Specifications below).
- 1.2 AD101: Added requirement to remove the existing ceiling in the unoccupied area west of the separating wall for installation of the Automatic Sprinkler System.
- 1.3 AE101: Modified Keynote 10B to include an 18” vertical grab bar with the 42” horizontal grab bar where indicated (see B1/AE101 & C1/AE101).
- 1.4 AE101: A5/AE101 modified to show: striping requirements for the ADA parking stalls and an accessible route from the ADA parking stalls to the main entry.
- 1.5 AE101: Indications of locations for ADA accessible service counter and testing station with detail callouts for ADA requirements. Note to bidders: service counters and testing stations are Not In Contract and so, will be furnished by the owner.
- 1.6 AE111: The requirement for new Acoustical Ceiling to be installed after installation of the Automatic Sprinkler System is added west of the ‘center’ dividing wall.
- 1.7 AE111: The requirement to coordinate installation of the new Acoustical Ceiling in areas with existing hard ceilings and allow for patching and repairing as necessary is added.
- 1.8 AE401: Modified Keynote 10B to include an 18” vertical grab bar with the 42” horizontal grab bar where indicated (see B3/AE401 & C3/AE401).
- 1.9 AE401: A2/AE401 – Modified layout of ramp and stairs as indicated.
- 1.10 ME-501: See the attached ME-501-R1.
- 1.11 E201: Note added to all emergency lighting fixtures to connect battery packs to un-switched circuit.
- 1.12 E201: Mounting elevations added for restroom lighting fixtures.
- 1.13 E201: Additional relay circuit added for hall lighting control.

- 1.14 E201: Existing motion sensor shown for reference in east employee restroom.
- 1.15 E201: Switch location moved in electrical room.
- 1.16 E201: Note removed from down lights at main entry way.
- 1.17 E301: Power added for power operated doors at each restroom door.
- 1.18 E301: Note added to ensure that power remains to both sets of power operated doors at the main entrance.
- 1.19 E301: Notes 1 and 8 modified.
- 1.20 E301: Notes 16 and 17 added.
- 1.21 E401: Circuit added to panel J for power operated doors. Circuit breaker was previously listed as spare.
- 1.22 E401: Additional relay added to lighting control relay schedule.

2. Specifications:

- 2.1 08711-3.7 - Replace the original Hardware Schedule (08711-3.7) with the attached revised Hardware Schedule and Hardware Index.
- 2.2 13900 – Insert the attached Specification Section 13900 – Fire Protection and revise the index to include this section.
- 2.3 16001 – Replace the original Section 16001 with the attached revised Section 16001.
- 2.4 16722 – Insert the attached Specification Section 16722 – Fire Sprinkler Monitoring System and revise the index to include this section.
- Detail Book Detail IN-05 – Insert the attached Detail IN-05 into the Detail Book and revise the index to include this detail.
- Detail Book Detail IN-06 – Insert the attached Detail IN-06 into the Detail Book and revise the index to include this detail.

3. Approvals:

(Prior Approval does not exempt the manufacturer or installer from meeting Specification requirements)

Division	Manufacturer	Product	Approved
09310	Interceramic	IC Brites White 101	yes
09310	Interceramic	Bold Tones	yes
		-(price group 3)	
09310	Interceramic	Intertech Unglazed	yes
		Porcelain Mosaics	
09310	Interceramic	Ethnic Glazed Color Body	yes
		Porcelain Mosaics 12x12	
09310	Custom Building Prod.	CustomFlex Mortar	yes
09310	Custom Building Prod.	MegaLite Mortar	yes
09310	Custom Building Prod.	Prism SureColor Grout	yes
09310	Custom Building Prod.	Wall Tile Thin-Set Mortar	yes
09310	Schluter Systems	Rondec rounded edge	yes
		profile system	
09310	Schluter Systems	Dilex-HKW cove-shaped	yes
		profile system	
09130	Schluter Systems	Dilex-AHK cove-shaped	yes
		profile system	
10155	Flush Metal Partition	Toilet Compartments	yes
10155	Global Partitions	Toilet Compartments	yes

See the attached prior approval sheets for:

- MECHANICAL – DIV 15, PRIOR APPROVALS
- PRIOR APPROVAL OF MANUFACTURERS OF ELECTRICAL EQUIPMENT

4. Attachments

30x42 Sheets

Sheet GI101
Sheet AD101
Sheet AE101
Sheet AE111
Sheet AE401
Sheet E001
Sheet E101
Sheet E201
Sheet E301
Sheet E401
Sheet E501
Sheet E502

Sheet E503

8.5x11 Sheets

ME-501-R
Door Hardware Schedule
Door Index
Specification Section 13900
Revised Specification Section 16001
Specification Section 16722
Detail IN-05
Detail IN-06
Mechanical Prior Approvals
Electrical Prior Approvals

Note: This addendum shall be part of the construction documents. Items in this addendum apply to all drawing and specification sections whether referenced or not involving the portion of the work added, deleted, modified or otherwise addressed in the addendum. Acknowledge receipt of this addendum in the space provided on the bid form. Failure to do so may subject the bidder to disqualification.

End of Addendum

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ROOFTOP UNIT SCH

SYMBOL	MANUFACTURER	MODEL NO.	LOCATION	NOMINAL TONS COOLING	TOTAL CFM	MIN O.A. CFM	ESP (IN WG)	COOL SENS CAPA (ME)	
								TOTAL CAPACITY (MBH)	
RTU-1	CARRIER	48PGDC04	EAST EXTERIOR	3	1490	190	0.75	34.90	26.
RTU-2	CARRIER	48PGDC05	NORTH EXTERIOR	4	1820	610	0.75	45.13	40.
RTU-3	CARRIER	48PGDC14	WAITING	12.5	5000	1400	1.00	144.35	121.

- (1) MBH OUTPUT AT 4300 FT ELEVATION
- (2) 100% OUTSIDE AIR ECONOMIZER AND 100% CENTRIFUGAL POWER EXHAUST
- (3) PROVIDE WITH FACTORY STANDARD ROOF CURB
- (4) PROVIDE WITH FACTORY INSTALLED FUSED DISCONNECT SWITCH
- (5) PROVIDE WITH DUCT MOUNTED SMOKE DETECTORS (120V) & CONTROL RELAY FOR FAN SHUTDOWN.
- (6) RTU-3 TO BE BID AS AN ALTERNATE
- (7) ROOFTOP UNIT MUST MEET ROCKY MOUNTAIN POWER FINANSWER EXPRESS REQUIREMENTS
- (8) CONNECT TO EXISTING GAS SUPPLY.



SCHEDULE

COOLING				HEATING		ELECTRICAL				SIZE (IN)				OPERATING WEIGHT (LBS)	COMMENTS
SENSIBLE CAPACITY (MBH)	EDB (F)	EWB (F)	O.A. (F)	INPUT (MBH)	OUTPUT (1) (MBH)	VOLT	PHASE	Hz.	MCA	L	W	H			
26.87	78.6	63.8	96	90.8	61	208	3	60	25	90.0	53.9	44.5	786	(2) (3) (4) (7) (8)	
40.51	82.3	63.4	96	151.8	102	208	3	60	29	90.0	53.9	44.5	901	(2) (3) (4) (7) (8)	
121.13	81.6	63.5	96	206.8	139	208	3	60	69	102.6	63.2	52.1	1400	(2) (3) (4) (5) (6) (7) (8)	



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	PROJECT	DRIVERS LICENSE OFFICE STATE FAIR PARK	
REFERENCE:	ME501	SHEET TITLE MECHANICAL SCHEDULE	
ISSUE:	ADDENDUM		
DATE:	2007-07-31	ME-501-R1	
PROJ NO:	20070224		
DRAWN BY:	AJM	SCALE	ME-501-R1
CHECKED BY:	JTJ	1/8"=1'-0"	

HW SET: 01

DOOR NUMBER:

105 106 107 108 109 110

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	ENTRY/OFFICE LOCK	T511P6D QUA	626	FAL
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 02

DOOR NUMBER:

111

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	PANIC DEVICE	CD-17-C-NL-OP	630	MON
1	EA	RIM CYLINDER	RIM CYLINDER	626	FAL
1	EA	OFFSET DOOR PULL	8190-0	630	IVE
1	EA	SURFACE CLOSER	SC80 HD/PA	689	DOR
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 03

DOOR NUMBER:

114

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8302-0 4" X 16"	630	IVE
1	EA	SURFACE CLOSER	SC80 RW/PA OR HD/PA	689	DOR
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 03.1

DOOR NUMBER:

102 104

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PUSH PLATE	8200 6" X 16"	630	IVE
1	EA	PULL PLATE	8302-0 4" X 16"	630	IVE
1	EA	AUTO-EQUALIZER	4642	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE

1	EA	WALL STOP	WS406CCV	630	IVE
2	EA	WALL PLATE SWITCH	7910-956	630	LCN
2	EA	ESCUTCHEON	7910-972-4		LCN
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 04
DOOR NUMBER:
115

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	PASSAGE SET	T101S QUA	626	FAL
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 05
DOOR NUMBER:
103 112 116

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5	652	IVE
1	EA	STOREROOM LOCK	T581P6D QUA	626	FAL
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 06
DOOR NUMBER:
111A

EACH TO HAVE:

6	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
1	EA	MULLION	2923	600	MON
1	EA	PANIC DEVICE	CD-17-C-EO	630	MON
1	EA	PANIC DEVICE	CD-17-C-NL-OP	630	MON
1	EA	RIM CYLINDER	RIM CYLINDER	626	FAL
2	EA	OFFSET DOOR PULL	8190-0	630	IVE
2	EA	SURFACE CLOSER	SC80 HD/PA	689	DOR
2	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
2	EA	WALL STOP	WS406CCV	630	IVE
2	EA	SILENCER	SR64	GRY	IVE

HW SET: 07
DOOR NUMBER:
118

EACH TO HAVE:

3	EA	HINGE	5BB1 4.5 X 4.5 NRP	652	IVE
---	----	-------	--------------------	-----	-----

1	EA	ASYLUM LOCK	T411P6D QUA	626	FAL
1	EA	SURFACE CLOSER	SC80 HD/PA	689	DOR
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	WALL STOP	WS406CCV	630	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: AL-01
DOOR NUMBER:
100

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	112HD	628	IVE
1	EA	PANIC DEVICE	CD-17-C-EO	630	MON
1	EA	PANIC DEVICE	CD-17-C-NL-OP	630	MON
2	EA	MORTISE CYLINDER	MORTISE CYLINDER	626	FAL
1	EA	RIM CYLINDER	RIM CYLINDER	626	FAL
2	EA	OFFSET DOOR PULL	8190-0	630	IVE
1	EA	SURFACE CLOSER	SC80 HD/PA	689	DOR
1	EA	AUTO-EQUALIZER	4642	689	LCN
2	EA	WALL PLATE SWITCH	7910-956	630	LCN
2	EA	ESCUTCHEON	7910-972-4		LCN
1			THRESHOLD AND PERIMETER SEAL BY DOOR MFG		B/O

HW SET: AL-02
DOOR NUMBER:
101

EACH TO HAVE:

2	EA	CONTINUOUS HINGE	112HD	628	IVE
2	EA	PULL/PUSHBAR	9190-0	630	IVE
1	EA	SURFACE CLOSER	SC80 HD/PA	689	DOR
1	EA	AUTO-EQUALIZER	4642	689	LCN
1	EA	WALL PLATE SWITCH	7910-956	630	LCN
1	EA	ESCUTCHEON	7910-972-4		LCN
1			THRESHOLD AND PERIMETER SEAL BY DOOR MFG		B/O

Door Index

Door No	HwSet
100	AL-01
101	AL-02
102	03.1
103	05
104	03.1
105	01
106	01
107	01
108	01
109	01
110	01
111	02
111A	06
112	05
114	03
115	04
116	05
118	07

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
- B. The requirements of the following Division 15 Sections apply to this Section:
 - 1. Basic Mechanical Requirements.
 - 2. Basic Mechanical Materials and Methods.
 - 3. Supports and Anchors.

1.2 SUMMARY

- A. This Section specifies automatic sprinkler systems and standpipe and hose systems for buildings and structures. Materials and equipment specified in this Section include:
 - 1. Pipe, fittings, valves, and specialties.
 - 2. Sprinklers, fire hoses and cabinets, combination fire hose and extinguishing cabinets, and accessories.
- B. Products furnished but not installed include sprinkler head cabinet with spare sprinkler heads. Furnish to the Owner's maintenance personnel.
- C. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 2 Section "Fire Service Piping" for fire protection piping from fire service mains to a point 5 feet outside the building.
 - 2. Division 7 Section "Joint Sealers," for materials and methods for sealing pipe penetrations through basement walls and fire/smoke barriers.
 - 3. Division 10 Section "Fire Extinguishers, Cabinets, and Accessories" for fire extinguishers and extinguisher cabinets.
 - 4. Division 15 Section "Mechanical Identification" for labeling and identification of fire protection piping system and components.
 - 5. Division 15 Section "Fire Pumps" for pumps, motors, controllers, and accessories.

1.3 DEFINITIONS

- A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).
- B. Other definitions for fire protection systems are listed in NFPA Standards 13, 14, and 24.
- C. Working Plans as used in this Section means those documents (including drawings and calculations) prepared pursuant to the requirements contained in NFPA 13 for obtaining approval of the authority having jurisdiction.

1.4 SYSTEM DESCRIPTION

- A. Fire protection system is a "Wet-Pipe" system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by fire.

1.5 SUBMITTALS

- A. Product data for each type sprinkler head, valve, piping specialty, and fire protection specialty, fire department connection, hose and rack, and hose cabinet specified.
- B. Flow Test Data: Perform flow test and submit to Engineer for review prior to sprinkler system design. Engineer will provide flow rate and pressure available for piping design after review of flow test.
- C. Shop drawings prepared in accordance with NFPA 13 identified as "Working Plans," including hydraulic calculations where applicable, and which have been approved by the authority having jurisdiction.
- D. Maintenance data for each type sprinkler head, valve, piping specialty, fire protection specialty, fire department connection, hose and rack, and hose cabinet specified, for inclusion in operating and maintenance manual specified in Division 1 and Division 15 Section "Basic Mechanical Requirements."
- E. Welders' qualification certificates.
- F. Test reports and certificates including "Contractor's Material & Test Certificate for Aboveground Piping" and "Contractor's Materials & Test Certificate for Underground Piping" as described in NFPA 13.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a qualified installer. The term qualified means experienced in such work (experienced shall mean having a minimum of 5 previous projects similar in size and scope to this project), familiar with all precautions required, and has complied with all the requirements of the authority having jurisdiction. Upon request, submit evidence of such qualifications to the Architect. Refer to Division 1 Section: "Definitions and Standards" for definitions for "Installers."
- B. Qualifications for Welding Processes and Operators: Comply with the requirements of AWS D10.9, Specifications for Qualifications of Welding Procedures and Welders for Piping and Tubing, Level AR-3."
- C. Regulatory Requirements: Comply with the requirements of the following codes:
 - 1. NFPA 13 - Standard for the Installation of Sprinkler Systems.
 - 2. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems.
 - 3. NFPA 1961 - Standard for Fire Hose.
 - 4. NFPA 1963 - Screw Threads and Gaskets for Fire Hose Connections.
 - 5. UL and FM Compliance: Fire protection system materials and components shall be Underwriter's Laboratories listed and labeled, and Factory Mutual approved for the application anticipated.

1.7 SEQUENCING AND SCHEDULING

- A. Schedule rough-in installations with installations of other building components.

1.8 EXTRA MATERIALS

- A. Valve Wrenches: Furnish to Owner, 2 valve wrenches for each type of sprinkler head installed.
- B. Sprinkler Heads and Cabinets: Furnish six extra sprinkler heads of each style included in the project. Furnish each style with its own sprinkler head cabinet and special wrenches as specified in this Section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide fire protection system products from one of the following:
 - 1. Gate Valves:
 - a. Fairbanks.
 - b. Jenkins.
 - c. Kennedy Valve, Div. of ITT Grinnell Valve Co., Inc.
 - d. Stockham.
 - 2. Swing Check Valves:
 - a. Fairbanks.
 - b. Jenkins.
 - c. Kennedy Valve, Div. of ITT Grinnell Valve Co., Inc.
 - d. Star Sprinkler Corp.
 - e. Stockham.
 - 3. Grooved Mechanical Couplings:
 - a. Stockham.
 - b. Victaulic Company of America.
 - 4. Water Flow Indicators:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Star Sprinkler Corp.
 - c. Victaulic Company of America.
 - d. Viking Corp.
 - 5. Water-Motor Gongs:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Star Sprinkler Corp.
 - c. Viking Corp.
 - 6. Air-Pressure Maintenance Device, Dry-Pipe System:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Star Sprinkler Corp.
 - c. Viking Corp.
 - 7. Detector Check Valves:
 - a. Ames Company, Inc.
 - b. Kennedy Valve, Div. of ITT Grinnell Valve Co., Inc.
 - c. Victaulic Company of America.

8. Alarm Check Valve:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Star Sprinkler Corp.
 - c. Viking Corp.

9. Hose Outlet Valves:
 - a. Guardian Fire Equipment, Inc.

10. Fire Department Connection Valve:
 - a. Guardian Fire Equipment, Inc.

11. Sprinkler Heads:
 - a. Automatic Sprinkler Corp. of America.
 - b. Central Sprinkler Corp.
 - c. Firematic Sprinkler Devices, Inc.
 - d. Globe Fire Equipment Co.
 - e. Guardian Automatic Sprinkler Co., Inc.
 - f. ITT Grinnell.
 - g. Reliable Automatic Sprinkler Co., Inc.
 - h. Star Sprinkler Corp.
 - i. Viking Corp.

12. Fire Hose, Valve, and Extinguisher Cabinets:
 - a. J. L. Industries.
 - b. Larsen's Mfg. Co.
 - c. Johnson-Lee, Division of W.F. Lee Corp.
 - d. Muckle Manufacturing, Division of Technico, Inc.
 - e. Watrous, Inc.
 - f. Accessory Specialties.
 - g. Bobrick Washroom Equipment.

2.2 PIPE AND TUBING MATERIALS

- A. General: Refer to Part 3 Article "PIPE APPLICATIONS" for identification of systems where the below specified pipe and fitting materials are used.
- B. Copper Tubing - Drawn Temper: ASTM B 88, Type L.
- C. SELECT FROM 2 OPTIONS BELOW.
- D. Steel Pipe: ASTM A 120, Schedule 40, seamless, black steel pipe, plain ends.
- E. Steel Pipe: ASTM A 120, Schedule 10, seamless, blade steel pipe, plain ends.

2.3 FITTINGS

- A. Cast-Iron Threaded Fittings: ANSI B16.4, Class 250, standard pattern for threaded joints. Threads shall conform to ANSI B1.20.1.
- B. Malleable-Iron Threaded Fittings: ANSI B16.3, Class 300, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.
- C. Steel Fittings: ASTM A 234, seamless or welded, for welded joints.

- D. Grooved Mechanical Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47 Grade 32510 malleable iron; or ASTM A53, Type F or Types E or S, Grade B fabricated steel fittings with grooves or shoulders designed to accept grooved end couplings.
- E. Grooved Mechanical Couplings: Consist of ductile or malleable iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure roll-grooved pipe and fittings. Grooved mechanical couplings including gaskets used on dry-pipe systems shall be listed for dry-pipe service.
- F. Wrought-Copper Fittings: ANSI B16.22, streamlined pattern.
- G. Cast-Iron Threaded Flanges: ANSI B16.1, Class 250; raised ground face, bolt holes spot faced.
- H. Cast Bronze Flanges: ANSI B16.24, Class 300; raised ground face, bolt holes spot faced.

2.4 JOINING MATERIALS

- A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
 1. Brazing Filler Metals: AWS A5.8, Classification BAg1 (Silver).
 2. Solder Filler Metals: ASTM B 32, 95-5 Tin-Antimony.
- B. Gasket Materials: Thickness, material, and type suitable for fluid or gas to be handled, and design temperatures and pressures.

2.5 GENERAL DUTY VALVES

- A. Gate Valves - 2 Inch and Smaller: Body and bonnet of cast bronze, 175 pound cold water working pressure - non-shock, threaded ends, solid wedge, outside screw and yoke, rising stem, screw-in bonnet, and malleable iron handwheel. Valves shall be capable of being repacked under pressure, with valve wide open.
- B. Gate Valves - 2-1/2 Inch and Larger: Iron body; bronze mounted, 175 pound cold water working pressure - non-shock. Valves shall have solid taper wedge; outside screw and yoke, rising stem; flanged bonnet, with body and bonnet conforming to ASTM A 126 Class B; replaceable bronze wedge facing rings; flanged ends; and a packing assembly consisting of a cast iron gland flange, brass gland, packing, bonnet, and bronze bonnet bushing. Valves shall be capable of being repacked under pressure, with valve wide open.
- C. Swing Check Valves: MSS SP-71; Class 175, cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line.

2.6 SPECIALTY VALVES

- A. Alarm Check Valve: 175 psig working pressure, designed for horizontal or vertical installations, and have cast iron, flanged inlet and outlet, bronze grooved seat with "O" ring seals, single hinge pin and latch design. Provide trim sets for bypass, drain, electric

sprinkler alarm switch, pressure gages, drip cup assembly piped without valves separate from main drain line, and fill line attachment with strainer.

- B. Alarm Check Valve: 175 psig working pressure, designed for horizontal or vertical installations, and have cast iron, flanged hinge pin and latch design. Provide trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, precision retarding chamber, drip cup assembly piped without valves separate from main drain line, and fill line attachment with strainer.
- C. Alarm Check Valve: 175 psig working pressure, designed for horizontal or vertical installations, and have cast iron, flanged inlet and outlet, bronze grooved seat with "O" ring seals, single hinge pin and latch design. Provide trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, precision retarding chamber, drip cup assembly piped with check valve to main drain line, and fill line attachment with strainer.
- D. Air-Pressure Maintenance Device, Dry-Pipe System: An automatic device to maintain the correct air pressure in a dry-pipe system or deluge system. System shall have shut-off valves to permit servicing without shutting down the sprinkler system, bypass valve for quick system filling, pressure regulator or switch to maintain system pressure, strainer; pressure ratings 14 to 60 psig adjustable range, and 175 psig maximum inlet pressure. Electrical ratings shall match compressor ratings.
- E. Wet pilot trim set includes a gage to read push rod chamber pressure, a globe valve for manual operation of the deluge valve and a connection for the actuation device.
- F. Emergency Pull Box: Metal enclosure, labeled with "Manual Emergency Station" and operating instructions, complete with union, 1/2 inch pipe nipple, and bronze ball valve. The enclosure cover shall be held closed by a breakable strut, which prevents accidental opening, and must be replaced after each opening.
- G. Detector Check Valves: Galvanized cast iron body, with a bolted cover with air bleed device for access to internal parts; 175 psig working pressure. One piece bronze disc with bronze bushings, pivot and replaceable seat. Provide threaded bypass taps in the inlet and outlet for bypass meter connection. Valve shall be set to allow minimal water flow through the bypass meter; when major water flow is required, the water pressure will fully open the clapper.

2.7 AUTOMATIC SPRINKLERS

- A. Sprinkler Heads: fusible link type, and style as indicated or required by the application. Unless otherwise indicated, provide heads with nominal 1/2 inch discharge orifice, for "Ordinary" temperature range.
- B. Sprinkler Head Finishes: Provide heads with the following finishes:
 - 1. Upright, Pendent, and Sidewall Styles: Chrome plated in finish spaces, exposed to view; rough bronze finish for heads in unfinished spaces and not exposed to view. Heads shall be wax-coated where installed exposed to acids, chemicals, or other corrosive fumes.
 - 2. Concealed Style: Rough brass, with painted white cover plate.
 - 3. Flush Style: Bright chrome, with painted white escutcheon plate.
 - 4. Recessed Style: Bright chrome, with bright chrome escutcheon plate.
 - 5. Residential Style: Dull chrome.
 - 6. Intermediate Level Style: Bright chrome.

- C. Sprinkler Head Cabinet and Wrench: Finished steel cabinet, suitable for wall mounting, with hinged cover and space for 6 spare sprinkler heads plus sprinkler head wrench. Provide a separate cabinet for each style sprinkler head on the project.

2.8 FIRE HOSES AND RACKS

- A. Hose Outlet Valves: 300 psig, 1-1/2 inch, polished chrome plated, brass angle valve, with external threads having the NH standard thread, for the 1-1/2 inch valve, as specified in NFPA 1963. Provide an automatic drip, so installed to prevent water which may leak past the valve from entering the hose.
- B. Hose Outlet Valves: 300 psig, 2-1/2 inch, polished chrome plated, brass angle valve, with removable, 2-1/2 inch X 1-1/2 inch reducing, lug pin, hose connector coupling and pressure restriction device. Valve and coupling shall have external threads having the NH standard thread, for the 2-1/2 inch valve, as specified in NFPA 1963. Provide an automatic drip, so installed to prevent water which may leak past the valve from entering the hose. Provide spanner wrench for removal of reducing coupling.
- C. Hose Outlet Valves: 300 psig, 2-1/2 inch, polished chrome plated, brass angle valve with external threads having the NH standard thread, for the 2-1/2 inch valve, as specified in NFPA 1963. Provide an automatic drip, so installed to prevent water which may leak past the valve from entering the hose. Provide a spanner wrench for removal of outlet cap.
- D. Fire Hoses: 100 foot long, 1-1/2 inch, lined linen hose with pin lug, chrome plated, quick disconnect coupling; and chrome plated brass fog nozzle spray pattern adjustable from shut-off directly to 50 degrees fog, through 90 degrees fog. Comply with the requirements of NFPA 1961.
- E. Hose Rack: Semiautomatic, steel rack, finished in red enamel, and holds hose in place with cadmium plated pins. Racks shall be secured to the outlet valve and a pivot for release of hose.

2.9 HOSE, VALVE, AND EXTINGUISHER CABINETS

- A. General: Provide cabinets to house hose valves; hoses and valves; and hoses, valves, and extinguishers as indicated.
- B. Construction: Manufacturer's standard enameled steel box, with trim, frame, door and hardware to suit cabinet type, trim style, and door style indicated. Weld all joints and grind smooth. Miter and weld perimeter door frames.
- C. Cabinet Type: Suitable for mounting conditions indicated, of the following types:
 - 1. Recessed: Cabinet box (tub) fully recessed in walls of sufficient depth to suit style of trim indicated.
 - 2. Semi-Recessed: Cabinet box (tub) partially recessed in walls of shallow depth.
 - 3. Surface-Mounted: Cabinet box (tub) fully exposed and mounted directly on wall.
- D. Trim Style: Fabricate trim in one piece with corners mitered, welded and ground smooth.
 - 1. Trimless: For installation in walls where surface of surrounding wall finishes flush with exterior finished surface of frame and door of fire extinguisher cabinet, without any overlapping trim attached to cabinet.
 - a. Provide recessed flange, of same material as box, attached to box to act as plaster stop.

2. Trimless with Hidden Flange: Of design where trim consists of perimeter flange of same metal and finish as box (tub) which overlaps surrounding wall finish and which, in turn is concealed from view by an overlapping door.
 3. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
 - a. Square-Edge Trim: Square edges with backbend depths as follows:
 - 1) 1/4 to 5/16 inch.
 - 2) 1/2 inch.
 - 3) 2 inch.
 - b. Rolled-Edge Trim: Rounded edges with backbend depth as follows:
 - 1) 1-1/4 inch.
 - 2) 2-1/2 inch.
 - 3) 4-1/2 inch.
 - c. Trim Metal: Of same metal as door.
 - d. Trim Metal: Enameled steel.
 - e. Trim Metal: Aluminum.
 - f. Trim Metal: Stainless steel, ASTM A 167, AISI Type 302/304 alloy.
 4. Door Material and Construction: Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.
 - a. Enameled Steel: Manufacturer's standard finish, hollow steel door construction with tubular stiles and rails.
 - b. Aluminum: Manufacturer's standard flush, hollow aluminum door construction.
 - c. Stainless Steel: Manufacturer's standard door construction, fabricated from austenitic stainless steel complying with ASTM A 167, for AISI Type 302/304 alloy.
 - d. Unbacked Acrylic: Manufacturer's standard unbacked acrylic door construction with metal edge reinforcing at hinge jamb and at latch.
 - e. Aluminum-Backed Acrylic: Manufacturer's standard aluminum-backed obscure-textured acrylic with silk screen lettering or design applied to back of acrylic face.
 - f. Door Glazing: Clear float glass complying with FS DD-G-451, type I, Class 1, Quality q3.
 - g. Door Glazing: Tempered float glass complying with FS DD-G-1403, Grade B, Style I, Type I, Quality q3, class as indicated below:
 - 1) Clear glass: Class 1 (transparent).
 - 2) Tinted glass: Class 2 (heat absorbing), bronze tint.
 - h. Plastic Laminate: High pressure plastic laminate face complying with NEMA LD-3 for GP-50; manufacturer's standard core and steel backing construction.
- E. Door Style: Manufacturer's standard design as indicated.
1. Full-Glass Panel: Float glass, 1/8 inch thick.
 2. Duo-Panel: Float glass, 1/8 inch thick.
 3. Break Glass Panel: Float glass, 1/8 inch thick, with inside latch and lock.
 4. Frameless Tempered Full-Glass Panel: Tempered float glass with polished edges and inside surface etched with lettering or design indicated and frosted.
 5. Solid Panel: Full flush opaque panel of material indicated.
 - a. Provide silk screen lettering or design as indicated.
 6. Full-Acrylic Panel: Frameless, 1/2 inch thick clear acrylic.
 - a. Bubble Type: One-piece molded clear plastic.

- F. Door Hardware: Provide manufacturer's standard door operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam action latch, or door pull, exposed or concealed, and friction latch. Provide continuous full height hinge permitting door to open 180 deg.
- G. Door Hardware for Frameless Tempered Full-Glass Panel Door: Provide manufacturer's standard corner-mounted plated steel hinges, corner-mounted plated metal handle, and catch, with finish indicated below:
 - 1. Finish: Bright chrome plated, Finish No. 651 in accordance with ANSI/BHMA A156.18.
 - 2. Finish: Bright brass plated, clear coated; Finish No. 632 in accordance with ANSI/BHMA A156.18.

2.10 FACTORY FINISHING OF HOSE, VALVE, AND EXTINGUISHER CABINETS

- A. General: Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations except as otherwise indicated. Apply finishes in factory after products are assembled. Protect cabinets with plastic or paper covering, prior to shipment.
- B. Painted Finishes: Provide painted finish to comply with requirements indicated below for extent, preparation, and type:
 - 1. Extent of Painted Finish: Apply painted finish to both concealed and exposed surfaces of cabinet components except where other than a painted finish is indicated.
 - 2. Color: Provide color or color matches indicated, or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.
 - 3. Preparation: Clean surfaces of dirt, grease, and loose rust or mill scale.
 - 4. Baked Enamel Finish: Immediately after cleaning and pretreatment, apply cabinet manufacturer's standard baked enamel finish system to the following surfaces:
 - a. Interior of cabinet.
 - b. Exterior of cabinet except for those surfaces indicated to receive another finish.
 - 5. Field-Paintable Factory Finish: Immediately after cleaning and pretreatment, apply to surfaces indicated below, manufacturer's standard factory-applied paint system which is suitable, after deglossing, as an undercoat for field-applied paint system specified in Division 9 section "Painting":
 - a. Exterior of cabinet except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet.
 - 6. Anodized Aluminum Finishes: Provide architectural anodic coatings complying with the following requirements:
 - a. Class II Clear (Natural) Anodized Finished: AS-M12C22A31 (mechanical finish, non-specular as fabricated; chemical etch, medium matte; 0.4 mil minimum thick clear anodic coating).
 - b. Class I Color Anodized Finish: AA-M12C22A42 (mechanical finish, non-specular as fabricated; chemical etch, medium matte; 0.7 mil minimum thick integrally deposited colored anodic coating).
 - 1) Provide color matching Architect's sample or, if none established, as selected by Architect from within standard industry colors and color density range.
 - 7. Stainless Steel Finish: AISI No. 4 polished finish. Furnish with paper masking to protect finish.

8. Obscure Acrylic Colors: Provide color or combination of colors selected from manufacturer's standard colors.
9. Plastic Laminate Colors: Provide color, finish and pattern indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

2.11 FIRE DEPARTMENT CONNECTIONS

- A. Wall Type Siamese Connections: Polished cast brass, flush wall type, with wall escutcheon and two-way connections. Connection sizes shall be 4 inch outlet and two 2-1/2 inch female inlets, having NH standard threads, for the connection size indicated, as specified in NFPA 1963. Each inlet shall have a clapper valve, and aluminum plug and chain. Unit shall have wall escutcheon of cast brass, finish to match connections, with words "STANDPIPE - FIRE DEPT CONNECTION" or "AUTO SPKR -FIRE DEPT CONNECTION," or "AUTO SPKR & STANDPIPE - FIRE DEPT CONNECTION" in raised letters.
- B. Sidewalk Siamese Connection: Chrome plated cast brass, angle body, two way, siamese connection. Connection sizes shall be 4 inch outlet and two 2-1/2 inch female inlets, having NH standard threads, for the connection size indicated, as specified in NFPA 1963. Each inlet shall have a clapper valve, and plug and chain. Provide 18 inch high chrome plated brass sleeve and chrome plated brass sidewalk plate, with words "STANDPIPE - FIRE DEPT CONNECTION," or "AUTO SPKR - FIRE DEPT CONNECTION," or "AUTO SPKR & STANDPIPE - FIRE DEPT CONNECTION" in raised letters.

2.12 ALARM DEVICES

- A. General: Types and sizes shall mate and match piping and equipment connections.
- B. Water Flow Indicators: Vane type waterflow detector, rated to 250 psig; designed for horizontal or vertical installation; have 2-SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7 ampere 125 volts AC and 0.25 ampere 24 Volts DC; complete with factory-set, field-adjustable retard element to prevent false signals, and tamper-proof cover which sends a signal when cover is removed.
- C. Water-Motor Gongs: 10 inch diameter cast aluminum gong, with factory-finish in red enamel; Pelton Wheel type operator with nylon shaft bearings, and shaft length and sleeve to suit wall thickness and construction; 3/4 inch inlet and 1 inch drain.
- D. Supervisory Switches: SPST, normally closed contacts, designed to signal valve in other than full open position.

PART 3 - EXECUTION

3.1 FLOW TEST

- A. Conduct flow test and submit to Engineer prior to piping design.

3.2 EXAMINATION

- A. Examine rough-in for fire hose valves and cabinets to verify actual locations of piping connections prior to installing cabinets.

- B. Examine walls for suitable conditions where cabinets are to be installed.
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.3 PIPE APPLICATIONS

- A. Install Schedule 40 steel pipe with threaded joints and fittings for 2 inch and smaller, and with welded joints for 2-1/2 inch and larger.
- B. Install Schedule 40 steel pipe with roll-grooved ends and grooved mechanical couplings.
- C. Install Schedule 10 steel pipe with rolled-grooved ends and grooved mechanical couplings.
- D. Install copper tubing with brazed joints for sprinkler systems above ground within the building.

3.4 PIPING INSTALLATIONS

- A. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. So far as practical, install piping as indicated.
 - 1. Deviations from approved "Working Plans" for sprinkler piping, require written approval of the authority having jurisdiction. Written approval shall be on file with the Architect prior to deviating for the approved "Working Plans."
- B. Install sprinkler piping to provide for system drainage in accordance with NFPA 13.
- C. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- D. Install unions in pipes 2 inch and smaller, adjacent to each valve. Unions are not required on flanged devices or in piping installations using grooved mechanical couplings.
- E. Install flanges or flange adaptors on valves, apparatus, and equipment having 2-1/2 inch and larger connections.
- F. Hangers and Supports: Comply with the requirements of NFPA 13 and NFPA 14. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in accordance with the grooved mechanical coupling manufacturer's written instructions, for rigid systems. Provide protection from damage where subject to earthquake in accordance with NFPA 13.
- G. Make connections between underground and above-ground piping using an approved transition piece strapped or fastened to prevent separation.
- H. Install mechanical sleeve seal at pipe penetrations in basement and foundation walls. Refer to Division 15 Section "Basic Piping Materials and Methods."
- I. Install test connections sized and located in accordance with NFPA 13 complete with shutoff valve. Test connections may also serve as drain pipes.

- J. Install pressure gage on the riser or feed main at or near each test connection. Provide gage with a connection not less than 1/4 inch and having a soft metal seated globe valve, arrange for draining pipe between gage and valve. Install gages to permit removal, and where they will not be subject to freezing.

3.5 PIPE JOINT CONSTRUCTION

- A. Welded Joints: AWS D10.9, Level AR-3.
- B. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:
 - 1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
 - 2. Align threads at point of assembly.
 - 3. Apply appropriate tape or thread compound to the external pipe threads.
 - 4. Assemble joints to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.
 - 5. Damaged Threads: Do not use pipe with threads which are corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.
- C. Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.
- D. Mechanical Grooved Joints: Cut or roll grooves on pipe ends dimensionally compatible with the couplings.
- E. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
 - 1. WARNING: Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.
- F. Soldered Joints: Comply with the procedures contained in the Copper Development Association "Handbook for Fire Sprinkler Systems."
- G. End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

3.6 VALVE INSTALLATIONS

- A. General: Install fire protection specialty valves, fittings, and specialties in accordance with the manufacturer's written instructions, NFPA 13 and 14, and the authority having jurisdiction.
- B. Gate Valves: Install supervised-open gate valves so located to control all sources of water supply except fire department connections. Where there is more than one control valve, provide permanently marked identification signs indicating the portion of the system controlled by each valve. Refer to Division 15 Section "Mechanical Identification" for valve tags and signs.
- C. Install check valves in each water supply connection.
- D. Alarm Check Valves: Install valves in the vertical position, in proper direction of flow including the bypass check valve and retard chamber drain line connection. Install valve

trim in accordance with the valve manufacturer's appropriate trim diagram. Test valve for proper operation.

- E. Detector Check Valves: Install in proper direction of flow in a location to detect system leakage and unauthorized use of water, and to prevent backflow into public water mains. Install bypass meter, with gate valves on each side of the meter to permit meter removal, and check valve downstream from the meter.
- F. Hose Outlet Valves: Install 1-1/2 inch hose outlet valves at each standpipe outlet for hose connections for use by building occupants. Install 2-1/2 inch hose outlet valves at each standpipe outlet for hose connections for use by the fire department.
- G. Hose Outlet Valves: Install 2-1/2 inch hose outlet valves with quick-disconnect 2-1/2 to 1-1/2 inch reducing coupling and flow restriction device at each standpipe outlet for hose connections.

3.7 SPRINKLER HEAD INSTALLATIONS

- A. Use proper tools to prevent damage during installations.
- B. Install heads centered in ceiling tiles.

3.8 FIRE HOSE AND RACK INSTALLATIONS

- A. Install hoses and racks in fire hose cabinets specified in Division 10 Section "Fire Extinguishers, Cabinets, and Accessories."
- B. Install fire hose, valve, and extinguisher cabinets in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.
 - 1. Prepare recesses in walls for cabinets as required by type and size of cabinet and style of trim and to comply with manufacturer's instructions.
 - 2. Securely fasten fire hose, valve, and cabinets to structure, square and plumb, to comply with manufacturer's instructions.
 - 3. Where exact location of surface-mounted cabinets in not indicated, locate as directed by Architect.
- C. Identify equipment in cabinet with lettering spelling "FIRE EXTINGUISHER" "FIRE HOSE" or "FIRE HOSE AND EXTINGUISHER" applied to door by process indicated below. Provide lettering to comply with requirements indicated for letter style, color, size, spacing and location or, if not otherwise indicated, as selected by Architect from manufacture's standard arrangements.
 - 1. Application Process: Silk screen.
 - 2. Application Process: Engraved.
 - 3. Application Process: Etched.

3.9 FIRE DEPARTMENT CONNECTION INSTALLATIONS

- A. Install automatic drip valves at the check valve on the fire department connection to the mains.
- B. Install mechanical sleeve seal at pipe penetration in outside walls.

3.10 FIELD QUALITY CONTROL

- A. Flush, test, and inspect sprinkler piping systems in accordance with NFPA 13.
- B. Flush, test, and inspect standpipe systems in accordance with NFPA 14.
- C. Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system.

END OF SECTION 13900

SECTION 16001 - ELECTRICAL GENERAL PROVISIONS

July 11, 2007

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Architectural, Structural, Mechanical and other applicable documents are considered a part of the electrical documents insofar as they apply as if referred to in full.

1.2 DESCRIPTION OF WORK:

- A. The extent of electrical work is indicated on drawings and/or specified in Division 16 sections of the specification. Provide all labor, materials, equipment, supervision and service necessary for a complete electrical system. Work includes, but is not necessarily limited to, the following items.

<u>ITEM</u>	<u>SECTION</u>
1. Electrical General Provisions	16001
2. Electrical Connections for Equipment	16070
3. Demolition	16080
4. Conduit Raceways	16110
5. Raceway Systems	16111
6. Conductors and Cables	16120
7. Electrical Boxes and Fittings	16135
8. Supporting Devices	16136
9. Wiring Devices	16140
10. Panelboards	16160
11. Overcurrent Protective Devices	16180
12. Grounding	16452
13. Interior and Exterior Building Lighting	16510
14. Lighting Control Equipment	16560
15. Occupancy Lighting Control and Equipment	16561
16. Fire Alarm and Detection Systems	16721
17. Fire Sprinkler Monitoring System	16722
18. Telephone/Data Systems (Raceways)	16740
19. Security Systems (Raceways)	16782

- B. Use of standard industry symbols together with the special symbols, notes, and instructions indicated on the drawings describe the work, materials, apparatus and systems required as a portion of this work.
- C. Visit the site during the bidding period to determine existing conditions affecting electrical and other work. All costs arising from site conditions and/or preparation shall be included in the base bid. No additional charges will be allowed due to inadequate site inspection.

1.3 DEFINITION OF TERMS

- A. The following terms used in Division 16 documents are defined as follows:
 - 1. "Provide": Means furnish, install and connect, unless otherwise indicated.
 - 2. "Furnish": Means purchase and deliver to project site.
 - 3. "Install": Means to physically install the items in-place.

4. "Connect": Means make final electrical connections for a complete operating piece of equipment.

1.4 RELATED SECTIONS:

- A. Consult all other sections, determine the extent and character of related work and properly coordinate work specified herein with that specified elsewhere to produce a complete installation.
- B. General and Supplementary Conditions: Drawings and general provisions of contract and Division 1 of the Specifications, apply to all Division 16 sections.
- C. Earthwork:
 1. Provide trenching, backfilling, boring and soil compaction as required for the installation of underground conduit, buried cable, in-grade pull boxes, manholes, lighting pole foundations, etc. See Division 2, Sitework, and other portions of Division 16, for material and installation requirements.
- D. Concrete Work:
 1. Provide forming, steel bar reinforcing, cast-in-place concrete, finishing and grouting as required for under ground conduit encasement, light pole foundations, pull box slabs, vaults, equipment pads, etc. See Division 3, Concrete for material and installation requirements.
- E. Miscellaneous Metal Work:
 1. Provide fittings, brackets, backing, supports, rods, welding and pipe as required for support and bracing of raceways, lighting fixtures, panelboards, distribution boards, switchboards, motor controls centers, etc. See Division 5, Metals for material and installation requirements.
- F. Miscellaneous Lumber and Framing Work:
 1. Provide wood grounds, nailers, blocking, fasteners, and anchorage for support of electrical materials and equipment. See Division 6, Rough Carpentry for material and installation requirements.
- G. Moisture Protection:
 1. Provide membrane clamps, sheet metal flashing, counter flashing, caulking and sealants as required for waterproofing of conduit penetrations and sealing penetrations in or through fire walls, floors and ceiling slabs and foundation walls. All penetrations through vapor barriers at slabs on grade shall be taped and made vaportight. See Division 7, Thermal and Moisture Protection for material and installation requirements.
- H. Access panels and doors:
 1. Provide in walls, ceiling, and floors for access to electrical devices and equipment. See Division 8, Doors and Windows for material and installation requirements.

- I. Painting:
 - 1. Provide surface preparation, priming and finish coating as required for electrical cabinets, exposed conduit, pull and junction boxes, poles, surface metal raceways, etc. See Division 9, Finishes for material and installation requirements.

1.5 WORK FURNISHED AND INSTALLED UNDER ANOTHER SECTION REQUIRING CONNECTIONS UNDER THIS SECTION:

- A. Provide electrical service, make requisite connections and perform operational test. Items furnished and installed under other sections and connected under this section, include but are not limited to the following:
 - 1. Electric motors.
 - 2. Package mechanical equipment: fans, fan coil units, pumps, boilers, duplex compressors, etc.
 - 3. Flow switches and valve monitors.
 - 4. Motorized dampers.
 - 5. Fire and smoke dampers
 - 6. Duct mounted smoke detectors.
 - 7. Elevator/Escalator Controllers.
 - 8. Irrigation controllers.
 - 9. Door hold-open/release devices.
 - 10. Motorized projection screens.
 - 11. Wheel chair lifts.
 - 12. Roll down doors.
 - 13. Electric hardware.
 - 14. Laboratory equipment including hoods, cold rooms, autoclaves, drying ovens, glassware washers and dryers, refrigerators, freezers, etc.
 - 15. Shop equipment including saw dust collectors, saws, lathes, grinders, welders, planers, presses, etc.
 - 16. Temperature control panels.
 - 17. Variable frequency controllers.
 - 18. Chiller starters.
 - 19. Motorized Chalkboards/Markerboards/Whiteboards.
 - 20. Display cases.
 - 21. Water coolers.
 - 22. Kitchen equipment including ovens, fryers, mixers, disposers, dishwashers, etc.
 - 23. Paint spray booths.
 - 24. Fire sprinkler alarm bells.
 - 25. Electric heat trace cable for domestic and industrial hot water piping systems.
 - 26. Electric heat trace cable for guttering, drainlines, etc.
 - 27. Anti-sweat heaters, fan coils, etc for walk-in coolers and freezers.
 - 28. Hand dryers, hair dryers.
 - 29. Dock levelers.

1.6 ITEMS FURNISHED UNDER ANOTHER DIVISION, BUT INSTALLED AND CONNECTED UNDER THIS DIVISION:

- A. Items furnished under other Divisions, but turned over to Division 16 for installation and final connection include, but are not necessarily limited to, the following.
 - 1. Wall mounted control stations for motorized roll-up doors/grills.
 - 2. Wall mounted control stations for motorized projection screens.
 - 3. Wall mounted control stations for handicap lift.
 - 4. Lighting fixtures for paint spray booths.

5. Lighting fixtures, receptacles, and switches for fume hoods.
6. Lighting fixtures for kitchen hoods.
7. Lighting fixtures for walk-in freezers and coolers.

1.7 WORK NOT INCLUDED IN THIS DIVISION:

- A. Items of work provided under another contract include, but are not necessarily limited to, the following:
1. Telephone cables and electronic equipment.
 2. Data system cables, fittings, coverplates and electronic equipment.
 3. Control wires for irrigation control valves.
 4. Energy management/temperature control system; both line and low voltage including conductors and conduit.
 5. Television monitors and projection equipment.
 6. Security system equipment, cables, fittings, and coverplates.
 7. CCTV and MATV cabling and electronic equipment.

1.8 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS:

- A. Before bidding, Contractor shall familiarize himself with the drawings, specifications and project site. Submit requests for clarification to Architect/Engineer in writing prior to issuance of final addendum. After signing the contract, the Contractor shall meet the intent, purpose, and function of the Contract Documents. Any costs of materials, labor and equipment arising therefrom, to make each system complete and operable, is the responsibility of the Contractor.

1.9 QUALITY ASSURANCE:

- A. Reference to codes, standards, specifications and recommendations of technical societies, trade organizations and governmental agencies refers to the latest edition of such publications adopted and published prior to submittal of the bid proposed, unless noted otherwise herein. Such codes or standards are considered a part of this specification as though fully repeated herein.
- B. When codes, standards, regulations, etc. allow work of lesser quality or extent than is specified under this Division, nothing in said codes shall be construed or inferred as reducing the quality, requirements or extent of the Drawings and Specifications. Perform work in accordance with applicable requirements of all governing codes, rules and regulations including the following minimum standards, whether statutory or not:
1. National Electric Code (NEC).
 2. International Building Code (IBC).
 3. International Fire Code (IFC).
 4. International Mechanical Code (IMC).
- C. Standards: Comply with the following standards where applicable for equipment and materials specified under this Division.
- | | | |
|----|-------|------------------------------------------------|
| 1. | UL | Underwriters' Laboratories |
| 2. | ASTM | American Society for Testing Materials |
| 3. | CBN | Certified Ballast Manufacturers |
| 4. | IPCEA | Insulated Power Cable Engineers Association |
| 5. | NEMA | National Electrical Manufacturer's Association |
| 6. | ANSI | American National Standards Institute |
| 7. | ETL | Electrical Testing Laboratories |

- D. All electrical apparatus furnished under this Section shall conform to (NEMA) standards and the NEC and bear the Underwriters' Laboratories (UL) label where such label is applicable.
- E. Comply with requirements of State and Local Ordinances. If a conflict occurs between these requirements and the Contract Documents, the most stringent requirements shall govern. The Contractor accepts this responsibility upon submitting his bid, and no extra charge will be allowed after the contract is awarded. This shall not be construed as relieving the Contractor from complying with any requirements of the Contract Documents which may be in excess of the aforementioned requirements, and not contrary to same.
- F. Obtain all permits, inspections, etc. required by authority having jurisdiction. Include all fees in bid. Furnish a certificate of approval to the Owner's Representative from the Inspection Authority at completion of the work.
- G. Employ only qualified craftsmen with at least three years of experience. Workmanship shall be neat, have a good mechanical appearance and conform to best electrical construction practices. Provide a competent superintendent to direct the work at all times. Any person found incompetent shall be discharged from the project and replaced by satisfactory personnel.
- H. Contractor shall have a current state contracting license applicable to type of work to be performed under this contract.

1.10 SUBMITTALS:

- A. SHOP DRAWINGS AND PRODUCT DATA:
 - 1. After the Contract is awarded but prior to manufacture or installation of any equipment, prepare complete Shop Drawings and Brochures for materials and equipment as required by each section of the specification. Submit 8 complete sets for review. All sets of shop drawing material shall be bound. Prior to submission of the Shop Drawings and Project Data, review and certify that they are in compliance with the Contract Documents. Verify all dimensional information to insure proper clearance for installation of equipment. Check all materials and equipment after arrival on the job site and verify compliance with the Contract Documents. A minimum period of two weeks, exclusive of transmittal time, will be required each time Shop Drawing and/or Brochure is submitted or resubmitted for review. This time period shall be considered by the Contractor when scheduling submittal data. If the shop drawings are rejected twice, the contractor shall reimburse the engineer the sum of \$200.00 for the third review and any additional reviews required.
 - 2. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from the Contract Document's requirements. It shall be clearly understood that the noting of some errors but overlooking others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Document's shall govern and are not waived, or superseded in any way by the review of the Shop Drawings and Brochures.
 - 3. Certifications shall be written or in the form of rubber stamp impressions as follows:

4. I hereby certify that this Shop Drawing and/or Brochure has been checked prior to submittal and that it complies in all respects with the requirements of the Contract Drawings and Specifications for this Project.

(Name of Electrical Subcontractor)

Signed _____.

Position _____ Date _____

5. Observe the following rules when submitting the Shop Drawings and Brochures.
- a. Each Shop Drawing shall indicate in the lower right hand corner, and each Brochure shall indicate on the front cover the following: Title of the sheet or brochure, name and location of the building; names of the Architect and Electrical Engineer, Contractor, Subcontractors, Manufacturer, Supplier/Vendor, etc., date of submittal, and the date of correction and revision. Unless the above information is included the submittal will be returned for resubmittal.
 - b. Shop Drawings shall be done in an easily legible scale and shall contain sufficient plans, elevations, sections, and isometrics to clearly describe the equipment or apparatus, and its location. Drawings shall be prepared by an Engineer/Draftsmen skilled in this type of work. Shop Drawings shall be drawn to at least 1/4" = 1'0" scale.
 - c. Brochures to be submitted shall be published by the Manufacturers and shall contain complete and detailed engineering and dimensional information. Brochures submitted shall contain only information relevant to the particular equipment or materials to be furnished. The Contractor shall not submit catalogs which describe several different items in addition to those items to be used, unless all irrelevant information is marked out, or unless relevant information is clearly marked. Brochures from each manufacturer shall be identified and submitted separately.

1.11 OPERATION AND MAINTENANCE MANUALS:

- A. Provide operating instruction and maintenance data books for all equipment and materials furnished under this Division.
- B. Submit four copies of operating and maintenance data books for review at least four weeks before final review of the project. Assemble all data in a completely indexed volume or volumes and identify the size, model, and features indicated for each item. The binder (sized to the material) shall be a 2" slide lock unit (Wilson-Jones B3-367-44). The cover shall be engraved with the job title in 1/2" high letters and the name and address of the Contractor in 1/4" high letters. Provide the same information in 1/8" letters on the spine.
- C. Include complete cleaning and servicing data compiled in clearly and easily understandable form. Show serial numbers of each piece of equipment, complete lists of replacement parts, motor ratings, etc. Each unit shall have its own individual sheet. (Example: If two items of equipment A and D appear on the same sheet, an individual sheet shall be provided for each unit specified).
- D. Include the following information where applicable.

1. Identifying name and mark number.
 2. Certified outline Drawings and Shop Drawings.
 3. Parts lists.
 4. Performance curves and data.
 5. Wiring diagrams.
 6. Light fixture schedule with the lamps and ballast data used on the project for all fixtures
 7. Manufacturer's recommended operating and maintenance instructions.
 8. Vendor's name and address for each item.
- E. The engineer shall review the manuals and when approved, will forward the manuals on to the architect. If the manuals are rejected twice, the contractor shall reimburse the engineer the sum of \$200.00 for each review afterwards.

1.12 RECORD DRAWINGS:

- A. Maintain, on a daily basis, a complete set of "Record Drawings", reflecting an accurate record of work in accordance with the following:
1. Show the complete routing and location of all feeders rated 100 amps and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.)
 2. Show the complete routing and location of all telecommunications conduits, systems raceways, and empty raceways, 1-1/4" and larger. Locate work buried below grade or under slab, work concealed above ceilings, and work in concealed spaces, dimensionally from fixed structural elements (not partition walls, etc.).
 3. Show all changes, deviations, addendum items, change orders, job instructions, etc., which change the work from that shown on the contract documents, including wall relocations, fixtures and device changes, branch circuiting changes, etc. Where locations of boxes, raceways, equipment, etc. are adjusted in the field to fit conditions, but such new locations may not be obvious by referring to the contract document, show new locations on the record drawings.
- B. At the discretion of the Architect/Engineer, the drawings will be reviewed on a periodic basis and used as a pre-requisite for progress payments. This requirement shall not be construed as authorization for the Contractor to make changes in the layout, or work without written authorization for such changes. The "Record Drawings" for daily recording shall consist of a set of blue line prints of the Contract Drawings.
- C. Upon completion of the work, purchase a complete set of electronic drawings. Transfer all "Record" information from the blue line prints to the drawings via the current CAD program in which it was written. The Architect/Engineer shall review the drawings and the Contractor shall incorporate the resulting comments into the final record drawings. The Contractor shall make two complete copies of the drawings electronically and forward this to the Engineer.
- D. Certify the "Record Drawings" for correctness by placing and signing the following certifications of the first sheet of the set:

1. "CERTIFIED CORRECT (3/8" high letters)

(Name of General Contractor)

By _____ Date

(Name of Electrical Contractor)

By _____ Date

1.13 GUARANTEE:

- A. Ensure that electrical system installed under this contract is in proper working order and in compliance with drawings, specifications, and/or authorized changes. Without additional charge, replace any work or materials which develop defect, except from ordinary wear and tear, within one year from the date of substantial completion. Exception: Incandescent and fluorescent lamps shall be guaranteed for a period of two months from the date of substantial completion.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. Products are specified by manufacturer name, description, and/or catalog number. Discrepancies between equipment specified and the intended function of equipment shall be brought to the attention of the Architect/Engineer in writing prior to bidding. Failure to report any conflict, including catalog numbers, discontinued products, etc., does not relieve the Contractor from meeting the intent of the contract documents nor shall it change the contract cost. If the Contractor is unable to interpret any part of the plans and/or specifications, or should he find discrepancies therein, he shall bring this to the attention of the Architect/Engineer who will issue interpretation and/or additional instructions to Bidders before the project is bid.

2.2 MANUFACTURERS:

- A. Provide products of manufacturers specified. Manufacturers catalog numbers and descriptions establish the quality of product required. Substitutions will be considered if a duplicate written application (2-copies) is at the office of the Architect/Engineer eight (8) working days prior to the day of the bidding. The application shall include the following: 1) A statement certifying that the equipment proposed is equal to that specified; that it has the same electrical and physical characteristics, compatible dimensions, and meets the functional intent of the contract documents; 2) The specified and submittal catalog numbers of the equipment under consideration; 3) A pictorial and specification brochure.
- B. Any conflict arising from the use of substituted equipment shall be the responsibility of the Contractor, who shall bear all costs required to make the equipment comply with the intent of the contract documents.
- C. Samples may be required for non-standard or substituted items before installation during construction. Provide all samples as required.
- D. No materials or apparatus may be substituted after the bid opening except where the equipment specified has been discontinued.
- E. Provide only equipment specified in the Contract Documents or approved by addendum.

2.3 SPARE PARTS:

- A. Provide spare parts (fuses, diffusers, lamps, etc.) as specified. Transmit all spare parts to Owner's Representative prior to substantial completion.

PART 3 – EXECUTION

3.1 INSTALLATION:

- A. Layout electrical work in advance of construction to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary for proper installation; perform with care. Use skilled mechanics of the trades involved. Repair damage to building and equipment at no additional cost to the contract. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting structural members shall not be permitted.
- B. Since the drawings of floor, wall, and ceiling installation are made at small scale; outlets, devices, equipment, etc., are indicated only in their approximate location unless dimensioned. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned, and coordinate such locations with work of other trades to prevent interferences. Verify all dimensions on the job. Do not scale the electrical drawings, but refer to the architectural and mechanical shop drawings and project drawings for dimensions as applicable.
- C. Perform for other trades, the electrical wiring and connection for all devices, equipment or apparatus. Consult Architectural, Mechanical, and other applicable drawings, and all applicable shop drawings to avoid switches, outlets, and other equipment from being hidden behind doors, cabinets, counters, heating equipment, etc., or from being located in chalkboards, tackboards, glass panels, etc. Relocate buried electrical devices and/or connections as directed at no additional cost.
- D. Coordinate the location of outlets, devices, connections, and equipment with the supplier of the systems furniture prior to rough-in.
- E. Where conduit, outlets or apparatus are to be encased in concrete, it must be located and secured by a journeyman or foreman present at the point of installation. Check locations of the electrical items before and after concrete and/or masonry installation and relocate displaced items.
- F. Provide block-outs, sleeves, demolition work, etc., required for installation of work specified in this division.

3.2 CLEAN:

- A. Clean up all equipment, conduit, fittings, packing cartons and other debris that is a direct result of the installation of the work of this Division.
- B. Clean fixtures, interiors and exteriors of all equipment, and raceways. Replace all filters in electrical equipment upon request for Substantial Completion.

3.3 POWER OUTAGES:

- A. All power outages required for execution of this work shall occur during non-standard working hours and at the convenience of the Owner. Include all costs for overtime work in bid.

- B. Submit written request at least 7 days in advance of scheduled outage and proceed with outage only after receiving authorization from the Owner's Representative.
- C. Keep all outages to an absolute minimum.

3.4 STORAGE AND PROTECTION OF MATERIALS:

- A. Provide storage space for storage of materials and apparatus and assume complete responsibility for all losses due to any cause whatsoever. In no case shall storage interfere with traffic conditions in any public thoroughfare or constitute a hazard to persons in the vicinity. Protect completed work, work underway, and apparatus against loss or damage.

3.5 EXCAVATING FOR ELECTRICAL WORK:

- A. General: Locate and protect existing utilities and other underground work in manner which will ensure that no damage or service interruption will result from excavating and backfilling. Perform excavation in a manner which protects walls, footings, and other structural members from being disturbed or damaged in any way. Burial depths must comply with NEC Section 300-5 (or State of Utah requirement, whichever is more stringent), unless noted otherwise on drawings.
- B. Protect persons from injury at excavations, by barricades, warnings and illumination.
- C. Coordinate excavations with weather conditions, to minimize possibility of washouts, settlements and other damages and hazards.
- D. Provide temporary covering or enclosure and temporary heat as necessary to protect bottoms of excavations from freezing and frost action. Do not install electrical work on frozen excavation bases or subbases.
- E. Do not excavate for electrical work until the work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimum. See other sections of specification for additional requirements for excavating.
- F. Store excavated material (temporarily) near excavation, in manner which will not interfere with or damage excavation or other work. Do not store under trees (within drip line).
- G. Retain excavated material which complies with requirements for backfill material. Dispose of excavated material which is either in excess of quantity needed for backfilling or does not comply with requirements for backfill material. Remove unused material from project site, and dispose of in lawful manner.

3.6 BACKFILL MATERIALS:

- A. For buried conduit or cable (other than below slab-on-grade, or concrete encased) - 2" thickness of well graded sand on all side of conduit or cable.
- B. For trench backfill to within 6" of final grade - soil material suitable for compacting to required densities.
- C. For top 6" of excavation - Top soil.
- D. Backfill excavations in 8" high courses of backfill material, uniformly compacted to the following densities (percent of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment.

1. Lawn/Landscaped Areas: 85 percent for cohesive soils, 95 percent for cohesionless soils.
 2. Paved Areas, Other than Roadways (90 percent for cohesive soils, 95 percent for cohesionless soils).
- E. Subsidence: Where subsidence is measurable or observable at electrical work excavations during general project warranty period, remove surface (pavement, lawn or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality and condition of the surface or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.7 CONCRETE BASES:

- A. Unless otherwise noted, provide 4" high reinforced concrete bases for all floor mounted or floor standing electrical equipment, including generators, transformers, switchgear, battery racks, motor control centers, etc. Extend bases 6" beyond equipment or mounting rails on all sides or as shown on the drawings. Notwithstanding this requirement, coordinate with equipment manufacturer, shop drawings, and height of base to ensure compliance with NEC 404.8.
- B. Concrete bases shall be provided under Division-16. Coordinate size and location of all bases and furnish all required anchor bolts, sleeves, reinforcing and templates as required to obtain a proper installation.
- C. Provide and locate properly sized concrete pads for power company furnished pad mounted transformers in accordance with power company clearance requirements. Where the serving utility is Utah Power, the electrical contractor shall conform to the requirements of Electrical Service Requirements, Section 6.4.

3.8 ROOF PENETRATIONS:

- A. Where raceways penetrate roofing or similar structural area, provide appropriate roof jack coordinate with the roofing contractor and the Architect in order to match the vent with the roof construction. The jack shall be sized to fit tightly to raceway for weather-tight seal, and with flange extending a minimum of 9" under roofing in all sides or as required by the roof type of construction. Completely seal opening between inside diameter of roof flashing and outside diameter of penetrating raceways. Coordinate all work with work required under roofing section of specifications.

3.9 FIRE PENETRATION SEALS:

- A. Seal all penetrations for work of this section through fire rated floors, walls and ceilings to prevent the spread of smoke, fire, toxic gas or water through the penetration either before, during or after fire. The fire rating of the penetration seal shall be at least that of the floor, wall or ceiling into which it is installed, so that the original fire rating of the floor or wall is maintained as required by Article 300-21 of the National Electrical Code. Where applicable, provide OZ Type CFSF/I and CAFSF/I fire seal fittings for conduit and cable penetrations through concrete and masonry walls, floors, slabs, and similar structures. Where applicable, provide 3M fire barrier sealing penetration system, and/or IPC Flame Safe Fire Stop System, and/or Chase Foam fire stop system, including wall wrap, partitions, caps, and other accessories as required. All materials to comply with UL 1479 (ASTM E-814). Comply with manufacturer's instructions and recommendations for installation of sealing fittings and barrier sealing systems.

3.10 PROJECT FINALIZATION AND START-UP:

- A. Upon completion of equipment and system installation, assemble all equipment Factory Representatives and Subcontractors for system start-up.
- B. Each Representative and Subcontractor shall assist in start-up and check out their respective system and remain at the site until the total system operation is accepted by the Owner's representative.
- C. The Factory Representative and/or System Subcontractor shall give personal instruction on operating and maintenance of their equipment to the Owner's maintenance and/or operation personnel. To certify acceptance of operation and instruction by the Owner's Representative, the contractor shall prepare a written statement as follows:
- D. This is to certify that the Factory Representative and System Subcontractor for each of the systems listed below have performed start-up and final check out of their respective systems.
- E. The Owner's Representative has received complete and thorough instruction in the operation and maintenance of each system.

1. <u>SYSTEM</u>	<u>FACTORY REPRESENTATIVE</u>
(List systems included)	(List name and address of Factory Representative).
_____	_____
Owner's Representative	Contractor

- F. Send copy of acceptance to Architect/Engineer.

3.11 FINAL REVIEW:

- A. At the time of final review, the project foreman shall accompany the reviewing party, and remove coverplates, panel covers and other access panels as requested, to allow review of the entire electrical system.

END OF SECTION 16001

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to electrical connections.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical connection for equipment includes final electrical connection of all equipment having electrical requirements. Make final connections for all owner furnished equipment. See other applicable portions of specification for building temperature control wiring requirements.
- B. Refer to Division-15 sections for motor starters and controls furnished integrally with equipment; not work of this section.
- C. Refer to Division-15 section for control system wiring; not work of this section.
- D. Refer to sections of other Divisions for specific individual equipment power requirements.

1.3 QUALITY ASSURANCE:

- A. **NEC COMPLIANCE:** Comply with applicable portions of NEC as to type products used and installation of electrical power connections.
- B. **UL LABELS:** Provide electrical connection products and materials which have been UL-listed and labeled.

PART 2 – PRODUCTS

2.1 GENERAL:

- A. For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, raceways, conductors, cords, cord caps, wiring devices, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices, terminations, and connections as required. Crimp on or slip-on type splicing materials (insulation displacement type) designed to be used without wire stripping are not acceptable. See Section 16110, Conduit Raceways; Section 16140 Wiring Devices; and Section 16120 Wire and Cable for additional requirements. Provide final connections for equipment consistent with the following:
- B. Permanently installed fixed equipment - flexible seal-tite conduit from branch circuit terminal equipment, or raceway; to equipment, control cabinet, terminal junction box or wiring terminals. Totally enclose all wiring in raceway.
- C. Movable and/or portable equipment - wiring device, cord cap, and multi-conductor cord suitable for the equipment and in accordance with NEC requirements (Article 400).

- D. Other methods as required by the National Electrical Code and/or as required by special equipment or field conditions.

PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS:

- A. Make electrical connections in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.
- B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams.
- C. Coordinate installation of electrical connections for equipment with equipment installation work.
- D. Verify all electrical loads (voltage, phase, full load amperes, number and point of connections, minimum circuit ampacity, etc.) for equipment furnished under other Divisions of this specification, by reviewing respective shop drawings furnished under each division. Meet with each subcontractor furnishing equipment requiring electrical service and review equipment electrical characteristics. Report any variances from electrical characteristics noted on the electrical drawings to Architect before proceeding with rough-work.
- E. Obtain and review the equipment shop drawings to determine particular final connection requirements before rough-in begins for each equipment item.
- F. Refer to basic materials and methods Section 16120, Conductors, for identification of electrical power supply conductor terminations.

END OF SECTION 16070

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Special Provisions, Division 1 and Division-2A Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to demolition.

1.2 DESCRIPTION OF WORK:

- A. Extent of major items of demolition work is indicated by drawings. Other demolition work shall be performed as required to maintain system operation.
- B. The intent of the drawings is to indicate major items affected and not to show every device, outlet, fixture, etc. affected by demolition work.
- C. The drawings do not necessarily reflect as-built conditions. The contractor shall visit the jobsite prior to bidding to determine the overall scope of demolition work.
- D. Refer to sections of other Divisions for applicable requirements affecting demolition work.
- E. Refer to Section 16001 for requirements with regard to power outages affecting the operation of existing electrical systems.

1.3 QUALITY ASSURANCE:

- A. NEC COMPLIANCE:
 - 1. Comply with applicable portions of NEC as to methods used for demolition work.

PART 2 - PRODUCTS

2.1 GENERAL:

- A. Demolition work shall be laid out in advance to eliminate unnecessary cutting, drilling, channeling, etc. Where such cutting, drilling, or channeling becomes necessary, perform with care, use skilled mechanics of the trades involved. Repair damage to building and equipment. Cutting work of other Contractors shall be done only with the consent of that Contractor. Cutting of structural members shall not be permitted.

2.2 PATCHING AND REPAIR

- A. The Contractor is responsible for all demolition, patching and repair of all finished interior surfaces pertaining to the installation of this particular phase of work. All surfaces shall be finished (painted, etc.) to match the adjacent materials, finishes and colors.
- B. Hard surfaces: Whenever demolition or excavation is required for the installation of the electrical system, it shall be the responsibility of this contractor to make repairs and/or replacements of hard finish surfaces such as concrete, asphalt, roofing, etc.
- C. The method of patching and repair shall follow good construction practices and all finished surfaces shall match materials and finish wherein the demolition occurred.

2.3 EXISTING EQUIPMENT

- A. The following is a part of this project and all costs pertaining thereto shall be included in the base bid.
- B. The new electrical equipment and apparatus shall be coordinated and connected into the existing system as required. Auxiliary systems shall comply, unless otherwise specified.
- C. The existing electrical devices, conduit and/or equipment that for any reason obstructs construction shall be relocated. Provide conduit, wiring, junction boxes, etc. as required to extend existing circuits and systems to relocated devices or equipment.
- D. The new fixtures indicated for existing outlets shall be installed in accordance with the fixture specifications.
- E. When installing equipment in the existing building, it shall be concealed.
- F. All existing electrical equipment and systems in portions of the building not being remodeled shall be kept operational, in service and in working condition throughout the entire construction period. Restore any circuits and systems interrupted. Provide temporary panels, temporary wiring and conduit, etc. as required.
- G. Maintain circuit integrity and continuity of all existing circuits and systems that interfere with or are interrupted by remodel work unless those circuits are to be abandoned completely. Maintain all circuits and systems in operation during construction. Provide temporary panels, temporary wiring and conduit, etc. as required.
- H. Existing raceways may be used where possible in place, except as noted. All circuits, conduit and wire that are not used in the remodeled area shall be removed back to the panelboard, where it shall be labeled a spare with circuit number indicated. Re-used raceway shall meet all requirements for new installations.
- I. The existing light fixtures which are not used in the remodeled area shall be carefully removed, and turned over to the owner or properly disposed of. Those fixtures indicated for re-use shall be thoroughly cleaned, repaired as required, relamped and installed as indicated.
- J. Obtain permission from the Architect and Owner's representative before penetrating any ceiling, floor, and wall surfaces.
- K. Any and all equipment having electrical connections that require disconnecting and reconnection at the same or another location throughout the course of construction shall be included as part of this contract.

END OF SECTION 16080

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to electrical raceways and specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of raceways is indicated by drawings and schedules.
- B. Types of raceways in this section include the following:
 - 1. Electrical Metallic Tubing
 - 2. Flexible Metal Conduit
 - 3. Intermediate Metal Conduit
 - 4. Liquid-tight Flexible Metal Conduit
 - 5. Rigid Metal Conduit
 - 6. Rigid Non-metallic Conduit

1.3 QUALITY ASSURANCE:

- A. **MANUFACTURERS:** Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. **STANDARDS:** Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.
- C. **SUBMITTALS:** Not required.

PART 2 – PRODUCTS

2.1 METAL CONDUIT AND TUBING:

- A. **GENERAL:**
 - 1. Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) as indicated; with minimum trade size of 3/4".
- B. **RIGID METAL CONDUIT (RMC):** FS WW-C-0581 and ANSI C80.1.
- C. **INTERMEDIATE STEEL CONDUIT (IMC):** FS WW-C-581.
- D. **PVC EXTERNALLY COATED RIGID STEEL CONDUIT:** ANSI C80.1 and NEMA Std. Pub. No. RN 1.
- E. **ALUMINUM CONDUIT:** Not acceptable.

- F. MC CABLE: Not acceptable.
- G. RIGID AND INTERMEDIATE STEEL CONDUIT FITTINGS:
 - 1. Provide fully threaded malleable steel couplings; raintight and concrete tight where required by application. Provide double locknuts and metal bushings at all conduit terminations. Install OZ Type B bushings on conduits 1-1/4" and larger.
- H. ELECTRICAL METALLIC TUBING (EMT): FS WW-C-563 and ANSI C80.3.
- I. EMT FITTINGS:
 - 1. Provide insulated throat nylon bushings with non-indenter type malleable steel fittings at all conduit terminations. Install OZ Type B bushings on conduits 1" larger. Cast or indenter type fittings are not acceptable.
- J. FLEXIBLE METAL CONDUIT: FS WW-C-566, of the following type;
 - 1. Zinc-coated steel.
- K. FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 1, and Style A.
- L. LIQUID TIGHT FLEXIBLE METAL CONDUIT:
 - 1. Provide liquid-tight, flexible metal conduit; constructed of single strip, flexible continuous, interlocked, and double-wrapped steel; galvanized inside and outside; coated with liquid-tight jacket of flexible polyvinyl chloride (PVC).
- M. LIQUID-TIGHT FLEXIBLE METAL CONDUIT FITTINGS: FS W-F-406, Type 1, Class 3, Style G.
- N. EXPANSION FITTINGS: OZ Type AX, or equivalent to suit application.

2.2 NON-METALLIC CONDUIT AND DUCTS:

- A. GENERAL:
 - 1. Provide non-metallic conduit, ducts and fittings of types, sizes and weights as indicated; with minimum trade size of 3/4".
- B. UNDERGROUND PVC PLASTIC UTILITIES DUCT:
 - 1. Minimum requirements shall be schedule 40 for encased burial in concrete and for Type II for direct burial.
- C. PVC AND ABS PLASTIC UTILITIES DUCT FITTINGS:
- D. ANSI/NEMA TC 9, match to duct type and material.
- E. HDPE CONDUIT: Not acceptable.

2.3 CONDUIT; TUBING; AND DUCT ACCESSORIES:

- A. Provide conduit, tubing and duct accessories of types and sizes, and materials, complying with manufacturer's published product information, which mate and match conduit and tubing. Provide manufactured spacers in all duct bank runs.

2.4 SEALING BUSHINGS:

- A. Provide OZ Type FSK, WSK, or CSMI as required by application. Provide OZ type CSB internal sealing bushings.

2.5 CABLE SUPPORTS:

- A. Provide OZ cable supports for vertical risers, type as required by application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS:

- A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and in accordance with the following:
 - 1. SERVICE ENTRANCE CONDUCTORS, AND CONDUCTORS OVER 600 VOLTS:
 - a. Install in rigid metal conduit (RMC), or intermediate metal conduit (IMC); except where buried below grade, install in non-metallic conduit or duct, individually encased in concrete. See duct banks.
 - 2. FEEDERS UNDER 600 VOLTS:
 - a. Install feeders to panels and motor control centers and individual equipment feeders rated 100 amps and greater, in rigid metal conduit (RMC), or intermediate metal conduit (IMC); except where buried below grade, install in non-metallic conduit or duct. Encase feeders 1-1/4" and larger, individually in concrete where installed below grade. See duct banks.
 - 3. BRANCH CIRCUITS, SIGNAL AND CONTROL CIRCUITS, AND INDIVIDUAL EQUIPMENT CIRCUITS RATED LESS THAN 100 AMPS:
 - a. Install in electric metallic tubing (EMT); except in poured walls, with one side in contact with grade, below concrete slab-on-grade or in earth fill, install in non-metallic plastic duct. In areas exposed to weather, moisture, or physical damage, install in GRC or IMC. In suspended slabs, install in EMT. Encase non-metallic duct 1-1/4" and larger in concrete. See duct banks.
- B. Provide 1000 feet of 3/4" conduit with 3 #12 conductors and 1000 feet of 3/4" conduit with 3 #10 conductors. Provide all supports, fittings, boxes, terminations, etc. as required for installation. Install only as directed by engineer. Credit back all unused material and labor to the Owner.
- C. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.
- D. Install raceway in accordance with the following:
 - 1. Provide a minimum of 12" clearance measured from outside of insulation from flues, steam and hot water piping, etc. Avoid installing raceways in immediate vicinity of boilers and similar heat emitting equipment. Conceal raceways in finished walls, ceilings and floor (other than slab-on-grade), except in mechanical, electrical and/or communication rooms, conceal all conduit and connections to motors, equipment, and surface mounted cabinets unless

exposed work is indicated on the drawings. Run concealed conduits in as direct a line as possible with gradual bends. Where conduit is exposed in mechanical spaces, etc., install parallel with or at right angles to building or room structural lines. Do not install lighting raceway until piping and duct work locations have been determined in order to avoid fixtures being obstructed by overhead equipment.

2. Where cutting raceway is necessary, remove all inside and outside burrs; make cuts smooth and square with raceway. Paint all field threads (or portions of raceway where corrosion protection has been damaged) with primer and enamel finish coat to match adjacent raceway surface.
- E. Comply with NEC for requirements for installation of pull boxes in long runs.
- F. Cap open ends of conduits and protect other raceways as required against accumulation of dirt and debris. Pull a mandril and swab through all conduit before installing conductors. Install a 200 lb. nylon pull cord in each empty conduit run.
- G. Replace all crushed, wrinkled or deformed raceway before installing conductors.
- H. Do not use flame type devices as a heat application to bend PVC conduit. Use a heating device which supplies uniform heat over the entire area without scorching the conduit.
- I. Provide rigid metal conduit (RMC) for all bends greater than 22 degrees in buried conduit. Provide protective coating for RMC bend as specified herein.
- J. Where raceways penetrate building, area ways, manholes or vault walls and floors below grade, install rigid metal conduit (RMC) for a minimum distance of 10 feet on the exterior side of the floor or wall. Provide OZ, Type FSK, WSK or CSMI sealing bushings (with external membrane clamps as applicable) for all conduit penetrations entering walls or slabs below grade. Provide segmented type CSB internal sealing bushings in all raceways penetrating building walls and slabs below grade, and in all above grade raceway penetrations susceptible to moisture migration into building through raceway.
- K. Install liquid-tight flexible conduit for connection of motors, transformers, and other electrical equipment where subject to movement and vibration.
- L. Install spare 3/4" conduits (capped) from each branch panelboard into the ceiling and floor space. Run five into the ceiling space and five into the floor space. Where the floor is not accessible run six conduits into the ceiling space. Run conduits the required distance necessary to reach accessible ceiling space.
- M. Provide OZ expansion fittings on all conduits crossing building expansion joints, both in slab and suspended.
- N. Provide OZ cable supports in all vertical risers in accordance with NEC 300-19; type as required by application.
- O. Complete installation of electrical raceways before starting installation of cables/conductors within raceways.
- P. Raceway installation below grade:
1. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness

.020 inches). Completely wrap and tape all field joints.

2. Mark all buried conduits which do not require concrete encasement by placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12" below final grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.
3. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.

Q. Raceway installation below slab-on-grade, or below grade:

1. For slab-on-grade construction, install runs of rigid plastic conduit (PVC) below slab. All raceway shall be located a minimum of 4" below gravel sub-base. Install RMC (with protective coating) for raceways passing vertically through slab-on-grade. Slope raceways as required to drain away from electrical enclosures and to avoid collection of moisture in raceway low points.
2. Apply protective coating to metallic raceways in direct contact with earth or fill of any type; consisting of spirally wrapped PVC tape (1/2" minimum overlap of scotch wrap tape or equal); or factory applied vinyl cladding (minimum thickness .020 inches). Completely wrap and tape all field joints.
3. Mark all buried conduits which do not require concrete encasement by placing yellow plastic marker tape (minimum 6" wide) along entire length of run 12" below final grade. Where multiple small lines are buried in a common trench and do not exceed an overall width of 16", install a single line marker.
4. Burial depths must comply with NEC Section 300-5 but in no case be less than 24", unless noted otherwise on drawings.

R. Raceway installation in suspended slabs:

1. Install conduit as close to the middle of concrete slab as practicable without disturbing reinforcement. Do not install conduits of diameter greater than 1/3 of the slab thickness. Space conduits not less than 3 diameters on center (except at stub up locations). Provide OZ expansion fittings at all expansion joints. All raceways shall be installed with concrete tight fittings. Include copper ground conductor in all raceways installed in suspended slabs.

S. Raceway installation in hazardous locations:

1. Install RMC in all hazardous locations as defined by NEC. Provide suitable fittings, seal-offs, boxes, etc. to comply with requirements.
2. Engage at least five full threads on all fittings. Provide inspection fittings with explosion proof drains to prevent water accumulation in conduit runs. Install seal-offs for arcing or high temperature equipment, at housing with splices or taps and where conduits enter or leave the hazardous area. Provide seal-offs of the appropriate type for vertical or horizontal installation. Ground all metallic parts.

T. DUCTBANKS:

1. Provide ductbank construction as indicated using 3000 psi at 28 day strength concrete, with red marker dye. Use Type II low alkali per ASTM C150. Use

ASTM C-33 aggregate gradation with maximum size of 3/4". Use W/C ratio of 0.50. Install #4 reinforcing bar per ASTM 615 grade 50 in each corner of ductbank. Provide minimum 4" concrete cover on all sides of exterior conduits. Provide polypropylene pull rope in all spare duct.

END OF SECTION 16110

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 Section making reference to electrical raceways specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of raceways is indicated by drawings and schedules.
- B. Types of raceways in this section include the following:
 - 1. Cable tray systems
 - 2. Overhead metal raceways
 - 3. Surface metal raceways

1.3 QUALITY ASSURANCE:

- A. STANDARDS:
 - 1. Comply with applicable portions of NEMA standards pertaining to raceways. Comply with applicable portions of UL safety standards pertaining to electrical raceway systems; and provide products and components which have been UL-listed and labeled. Comply with NEC requirements as applicable to construction and installation of raceway systems.

1.4 SUBMITTALS:

- A. PRODUCT DATA:
 - 1. Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of raceway as follows:
 - a. Surface Metal Raceways
 - b. Cable Tray Systems
 - c. Overhead metal raceways
- B. SHOP DRAWINGS:
 - 1. Submit dimensioned drawings of raceway systems showing layout of raceways and fittings, spatial relationships to associated equipment, and adjoining raceways, for each type of raceway as follows:
 - a. Surface metal Raceways
 - b. Cable Tray Systems
 - c. Overhead metal raceways

PART 2 - PRODUCTS

2.1 MANUFACTURED RACEWAY SYSTEMS:

A. GENERAL:

1. Provide electrical raceways of types, grades, sizes, weights [wall thicknesses], and number of channels, for each service indicated. Provide complete assembly of raceway including, but not necessarily limited to, couplings, offsets, elbows, expansion joints, adapters, holddown straps, end caps, and other components and accessories as needed for complete system.

B. SURFACE METAL RACEWAYS:

1. Provide galvanized steel surface metal raceways of sizes and channels indicated. Provide fittings indicated which match and mate with raceway. Paint with manufacturer's standard prime coating and finish color as indicated. Provide receptacles on centers as indicated on drawings or as directed by engineer.

C. MANUFACTURER:

1. Subject to compliance with requirements, provide surface metal raceways of one of the following:
 - a. Wiremold Company
 - b. Hubbell Incorporated

D. CABLE TRAY SYSTEMS:

1. Provide UL-listed tray systems of sizes, types and capacities indicated, and meeting all requirements of NEMA VE-1. Trays to be provided include but are not necessarily limited to the following:

<u>Type</u>	<u>Width</u>	<u>Depth</u>	<u>Rung Spacing</u>	<u>NEMA Class</u>
Ladder	18" 24"	3" 4" 5" 6"	6" 9" 12" 18"	1

2. Provide radius as indicated, and in no case smaller than required to comply with minimum radius requirement of cable manufacturer.
3. Provide all fittings including elbows, intersections, expansion joints, transition fittings, reducers, barrier strips, conduit-to-tray clamps, hangers, supports, retaining clips, etc. Bond each expansion joint in tray system by means of 1/O copper jumper (with crimped lug connectors) at each joint. Provide cantilever, single-rod or trapeze support systems as indicated. Provide all rod or trapeze supported tray systems with rigid unistrut support to structure; laterally at intervals not to exceed 25 feet on center, and longitudinally at intervals not to exceed 50 feet on center.
4. Provide tray with hot-dip (after fabrication) galvanized corrosion-resistant finish. Grind all rough edges, drip concentrations, etc, to smooth finish. Apply cold zinc spray to all field cut surfaces.

E. MANUFACTURER:

1. Subject to compliance with requirements, provide cable tray systems of one of the following:
 - a. B-Line Systems
 - b. P/W Industries
 - c. Globe Metal Products, U.S.Gypsum Co.
 - d. T.J. Cope, Inc.
 - e. Square D Company
 - f. Chalfant

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS:

- A. Install electrical raceways where indicated; in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and complying with recognized industry practices.
- B. Coordinate with other work including metal and concrete deck work, as necessary to interface installation of electrical raceways and components.
- C. Seal joints of underfloor ducts with sealing compound or tape prior to placing concrete.
- D. Level and square raceway runs, and install at proper elevations/heights.

3.2 ADJUSTING AND CLEANING:

- A. Upon completion of installation of raceways, inspect interiors of raceways; remove burrs, dirt and construction debris.

END OF SECTION 16111

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to conductors and cables specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of electrical conductor and electrical cable work is indicated by drawings and schedules.
- B. Types of conductors and cables in this section include the following:
 - 1. Copper Conductors (600V)
- C. Applications for conductors and cables required for project include:
 - 1. Power Distribution
 - 2. Feeders
 - 3. Branch Circuits

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to construction and installation of electrical conductors and cable. Comply with UL standards and provide electrical conductors and cables which have been UL-listed and labeled.
- B. Comply with applicable portions of NEMA/Insulated Cable Engineers Association standards pertaining to materials, construction and testing of conductors and cable.
- C. Comply with applicable portions of ANSI/ASTM and IEEE standards pertaining to construction of conductors and cable.

1.4 SUBMITTALS:

- A. FIELD TEST DATA:
 - 1. Submit megohmmeter test data for circuits under 600 volts.

PART 2 - PRODUCTS

2.1 COPPER CONDUCTORS (600V):

- A. Provide factory-fabricated conductors of sizes, ratings, materials, and types indicated for each service. Where not indicated provide proper selection to comply with project's installation requirements and NEC standards. Provide conductors in accordance with the following:
 - 1. Distribution and Panelboard Feeders; and Other Conductors, #2 AWG and Larger – Copper conductor; see drawings for insulation type.

2. Branch Circuit Conductors and All Conductors #3 AWG and Smaller - Copper conductor, with THHN/THWN insulation. Size all conductors in accordance with NEC; minimum size to be #12 AWG. Provide stranded conductors for #8 AWG and larger.
- B. Provide color and coding of conductors as follows:
- | | |
|-----------------|------------------|
| <u>120/208V</u> | <u>277/480V</u> |
| A-Phase - Black | A-Phase - Brown |
| B-Phase - Red | B-Phase - Purple |
| C-Phase - Blue | C-Phase - Yellow |
| Neutral - White | Neutral - Gray |
| Ground - Green | Ground - Green |
- C. Provide colors for switch legs, travelers and other wiring for branch circuits different than listed above.
- D. Provide #10 AWG neutral conductor for all three and four wire fluorescent circuit home runs.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: Install electric conductors and cables as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standards of Installation", and in accordance with recognized industry practices.
- B. Coordinate installation work with electrical raceway and equipment installation work, as necessary for proper interface.
- C. Cables may be pulled by direct attachment to conductors or by use of basket weave pulling grip applied over cables. Attachment to pulling device shall be made through approved swivel connection. Nonmetallic jacketed cables of small size may be pulled directly by conductors by forming them into a loop to which pull wire can be attached; remove insulation from conductors before forming the loop. Larger sizes of cable may be pulled by using basket weave pulling grip, provided the pulling force does not exceed limits recommended by manufacturer; if pulling more than one cable, bind them together with friction tape before applying the grip. For long pulls requiring heavy pulling force, use pulling eyes attached to conductors.
- D. Do not exceed manufacturer's recommendations for maximum allowable pulling tension, side wall pressure, and minimum allowable bending radius. In all cases, pulling tension applied to the conductors shall be limited to 0.008 lbs. per circular mil of conductor cross-section area.
- E. Pull in cable from the end having the sharpest bend; i.e. bend shall be closest to reel.

Keep pulling tension to minimum by liberal use of lubricant, and turning of reel, and slack feeding of cable into duct entrance. Employ not less than one man at reel and one in pullhole during this operation.

- F. For training of cables, minimum bend radius to inner surface of cable shall be 12 times cable diameter.
- G. Where cable is pulled under tension over sheaves, conduit bends, or other curved surfaces, make minimum bend radius 50% greater than specified above for training.
- H. Use only wire and cable pulling compound recommended by the specific cable manufacturer, and which is listed by UL.
- I. Seal all cable ends unless splicing is to be done immediately. Conduit bodies shall not contain splices.
- J. Support all cables in pullholes, concrete trenches, and similar locations by cable racks and secure to rack insulators with nylon cord or self-locking nylon cable ties. Place each cable on separate insulator. In manholes, pullholes, concrete trenches, and similar locations, wrap strips of fire-proofing tape (approx. 1/16 inch thick by 3 inches wide) tightly around each cable spirally in half-lapped wrapping or in two butt-joined wrappings with the second wrapping covering the joints in the first. Apply tape with the coated side toward the cable, and extend tape one inch into the ducts. To prevent unraveling, random wrap the fireproofing tape the entire length of the fireproofing with pressure sensitive glass cloth tape. Provide fireproofing tape of a flexible, conformable fabric having one side coated with flame retardant, flexible, polymeric coating and/or a chlorinated elastomer not less than 0.050 inch thick weighing not less than 2.5 pounds per square yard. Provide tape which is noncorrosive to cable sheath, self-extinguishing, and which will not support combustion. Construct tape of materials which do not deteriorate when subjected to oil, water, gases, salt water, sewage and fungus.
- K. Follow manufacturer's instructions for splicing and cable terminations.

3.2 AFTER INSTALLATION TEST FOR CABLE 600 VOLTS AND BELOW:

- A. Prior to energization, test cable and wire for continuity of circuitry, and for short circuits, Megger all circuits of 100 amp and greater rating. Correct malfunctions. Submit record in triplicate of megohmmeter readings to Architect/Engineer.
- B. Subsequent to wire and cable connections, energize circuitry and demonstrate functioning in accordance with requirements.
- C. IDENTIFICATION OF FEEDERS: Each cable at each entry to and exit for each manhole, pullhole, pullbox, cable tray switchgear and switch, shall have a marker affixed, upon which is stamped or embossed the feeder designation; i.e. "MCCI", "PANEL L", "CHILLER", "NO. 1", etc. Identification letters shall be 1/8 inch minimum size. Markers shall be rigid, non-corrosive material, attached to the feeder cables with feeder identification. Nylon straps shall be used to tie the markers.

END OF SECTION 16120

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specifications sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is a part of each Division-16 section making reference to electrical wiring boxes and fittings specified herein. See Section 16110, Raceways, for additional requirements.

1.2 DESCRIPTION OF WORK:

- A. The extent of electrical box and electrical fitting work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings in this section include the following:
 - 1. Outlet Boxes
 - 2. Junction Boxes
 - 3. Pull Boxes
 - 4. Floor Boxes
 - 5. Conduit Bodies
 - 6. Bushings
 - 7. Locknuts
 - 8. Knockout Closures
 - 9. Miscellaneous Boxes and Fittings

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to construction and installation of electrical boxes and fittings. Comply with ANSI C 134,1 (NEMA Standards Pub No. OS 1) as applicable to sheet-steel outlet boxes, device boxes, covers and box supports. Provide electrical boxes and fittings which have been UL-listed and labeled.

1.4 SUBMITTALS: None required

PART 2 - PRODUCTS

2.1 FABRICATED MATERIALS:

- A. INTERIOR OUTLET BOXES:
 - 1. Provide one piece, galvanized flat rolled sheet steel interior outlet wiring boxes with accessory rings, of types, shapes and sizes, including box depths, to suit each respective location and installation, construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box and covers and wiring devices; minimum size 4"x4"x1-1/2". Provide minimum 2-1/8" depth for boxes with three or more conduit entries.
 - 2. Provide an 'FS' box, with no knockouts when surface mounted in a finished, non-utility space. Surface mounting is only acceptable when approved by the Architect.

B. INTERIOR OUTLET BOX ACCESSORIES:

1. Provide outlet box accessories as required for each installation, including mounting brackets, hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring applications.

C. WEATHERPROOF OUTLET BOXES:

1. Provide corrosion-resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes (including depth) required, with threaded conduit ends, cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, with face plate gaskets and corrosion-resistant fasteners.

D. JUNCTION AND PULL BOXES:

1. Provide code-gage sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

E. FLOOR BOXES:

1. Provide leveling and fully adjustable floor service receptacle outlets and fittings of types and ratings indicated; and with finish as selected by Architect. Equip with wiring devices as specified in section 16140. Provide boxes compatible with floor system; provide cast iron boxes for slab-on-grade construction. Equip with tile and/or carpet flanges to accommodate floor finish material. Provide equipment as follows:

F. MANUFACTURER:

1. Subject to compliance with requirements, provide floor boxes of one of the following:
 - a. Bell Electric/Square D Co.
 - b. Crouse-Hinds Co.
 - c. Harvey Hubbell, Inc.
 - d. Steel City/Midland-Ross Corp.

G. CONDUIT BODIES:

1. Provide galvanized cast-metal conduit bodies, of types, shapes and sizes to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

H. BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS:

1. Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and malleable steel conduit bushings and offset connectors, of types and sizes to suit respective uses and installation.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

A. GENERAL:

1. Install electrical boxes and fittings where indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
2. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.
3. Provide coverplates for all boxes. See Section 16140, Wiring Devices.
4. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.
5. Provide knockout closures to cap unused knockout holes where blanks have been removed.
6. Install boxes and conduit bodies to ensure ready accessibility of electrical wiring. Do not install boxes above ducts or behind equipment. Install recessed boxes with face of box or ring flush with adjacent surface. Seal between switch, receptacle and other outlet box openings and adjacent surfaces with plaster, grout, or similar suitable material.
7. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry. Use bar hangers for stud construction. Use of nails for securing boxes is prohibited. Set boxes on opposite sides of common wall with minimum 10" of conduit between them.
8. Provide electrical connections for installed boxes.

END OF SECTION 16135

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification section, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is a part of each Division-16 section making reference to supports, anchors, sleeves, and seals, specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of supports, anchors, and sleeves is indicated by drawings and schedules and/or specified in other Division-16 sections. See Section 16110, Raceways, for additional requirements.
- B. Work of this section includes supports, anchors, sleeves and seals required for a complete raceway support system, including but not limited to: clevis hangers, riser clamps, C-clamps, beam clamps, one and two hole conduit straps, offset conduit clamps, expansion anchors, toggle bolts, threaded rods, U-channel strut systems, threaded rods and all associated accessories.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to construction and installation of electrical supporting devices. Comply with applicable requirements of ANSI/NEMA Std. Pub No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies". Provide electrical components which are UL-listed and labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES:

- A. GENERAL:
 - 1. Provide supporting devices; complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified. See drawings for additional requirements.

PART 3 - EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES:

- A. Install hangers, anchors, sleeves, and seals as required, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports, clamps and attachments to support piping properly from

building structures. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. For pre-and post tensioned construction, use pre-set inserts for support of all electrical work. Do not use toggle bolts, moly bolts, wood plugs or screws in sheetrock or plaster as support for any equipment or raceway.

D. RACEWAYS:

1. Support raceways which are rigidly attached to structure at intervals not to exceed 8 feet on center, minimum of two straps per 10 foot length of raceway, and within 12" of each junction box, coupling, outlet or fitting. Support raceway at each 90 degree bend. Support raceway (as it is installed) in accordance with the following:

<u>NUMBER OF RUNS</u>	<u>3/4" TO 1-1/4" Ø</u>	<u>1-1/2" & LARGER Ø</u>
1	Full straps, clamps or hangers.	Hanger
2	Full straps, clamps or hangers.	Mounting Channel
3 or more	Mounting Channel	Mounting Channel

2. Support suspended raceways on trapeze hanger systems; or individually by means of threaded rod and straps, clamps, or hangers suitable for the application. Do not use "tie wire" as a portion of any raceway support system; do not support raceway from ceiling support wires.

E. FLOOR MOUNTED EQUIPMENT:

1. Provide rigid attachment of all floor mounted equipment to the floor slab or structural system. Provide 5/8" bolts or expansion anchors at each 90 degree corner and at intervals not to exceed 48" on center along entire perimeter of the equipment. Provide rigid attachment for all floor mounted switchboards, panelboards, power and control equipment, motor control centers, dimmer cabinets, transformers (provide neoprene vibrations isolators at anchor points), oil switches, battery packs and racks, and similar equipment furnished under Section 16.

F. WIREWAYS, BUS DUCTS AND CABLE TRAYS:

1. Provide vertical and lateral support systems for all wireways, busway, and cable trays which are supported from overhead structure. See Sections 16111 and 16145 for additional requirements.

END OF SECTION 16136

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
 - 1. Receptacles
 - 2. Switches
 - 3. Dimmer controls
 - 4. Cord caps
 - 5. Cord connectors
 - 6. Poke-through assemblies
 - 7. Telephone/power poles

1.3 QUALITY ASSURANCE:

- A. Comply with NEC and NEMA standards as applicable to construction and installation of electrical wiring devices. Provide electrical wiring devices which have been UL listed and labeled.

1.4 SUBMITTALS:

- A. PRODUCT DATA:
 - 1. Submit manufacturer's data on electrical wiring devices.

PART 2 - PRODUCTS

- A. FABRICATED WIRING DEVICES:
- B. GENERAL:
 - 1. Provide factory-fabricated wiring devices, in types, and electrical ratings for applications indicated and complying with NEMA Stds. Pub No. WD 1.
 - 2. Provide wiring devices (of proper voltage rating) as follows:

<u>MFGR.</u>	<u>RECEPTACLE</u>	<u>SWITCHES</u>			
		<u>1-POLE</u>	<u>3-WAY</u>	<u>4-WAY</u>	<u>W-PILOT</u>
Hubbell	HBL5352	HBL 1221	HBL 1223	HBL1224	HBL1221-PL
Bryant	5352	1221	1223	1224	1221-PL
Pass Seymour	5352	20AC1	20AC3	20AC4	20AC1-RPL
Leviton	5362	1221	1223	1224	
Cooper	5352	1221	1273	1224	1221-PL

3. Provide devices in colors selected by Architect. Provide red devices on all emergency circuits.

C. TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) RECEPTACLES:

1. Provide TVSS receptacles having 4 series parallel 130V MOV's capable of a minimum of 140 joules suppression. Provide units with visual (and audible) surge status indicators to monitor condition of surge circuit; visual indicator to be "on" when power present and suppression circuit is fully functional. (Audible indicator shall sound a "beep" alarm approximately every 30 seconds if suppression circuit has been damaged.) Provide NEMA 5-20R, 20 amp, 125V receptacle of one of the following manufacturers:

MANUFACTURER

<u>SPECIFICATION GRADE</u>	<u>HUBBELL</u>	<u>PASS SEYMOUR</u>
Duplex Recept-Visual only	5350	5352 XXXSP
Duplex Recept-Visual/Audible	5352	5362 XXXSP
Single Recept-Visual only	5351	N/A
Duplex Recept-Isol Gnd, Visual/Audible	IG5352S	IG5362 XXXSP
Single Recept-Isol Gnd, Visual only	IG5351S	N/A

2. Color of devices selected by Architect. Provide red devices on all emergency circuits.

D. GROUND-FAULT INTERRUPTER:

1. Provide general-duty, duplex receptacle, ground-fault circuit interrupters; feed-thru types, capable of protecting connected downstream receptacles on single circuit; grounding type UL-rated Class A, Group A, 20-amperes rating; 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 milliamperes ground-fault trip level; color as selected by Architect. Provide Hospital grade where required elsewhere by specification or drawings. Provide units of one of the following:
 - a. P&S/Sierra
 - b. Hubbell
 - c. Leviton
 - d. Square D

E. CORD CAPS AND CONNECTORS:

1. Provide 3, 4 and 5-wire grounding, cap plugs, and connectors of ampere and voltage rating required, for final equipment, and as indicated otherwise on drawings.
2. Provide products of one of the following:
 - a. Cooper
 - b. General Electric
 - c. Hubbell
 - d. Leviton
 - e. P&S

F. INCANDESCENT LAMP DIMMERS:

1. Provide branch lighting solid-state AC dimmer controls for incandescent fixtures; wattage and voltage as indicated, 60 hertz, with continuously adjustable slider control. Dimmer shall match low voltage transformer. Color as selected by Architect. Provide devices manufactured by one of the following:
 - a. Lutron (Nova Series)
 - b. Hubbell (AS Series)

G. FLUORESCENT LAMP DIMMERS:

1. Provide single-pole, semi-conductor modular type AC dimmers for fluorescent fixtures; 60 hertz, with wattage and voltage as indicated, continuously adjustable slider control, and with electromagnetic filters to reduce noise and interference to minimum. Construct with continuously adjustable trim potentiometer for adjustment of low end dimming. Dimmer shall match lamp/ballast combination. Color as selected by Architect. Provide devices manufactured by one of the following:
 - a. Lutron (Nova Series)

H. WIRING DEVICE ACCESSORIES:

1. WALL PLATES:
 - a. Provide coverplates for wiring devices; plate color to match wiring devices to which attached. Provide nylon or Lexan coverplates in all finished areas. Provide galvanized steel plates in unfinished areas. Provide blank coverplates for all empty outlet boxes. Engrave all receptacle plates other than those serving 120 volt, single phase devices. State voltage and amperage characteristics. Example "208V, 30A".

I. WEATHER-PROTECTING DEVICE ENCLOSURES:

1. Where required for compliance with NEC 406-8 (receptacles installed outdoors for use other than with portable tools or equipment), provide weather-tight device covers which provide complete protection with the cord and cap inserted into the wiring device. Provide units which mount on either single or double gang devices. Provide device enclosures manufactured by one of the following:

- a. Intermatic WP1020 or WP1030
- b. P&S WIUC10C or WIUC20c

J. POKE-THROUGH ASSEMBLY DEVICES:

- 1. Provide factory-assembled poke-through assembly devices equipped with wiring devices as specified herein; capable of maintaining fire floor rating of 3 hours. Construct for installation in concrete floor with center tube, fire-stop wafers, spreader plates, service fitting base plate, and 4-11/16" conduit box. Provide service fitting with alignment adjustment screws for complete installation; finish as selected by Architect. Provide devices manufactured by one of the following:
 - a. Hubbell
 - b. Wiremold Co.

K. TELEPHONE/POWER POLES:

- 1. Provide factory-assembled telephone/power poles of types, sizes and ratings indicated; for use with telephone and power systems installed above suspended ceilings. Provide with 2 duplex receptacles as specified herein. Isolate power section from telephone compartment with separating steel enclosure. Extend wiring from receptacles to junction box at top of pole where connections are made above suspended ceiling. Provide pole foot with carpet pad and ceiling tile trim pad. Provide poles in color selected by Architect, manufactured by one of the following:
 - a. Hubbell
 - b. Wiremold Co.

PART 3 – EXECUTION

- A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation" and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work. Install devices in boxes such that front of device is flush and square with coverplate. Drawings are small scale and, unless dimensioned, indicate approximate locations only of outlets, devices, equipment, etc. Locate outlets and apparatus symmetrically on floors, walls and ceilings where not dimensioned and coordinate with other work. Verify all dimensioned items on job site. Consult architectural cabinet, millwork, and equipment shop drawings before beginning rough-in of electrical work. Adjust locations of all electrical outlets as required to accommodate work in area, and to avoid conflicts with wainscoat, back splash, tackboards, and other items.
- C. Provide receptacles in surface raceway at 24" on center unless indicated otherwise.
- D. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris. Mark each device box (for each type of wiring device) with a permanent ink felt tip marker, indicating the circuit to which the device is connected. Example: "CKT A-1".
- E. Install blank plates on all boxes without devices.

- F. Delay installation of wiring devices until wiring work and painting is completed. Provide separate neutral conductor from panel to each GFI receptacle.
- G. Install GFI receptacles for all receptacles installed in restrooms, kitchens, outdoors or within six feet of any sink. Provide in elevator equipment rooms and pits.
- H. Where wall box dimmers are specified, provide a separate neutral for each phase of the branch circuits on which dimmers are installed.

3.2 PROTECTION OF WALL PLATES AND RECEPTACLES:

- A. At time of substantial completion, replace those items, which have been damaged, including those stained, burned and scored.

3.3 GROUNDING:

- A. Provide electrically continuous, tight grounding connections for wiring devices, unless otherwise indicated.

3.4 TESTING:

- A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

END OF SECTION 16140

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to panelboards specified herein.

1.2 DESCRIPTION OF WORK:

- A. The extent of panelboard and enclosure work, is indicated by drawings and schedules.
- B. Types of panelboards and enclosures in this section include lighting and appliance panelboards, and power distribution panelboards.

1.3 QUALITY ASSURANCE:

- A. Provide units which have been UL listed and labeled. Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes. Comply with NEC pertaining to installation of wiring and equipment in hazardous locations. Comply with NEMA Stds. Pub No. 250, "Enclosures for Electrical Equipment (1000 volt maximum). Pub No. 1, "Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".

1.4 SUBMITTALS:

- A. PRODUCT DATA:
 - 1. Submit manufacturer data including specifications, installation instructions and general recommendations, for each type of panelboard required.
- B. SHOP DRAWINGS:
 - 1. Submit dimensioned drawings of panelboards and enclosures showing accurately scaled layouts of enclosures and required individual panelboard devices, including but not necessarily limited to, circuit breakers, fusible switches, fuses, ground-fault circuit interrupters, and accessories.

PART 2 – PRODUCTS

ACCEPTABLE MANUFACTURERS:

2.1 MANUFACTURERS:

- A. Subject to compliance with requirements, provide of one of the following:
 - 1. Cutler Hammer Products, Eaton Corp.
 - 2. General Electric Company
 - 3. Square D Company

2.2 PANELBOARDS:

A. GENERAL:

1. Except as otherwise indicated, provide panelboards, enclosures and ancillary components, of types, sizes, and ratings indicated. Equip with number of unit panelboard devices as required for complete installation. Fully equip "spaces" with hardware to receive breaker or switch of size indicated. Provide CU/AL rated lugs of proper size to accommodate conductors specified.

B. POWER DISTRIBUTION PANELBOARDS:

1. Provide dead-front safety type power distribution panelboards as indicated, with switching and protective devices in quantities, ratings, types and with arrangement shown. Equip with copper bus bars, full-sized neutral bus and ground bus. Provide fusible or circuit breaker branch and main devices as indicated. Series rated systems are not acceptable. See Section 16180, Overcurrent Protection Devices.

C. LIGHTING AND APPLIANCE PANELBOARDS:

1. Provide dead-front safety type lighting and appliance panelboards as indicated, with switching and protective devices in quantities, ratings, types, and arrangement shown. Provide bolt-on thermal magnetic type branch breakers. Where multiple breakers are indicated, provide with common trip handle. Series rated systems are not acceptable. Equip with copper bus bars, full-sized neutral bus, and ground bus.

D. PANELBOARD ENCLOSURES:

1. Provide galvanized sheet steel cabinet type enclosures, in sizes and NEMA types as indicated, code-gage minimum 16-gage thickness. Provide door-in-door hinged fronts. Provide fronts with adjustable indicating trim clamps, and doors with flush locks and keys, all panelboard enclosures keyed alike, with concealed door hinges and door swings as indicated. Equip with interior circuit-directory frame, and card with clear plastic covering. Provide baked gray enamel finish over a rust inhibitor. Provide enclosures fabricated by same manufacturer as overcurrent devices contained therein Bolt engraved plastic laminate labels indicating panel name and voltage on the interior and exterior of panelboards.

E. FINISH:

1. Coat interior and exterior of surface with manufacturer's standard color; baked on enamel finish.

F. IDENTIFICATION:

1. Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the interior of each panelboard; include panelboard name and voltage. Provide red plastic laminate labels on emergency system panels.

PART 3 – EXECUTION

3.1 INSTALLATION OF PANELBOARDS:

A. GENERAL:

1. Install panelboards and enclosures where indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", in compliance with recognized industry practices to ensure products fulfill requirements.

B. MOUNTING:

1. Provide 4" high concrete curb under floor standing distribution panelboards.
2. Coordinate installation of panelboards and enclosures with cable and raceway installation work. Anchor enclosures firmly to walls and structural surfaces, ensuring they are permanently and mechanically secure. Arrange conductors neatly within enclosure, and secure with suitable nylon ties. Fill out panelboard's circuit directory card upon completion of installation work. Utilize actual final building room numbers, not architectural numbers used on drawings. Identify individual lighting circuits and individual receptacle circuits by room served. Label circuit breakers to identify location of subpanel or equipment supplied using room numbers and equipment names. Include room number with equipment circuit designations. All directories to be typewritten.

END OF SECTION 16160

SECTION 16180 - OVERCURRENT PROTECTIVE DEVICES

July 11, 2007

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to overcurrent protective devices specified herein.

1.2 DESCRIPTION OF WORK:

- A. Extent of overcurrent protective device work is indicated by drawings and schedules and specified herein. Overcurrent protective devices specified herein are for installation as individual components in separate enclosures; and for installation as integral components of switchboard and panelboards. See Section 16175, Switchgear and Switchboards, and Section 16160, Panelboards.
- B. Types of overcurrent protective devices in this section include the following for operation at 600 Volts and below:
 - 1. Molded case circuit breakers
 - 2. Power circuit breakers
 - 3. Molded case systems breakers
- C. Refer to other Division-16 sections for cable/wire and connector work required in conjunction with overcurrent protective devices.

1.3 QUALITY ASSURANCE

- A. Comply with NEC requirements and NEMA and ANSI standards as applicable to construction and installation of overcurrent devices.

1.4 SUBMITTALS:

- A. **PRODUCT DATA:** Submit manufacturer's data on overcurrent protective devices, including catalog cuts, time-current trip characteristic curves, and mounting requirements.
- B. **SHOP DRAWINGS:** Submit layout drawings of overcurrent protective devices, with layouts of circuit breakers, including spatial relationships to proximate equipment. Failure to submit said spatial layouts does not relieve contractor of responsibility to verify all required clearances before release of equipment for fabrication.
- C. **MAINTENANCE STOCK, FUSES:** For types and ratings required, furnish additional fuses, amounting to one unit for every 5 installed units, but not less than two units of each size and type, unless specified otherwise in another section of these specifications.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide products of one of the following (main and branch device manufacturer must be same as panelboard and/or switchboard manufacturer):

B. CIRCUIT BREAKERS AND FUSIBLE SWITCHES:

1. Cutler Hammer Products, Eaton Corp.
2. General Electric Co.
3. Square D Co.

C. MOLDED CASE CIRCUIT BREAKERS:

1. Provide factory-assembled, molded case circuit breaker for power distribution panelboards and switchboards; and for individual mounting, as indicated. Provide breakers of amperage, voltage, and RMS interrupting rating shown, with permanent thermal trip and adjustable instantaneous magnetic trip in each pole. Series rated systems are not acceptable. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick-break action and positive handle indication. Construct breakers for mounting and operating in any physical position and in an ambient temperature of 40 degrees C. Provide with mechanical screw type removable connector lugs, AL/CU rated, of proper size to accommodate conductors specified.

D. MANUFACTURER: Subject to compliance with requirements, provide ground-fault sensing and relaying equipment of one of the following:

1. General Electric Co.
2. Brown Boveri Electric, Inc.
3. HI-Z Corporation
4. Pringle Electric Mfg. Co.
5. Square D Co.

2.2 FUSES

- A. GENERAL: Except as otherwise indicated, provided fuses of type, sizes and ratings and electrical characteristics of a single manufacturer as follows. Provide fuses labeled UL Class L or UL Class R, current limiting and rated for up to 200,000 amperes. Provide Buss KAZ signal activating fuses where required elsewhere in specification.
- B. Where fuses are shown feeding individual or groups of equipment items, comply with manufacturer's recommendation for fusing; adjust fuse size and type as necessary to comply with manufacturer's recommendation.
- C. Provide and install spare fuse cabinet in main electrical room.
- D. MAIN SERVICE AND FEEDER CIRCUITS: For fuse ratings over 600 amperes provide UL Class L Fuses (KRP-C, or A4BQ or LCL or KLPC). For fuse ratings up to 600 amperes, provide UL Class RK1 (KTN-R, KTS-R or A2K-R, A6K-R or NCCR, SCLR or KLN-R, KLS-R). If fuse directly feeds motors, transformers or other inductive load provide UL RK5 time delay (FRN-R, FRS-R or TR-R, TRS-R or ECN-R, ECS-R or FLN-R, FLS-R).
- E. BRANCH CIRCUITS: For motor circuits, transformer circuits, or other inductive loads, provide UL Class RK5 (FRN-R, FRS-R or TR-R, TRS-R or ECN-R, ECN-S or FLN-R, FLS-A). For other circuits, provide UL Class RK1, (KTN-R, KTS-R OR A2K-R, A6K-R or NCLR, SCLR OR KLN-R, KLSR).
- F. MANUFACTURER: Subject to compliance with requirements, provide fuses of one of the following:

1. Bussman Mfg. Co.
 2. Gould Shawmut, Gould Electric Fuse Division
 3. Reliance Fuse Div./Brush Fuse Inc.
 4. Littlefuse, Inc.
- G. IDENTIFICATION: Provide 1/16" thick black plastic laminate labels with 1/4" high lettering on the exterior of all overcurrent devices which are furnished in separately mounted enclosures. Provide red labels for devices supplied with emergency power.

PART 3 – EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES:

- A. Install overcurrent protective devices as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC and NEMA standards for installation of overcurrent protective devices.
- B. Coordinate with work as necessary to interface installations of overcurrent protective devices with other work.
- C. Set field-adjustable circuit breakers for trip settings as indicated, subsequent to installation of devices.
- D. Install fuses in overcurrent protective devices. For motor circuits, fuse sizes shown on drawings are for general guidance only. Size fuses in accordance with fuse manufacturer's recommendation for given motor nameplate ampere rating. Test operation. If nuisance tripping occurs, increase fuse size and disconnect device (if necessary) as required to provide nuisance free tripping. Adjust fuse size properly for ambient temperature, frequent starting and stopping of motor loads, and for loads with long start times. Include all costs in bid.
- E. Field test all ground fault protective devices for proper operation; test to be performed by representative of the manufacturer. Include verification of complete time current trip characteristics.

3.2 FIELD QUALITY CONTROL

- A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION 16180

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Provide grounding as specified herein, and as indicated on drawings.
- B. Provide grounding and bonding of all electrical and communication apparatus, machinery, appliances, building components, and items required by the NEC to provide a permanent, continuous, low impedance, grounding system.
- C. Unless otherwise indicated, ground the complete electrical installation including the system neutral, metallic conduits and raceways, boxes, fittings, devices, cabinets, and equipment in accordance with all code requirements.
- D. Ground each separately derived system, as described in NEC Section 250-30, unless otherwise indicated.
- E. Types of grounding in this section include the following:
 - 1. Underground Metal Water Piping
 - 2. Metal Building Frames
 - 3. Grounding Electrodes
 - 4. Grounding Rods
 - 5. Reference Ground Buses
 - 6. Isolated Grounding Systems
 - 7. Separately Derived Systems
 - 8. Service Equipment
 - 9. Enclosures
 - 10. Systems
 - 11. Equipment
 - 12. Other items indicated on drawings
- F. Requirements of this section apply to electrical grounding work specified elsewhere in these specifications.

1.3 QUALITY ASSURANCE:

- A. Comply with NEC as applicable to electrical grounding and ground fault protection systems. Comply with applicable ANSI and IEEE requirements. Provide products which have been UL listed and labeled.
- B. Resistance from the service entrance ground bus, through the grounding electrode to earth, shall not exceed 5 ohms.

1.4 SUBMITTALS:

- A. Submit the name of test agency to be used for testing specified in this section. Submit

results of tests specified in this section. Also include test results in Operation and Maintenance Manuals as specified.

PART 2 – PRODUCTS

2.1 MATERIALS AND COMPONENTS:

- A. GENERAL: Except as otherwise indicated, provide each electrical grounding system as specified herein, and as shown on drawings, including but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), grounding rods/electrodes and plate electrodes, bonding jumper braid, and other items and accessories needed for complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.
- B. ELECTRICAL GROUNDING CONDUCTORS: Unless otherwise indicated, provide electrical grounding conductors for grounding connections matching power supply wiring materials and sized according to NEC. Provide with green insulation.

PART 3 - EXECUTION

3.1 INSTALLATION OF GROUNDING SYSTEMS:

- A. Install electrical grounding systems in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding devices comply with requirements.
- B. Install clamp-on connectors only on thoroughly cleaned and metal contact surfaces, to ensure electrical conductivity and circuit integrity.
- C. Provide grounding for the entire raceway, enclosure, equipment and device system in accordance with NEC. All non-metallic raceways shall include copper grounding conductor sized in accordance with NEC. Include copper grounding conductor in all raceway installed in suspended slabs.
- D. Provide grounding conductors for dimming systems in accordance with manufacturer's requirement.
- E. EQUIPMENT BONDING/GROUNDING: Provide a NEC sized conductor, whether indicated or not on the drawings, in raceways as follows:
 - 1. Non-metallic conduits and ducts.
 - 2. Distribution feeders.
 - 3. Motor and equipment branch circuits.
 - 4. Device and lighting branch circuits.
 - 5. Provide grounding bushings and bonding jumpers for all conduit terminating in reducing washers, concentric, eccentric or oversized knockouts at panelboards, cabinets and gutters.
- F. Provide bonding jumpers across expansion and deflection couplings in conduit runs, across pipe connections at water meters, and across dielectric couplings in metallic cold water piping system.
- G. Provide bonding wire in all flexible conduit.

END OF SECTION 16452

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Types of lighting fixtures in this section are indicated by schedule and include the following:
 - 1. High-Intensity-Discharge (HID)
 - 2. Fluorescent
 - 3. Incandescent/Halogen
 - 4. LED (Light Emitting Diode)

1.3 QUALITY ASSURANCE:

- A. Comply with NEC, NEMA and ANSI 132,1 as applicable to installation and construction of lighting fixtures. Comply with NEC 410-65C for all recessed incandescent light fixtures. Provide lighting fixtures which have been UL-listed and labeled.

1.4 SUBMITTALS:

- A. PRODUCT DATA:
 - 1. Submit manufacturer's data on interior and exterior building lighting fixtures.
- B. SHOP DRAWINGS:
 - 1. Submit dimensioned drawings of lighting fixtures. Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with proposed fixture and accessories clearly indicated on each sheet. Submit all available standard color samples with the shop drawings. If standard colors are not acceptable, a color sample will be provided to the fixture manufacturer. Return of the shop drawings will be delayed until color samples are provided. Submit ballast manufacturer cut sheets. Submit a list of all lamps used on all projects.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Subject to compliance with requirements, provide products of one of the following (for each type of fixture):
 - 1. HID MAGNETIC BALLASTS:
 - a. Advance Transformer Co.
 - b. Universal Lighting Technologies Co.
 - c. Venture Lighting International

2. INCANDESCENT AND FLUORESCENT LAMPS:

- a. General Electric Co.
- b. Osram Sylvania
- c. Phillips Lighting Corp.

3. HID LAMPS:

- a. General Electric Co.
- b. Osram Sylvania
- c. Phillips Lighting Corp.
- d. Venture Lighting International

2.2 INTERIOR AND EXTERIOR LIGHTING FIXTURES:

A. GENERAL:

- 1. Provide lighting fixtures, of sizes, types and ratings indicated complete with, but not necessarily limited to, housings, lamps, lamp holders, reflectors, ballasts, starters, and wiring. Label each fixture with manufacturer's name and catalog number. Provide all enclosed fixtures with positive latch mechanisms; spring tension clips not acceptable. Provide all exterior fixtures with damp or wet location label as required by application.

B. SUPPORT REQUIREMENTS:

- 1. Provide all pendant and stem hung fixtures with flexible ball joint hangers at all points of support. Equip hooks used to hang fixtures with safety latches. Provide all detachable fixture parts, luminous ceiling accessories, louvers, diffusers, lenses, and reflectors with locking catches, screws, safety chain, or safety cable.
- 2. Comply with manufacturer's written recommendations for all lamp ballast combinations.
- 3. Equip outdoor fixtures with low temperature starting ballasts.

C. BALLAST FUSING:

- 1. Provided in-line fusing for all fluorescent and HID ballasts. For fluorescent ballasts, provide GLR fuses and HLR -in-line fuse holders for each ballast. For HID fixtures provide KTK fuses and HPF fuse holders. Size fuses per ballast manufacturer's recommendation.
 - a. Comply with manufacturer's written recommendations for all lamp ballast combinations.
 - b. Equip outdoor fixtures with low temperature starting ballasts.

D. FLUORESCENT LAMP BALLASTS: - (ELECTRONIC):

- 1. Provide rapid start, fluorescent programmable start lamp ballasts capable of operating lamp types indicated, with power factor(ratio of actual power to apparent power) above 95%, ballast factor of .71, and operating with audible noise level lower than the quietest C.B.M. certified ballast for the same application, listed as class A. Provide ballasts which comply with applicable state, federal, and industry standards and:

- a. Are UL listed,
 - b. Comply with FCC requirements governing electromagnetic and radio frequency interference.
 - c. Comply with IEEE standards for line voltage transient protection, and ANSI C.62.41 for location director A3 in the normal mode and location category A1 in the common mode.
 - d. Comply with ANSI and IEEE standards for harmonic distortion
2. Light output shall not vary by more than 1% over a plus or minus 10% variation in line voltage, and shall not vary more than 5% of light output of equivalent C.B.M. certified ballast. See drawings and schedules for input voltage requirements. Ballasts shall consistently start and operate lamps from a supply line voltage of plus or minus 10% from nominal line voltage.
 3. Provide ballasts which operate at a frequency above 20K hz from an input frequency of 60 hz; have an efficacy factor (relative light output per watt consumed) at least 10% above the C.B.M. certified electromagnetic system for the same application; and have a lamp crest factor (ratio of peak to R.M.S. lamp current) of 1.7 or less. Ballasts shall have a total current harmonic distortion of less than 10%.
 4. All T5 and Compact electronic ballasts shall be programmed rapid start for maximum lamp life on shorter start cycles. Filament voltage shall be applied prior to the application of open circuit voltage to allow adequate heating of the filaments and then open circuit voltage is applied to start the lamps. Ballasts shall provide for a minimum lamp starting temperature of 0 degrees F. T8 ballasts shall be rapid start unless specified on the fixture schedule otherwise.
 5. Ballasts for lamps of T5, T4, and T2 diameter shall contain end-of-life sensing circuitry to prevent lamp, lamp base, or socket damage at end-of-life.
 6. Ballast manufacturer shall warrant ballasts for T8 and T5 lamps to be free from defects in material or workmanship for at least 5 years from date of manufacture. Ballasts for T4 and smaller shall be 3 years. Contractor shall provide warrantee in accordance with other sections of this specification. Warranty shall include an allowance for nominal replacement labor and replacement of defective product.
 7. Comply with manufacturer's written recommendations for all lamp ballast combinations. Provide electronic ballasts of one of the following:
 - a. Motorola
 - b. Advance Transformer Company
 - c. Howard Industries
 - d. Osram Sylvania
 - e. Universal Lighting Technologies Co.
 8. CBM LABELS:
 - a. Provide fluorescent-lamp ballasts which comply with Certified Ballast Manufacturers Association standards and carry the CBM label.

E. FLUORESCENT LAMPS:

1. Equip interior fluorescent fixtures with full light output, T8 lamps where available

as standard products. Where applicable, equip fixtures with lamps as follows:

4' T8 3150 Initial Lumens, average life of 24,000 hours.

- a. Sylvania Octron
- b. General Electric
- c. Phillips.

2. Provide fluorescent lamps with low levels of mercury, capable of acceptance of the Environmental Protection Agency (EPA) through the TCLP (Toxic Characteristic Leaching Procedure).

F. HIGH-INTENSITY-DISCHARGE-LAMP BALLASTS:

1. Provide HID ballasts, of ratings, types and makes as recommended by lamp manufacturer, which properly match lamps to power line by providing appropriate voltage and impedances for which lamps are designed. Equip exterior fixtures with low temperature starting ballasts. Provide high power factor, or power factor improved ballasts.

G. HID LAMPS:

1. Equip fixtures with HID lamps as specified. Provide coordinated lamp ballast combination to ensure full light output (rated lumens) of lamp. Where lamp manufacturer recommends operation of lamp in enclosed fixtures, provide suitable enclosure for fixtures specified. Include detailed drawing of enclosure with shop drawing submittal.

H. DIFFUSERS:

1. Where plastic diffusers are specified, provide 100 percent virgin acrylic compound; minimum thickness, .125 inches.

PART 3 - EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

- A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standards of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fixtures fulfill requirements.
- B. Coordinate with other work as appropriate to properly interface installation of lighting fixtures with other work. Consult architectural reflected ceiling plan for exact location of all lighting fixtures.
- C. Provide all necessary supports, brackets, and miscellaneous equipment for mounting of fixtures. Support all ceiling mounted fixtures from the building structure; independent of the ceiling system, unless noted. Support each recessed fixture (fluorescent incandescent, and/or HID) from the building structure with #12 ga. steel wire attached to each corner (in addition to supports normally provided for attachment to the ceiling system). Provide backing supports above (or behind) sheetrock, plaster and similar ceiling and wall materials. Support surface mounted ceiling fixtures from channel. Support ceiling mounted outlet boxes independent of the raceway system, and capable of supporting 200 pounds. Feed each recessed fixture directly from an outlet box with flex conduit as required; do not loop from fixture to fixture. See plans for additional details.

- D. Provide each lay-in light fixture with at least 36" (Not to exceed 72") of 3/8" steel flexible conduit.
- E. Coordinate lighting in mechanical room with duct and equipment locations.
- F. Provide gypsum board protection as required, (acceptable to fire official having jurisdiction) to insure fire rating of each ceiling in which fixtures are installed.
- G. COORDINATION MEETINGS:
 - 1. Meet at least twice with the ceiling installer. Hold first meeting before submittal of shop drawings to coordinate each light fixture mounting condition with ceiling type. During second meeting, coordinate fixture layout in each area.
 - 2. Meet at least once with the mechanical installer prior to fabrication and installation of duct work. Coordinate depth and location of all fixtures and duct work in all areas.
- H. ADJUST AND CLEAN:
 - 1. Clean lighting fixtures of dirt and debris upon completion of installation.
 - 2. Protect installed fixtures from damage during remainder of construction period. Repair all nicks and scratches to appearance of original finish.
- I. SPARE PARTS:
 - 1. Provide a spare set of diffusers (acrylic and/or glass only) for each fixture type and one for each additional 10 fixtures of each type; not to exceed 10 spares for any single fixture type.
 - 2. In addition, furnish stock of replacement lamps amounting to 15 percent (but not less than one lamp) of each type and size used. Deliver replacement stock as directed to Owner's storage space.

3.2 FIELD QUALITY CONTROL:

- A. Upon completion of installation of lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements.
- B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise remove and replace with new units, and proceed with retesting.
- C. At the time of Substantial Completion, replace lamps in interior lighting fixtures which are observed to be noticeably dimmed after the Contractor's use and testing, as judged by Architect/Engineer.
- D. GROUNDING:
 - 1. Provide equipment grounding connections for each lighting fixture.

END OF SECTION 16510

SECTION 16560 - LIGHTING CONTROL EQUIPMENT

July 11, 2007

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of lighting control equipment work is indicated by drawings and schedules, and is hereby defined to include, but not by way of limitation, lighting control panels, control stations and other user interface devices, wiring and ancillary equipment.
- B. Type of lighting control equipment specified in this section includes the following:
 - 1. Programmable Relay Panels
 - 2. Over-ride switch stations
- C. Requirements are indicated elsewhere in these specifications for work including, but not limited to, raceways, and electrical boxes and fittings, required for installation of lighting control equipment; not work of this section.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years. To insure a uniform installation and single responsibility, all switching and dimming equipment described herein shall be supplied by a single manufacturer.
- B. Installer: Qualified with at least 3 years of successful installation experience on projects with lighting control equipment installation work similar to that required for project.
- C. NEC Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment enclosures.
- D. Codes and Standards: Provide units, which meet the requirements of I.E.E.E. Std. #587-1980 and IEEE Std. 2000.1-1998.
- E. Independent Testing Laboratory: Provide units which have been tested and listed under UL 916 Energy Management Equipment Standards.

1.4 SUBMITTALS:

- A. Product Data: Manufacturer's published catalog data sheets for all equipment and components of lighting control system.
- B. Shop Drawings: Submit detailed drawings and documentation of lighting control components and interconnection including, but not necessarily limited to:

1. Electronic Controllers.
2. Control Stations.
3. Photo Sensors.
4. One-line schematic diagram with wire type details.
5. Network wiring details.
6. Lighting control panel load schedule.
7. Input and output wiring details.
8. Accurately scaled equipment layouts, wires/cables routing and connections to control wiring and electrical power feeders.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide lighting control equipment of one of the following:
1. Total Lighting Control – GE
 2. Lighting Control Solutions – Watt Stopper
 3. Synergy Lighting Control – Lithonia Lighting
 4. PCI – Lighting Control Systems

2.2 SYSTEM DESCRIPTION:

- A. The lighting control system shall provide seamless control and monitoring of all lighting included in the scope of work regardless of whether it is relay switched or dimmed.
- B. Low voltage switches and photocells shall be mounted in the interior spaces. Low voltage wiring from the switches and sensors to the relay panel shall be Class 2 or Class 2P (plenum rated) as required by the National Electric Code (NEC) and local standards. Each low voltage wire shall be labeled with the relay number (1-48) at each switch or sensor. Use only properly color coded, stranded #20 AWG (or as required by manufacturer) wire. All relays and switches shall be tested after installation to confirm proper operation and the loads recorded on the directory card in each panel.

2.3 EQUIPMENT:

- A. Enclosure: Shall be NEMA 1 rated, code gauge steel cabinet. Enclosures and contents shall be designed to operate in interior spaces with temperatures of 32° - 104° F (0° - 40°C) and, 0-90% non-condensing humidity. Enclosure shall be available with optional recessed mounting hardware. See drawings for mounting requirements and refer to schedules on drawings for sizes.
- B. Interior: Bracket and circuit board back plane with pre-mounted relays. Interiors shall be sized to accept relays and will provide true on/off indication of relay status through leds mounted on the circuit boards. Each relay shall be capable of direct on/off control by a low voltage switch or occupancy sensor. Relays shall be momentary – pulsed mechanically latching contractors rated at 20 amps, 120-277 vac. They shall attach to the interior by a single plug-in connector.
- C. Power Supply: The enclosure shall be supplied with multi-tapped transformer and shall not require specification of voltage for each control location. Provide dedicated power feed to each enclosure. Transformer shall be 24 vac secondary to include internal overcurrent protection with automatic reset and metal oxide varistor

protection against power line spikes.

- D. Cover: Provide surface cover with captive screws in hinged, lockable configuration. A wiring schedule directory card shall be affixed to the cover's back to allow identification of circuits/ relays/ loads controlled if the door is open or the cover is off. Schedules must be typed and related to final room names and numbers (not bid document room names and numbers), no exceptions.
- E. System Controller: The system controller shall consist of the user interface panel (UIP) and system control electronics. The system controller shall plug-into the enclosure. Do not install system controller into the enclosure until after rough-in phase of installation is complete.
- F. Indoor Controller:
 - 1. Provide master on/off control of a relay group while still allowing individual relays to be overridden by their local switch.
 - 2. Two independent switch input channels shall accept any 2 or 3 wire switch.
 - 3. One master input to control all connected relays on on/off.
 - 4. Occupied/ Unoccupied dry contact for interface to schedule control options for manual on/auto on, user-adjustable time delay for overrides and blink warn before off.
- G. Outdoor Controller:
 - 1. Works in combination with a single weatherproof photosensor to be powered via low voltage wiring from the panel.
 - 2. Control unit provides occupied/ unoccupied dry contact for interface to schedule control, plus 3 separate intelligent outputs for on/off control of security, parking, and signage lighting. Each output shall:
 - a. Have corresponding user-selectable foot candle set point with an additional selectable egress relay for parking.
 - b. Is capable of driving up to 3 relays wired in parallel, or 1 smart input to another control unit.
 - c. Is controlled using smart sceneries designed specifically for the three types of lighting.
- H. Switches/Plates:
 - 1. Provide specification grade standard, pilot or locator configuration momentary pushbutton type switches as shown on the plans for overriding the relays. Provide in color to match Wiring Devices (Section 16140).
 - 2. Provide industrial grade non-pilot light toggle switches as shown on the plans for overriding the relays. Provide in color to match Wiring Devices (Section 16140).
 - 3. Provide matched specification grade plates to match plates in Wiring Devices (Section 16140).
- I. Low Voltage Wire:
 - 1. All low voltage wiring shall be color coded to match the relays, switches and sensors. Wire shall be UL listed as conforming to Class 2 or Class 2P wire requirements.
 - 2. Switch colors as follows:
 - a. Red/Black/White
 - b. Red/Black/White/Yellow (Pilot)

- c. Red/Black/White/Blue (Locator)

PART 3 - EXECUTION:

3.1 INSTALLATION OF LIGHTING CONTROL EQUIPMENT:

- A. Install lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturers written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements.
- B. Comply with Requirements of NEC, and applicable portions of NECA's 'Standard of Installation' pertaining to general electrical installation practices.
- C. Coordinate with other electrical work, including raceways, electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.
- D. The contractor shall provide accurate 'As Built' drawings to the owner indicating the correct and latest program in each controller. The 'As Built' drawings shall clearly indicate the lighting control panel identification. The load controlled by each relay, and the device connected to each input.

3.2 FIELD QUALITY CONTROL:

- A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements.
- B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

3.3 PRODUCT SUPPORT AND SERVICES:

- A. System Start-Up: Provide a factory authorized technician to verify the installation, test the system, and train the owner on proper operation and maintenance of the system. Before requesting start-up services, the installing contractor shall verify that:
 - 1. The control system has been fully installed in accordance with manufacturer's installation instructions.
 - 2. Low voltage wiring for overrides and sensors in completed.
 - 3. Accurate 'as-built' load schedules have been prepared for each lighting control panel.
 - 4. Proper notification of the impending start-up has been provided to the owner's representative.
- B. Factory support: Factory telephone support shall be available at no cost to the owner during the warranty period. Factory assistance shall consist of assistance in solving programming or other application issues pertaining to the control equipment. The factory shall provide a toll free number for technical support.

3.4 WARRANTY:

- A. Manufacturer shall provide a one (1) year limited warranty on lighting control system.
A ten (10) year limited warranty shall be provided on the lighting control relays.

END OF SECTION 16560

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. This section is a Division-16 Basic Materials and Methods section, and is part of each Division-16 section making reference to wiring devices specified herein.

1.2 DESCRIPTION OF WORK:

- A. The extent of occupancy sensor work is indicated by drawings and schedules.
- B. Types of occupancy sensors in this section include the following:
 - 1. Ultrasonic Ceiling Sensors
 - 2. Passive Infrared Ceiling and Wall Mount Sensors
 - 3. Control Pack
 - 4. Passive Infrared Wall Switch
 - 5. Ultrasonic Wall Switch
 - 6. Ultrasonic Ceiling Sensor with Daylight Control
 - 7. Dimming Ballast Ambient Light Controller
 - 8. Dual Technology Ceiling Sensor w/ Control Pack

1.3 QUALITY ASSURANCE:

- A. Comply with NEC and NEMA standards as applicable to construction and installation of occupancy sensors. Provide occupancy sensors which have been UL listed and labeled.
- B. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems, motor loads and any other passive infrared or microwave systems.

1.4 SUBMITTALS:

- A. **PRODUCT DATA:** Submit manufacturer's data on occupancy sensors, control modules, wiring diagrams, interconnection diagrams and any related accessories.
- B. Submit scaled drawings with lighting fixtures shown clearly marked by manufacturer showing proper product, location and orientation of each sensor.

PART 2 - PRODUCTS

2.1 MANUFACTURER: The manufacturer shall have a minimum of five years of experience in the sensor and lighting control industry. Sensors and related relays shall be compatible with the specific lighting types controlled. All sensors shall be of the same manufacturer, mixing brands of sensors is not acceptable.

- A. **ULTRASONIC (MICROPHONICS) CEILING SENSORS:** Where units are indicated, provide a sensor that meets the following minimum requirements:
 - 1. The sensor shall be Class 2, low voltage device capable of mounting to a wall or ceiling as required for optimum coverage.
 - 2. Sensor shall incorporate one transmitter for each receiver oriented in the same direction.

3. Sensor shall be capable of being networked with additional units to achieve adequate coverage.
4. Sensor shall utilize a dry contact relay for control of lighting relay.
5. Sensor shall have adjustable sensitivity from 0% to 100% for coverage pattern.
6. Sensor shall have time out adjustment from 15 seconds to 32 minutes. Timer shall use a timer chip and be linear in adjustment.
7. Sensitivity and timer controls shall be accessible on the front of the sensor, but recessed to inhibit tampering.
8. Sensor shall incorporate an accessible, but recessed, ON override device.
9. Sensor shall be easily mounted to a suspended ceiling tile without using large holes, or to a standard 4 x 4 box.
10. Sensor shall be available with more than one pair of transmitters/receivers to achieve coverage required.
11. Sensor shall incorporate a real time motion indicator visible from the front of the unit.
12. Transmitters/receivers shall be protected from damage.
13. Subject to compliance with the above requirements, provide models of one of the following:
 - a. Hubbell-ATU Series
 - b. Sensor Switch-CM Series
 - c. Wattstopper-WT Series
 - d. Mytech – Omni- US Series
 - e. Lithonia – LMTO Series
 - f. Novitas – 01-160/100/110/180/190
 - g. Leviton – OSC UOW Series

B. PASSIVE INFRARED CEILING AND WALL MOUNT SENSORS: Where units are indicated, provide a sensor that meets the following minimum requirements:

1. The sensor shall be Class 2, low voltage device capable of mounting to a wall or ceiling as required for optimum coverage.
2. Sensor shall utilize a dual element pyroelectric detector and a multi-segmented lens to achieve adequate coverage.
3. Sensor shall be capable of being networked with additional units to achieve adequate coverage.
4. Sensor shall utilize a dry contact relay for control of lighting relay.
5. Sensor shall have time out adjustment from 8 seconds to 32 minutes. Timer shall be linear in adjustment.
6. Sensor shall incorporate a motion indicator behind the lens array.
7. Ceiling mount sensor shall have a 360 degree field of view with a 34 foot diameter coverage pattern when mounted at a height of twelve feet.
8. Ceiling mount sensor shall protrude no more than 1.5 inches when surface mounted. Sensor shall be capable of recessed mounting without impairing field of view.
9. Wall mount sensor shall have a 117 degree field of view and cover up 1600 square feet when mounted at a height of eight feet.
10. Wall mount sensor shall have three adjustment positions for range control.
11. Subject to compliance with the above requirements, provide models of one of the following:
 - a. Hubbell-ATP Series
 - b. Sensor Switch-CM Series
 - c. Wattstopper-CX Series
 - d. Mytech-Omni-IR/LO-IR Series
 - e. Lithonia - LIRO Series

- f. Novitas – 01-340/500
- g. Leviton – OSWWV/IOW Series

C. PASSIVE INFRARED WALL SWITCH: Where units are indicated provide a sensor that meets the following minimum requirements:

1. Sensor shall utilize a dual element pyroelectric detector behind a lens to detect the motion of infrared energy emitted by the human.
2. Lens shall be of the multi-element type that divides the field of view into forty zones of detection.
3. Sensor shall fit a single gang switch box and utilize a decorator cover plate.
4. Sensor shall not protrude more than 0.75 inches from switch box.
5. Sensor shall operate at 120VAC and 277VAC.
6. Sensor shall have a time-out delay, adjustable from 1 minute to 30 minutes.
7. Sensor shall have an Automatic/OFF switch on front of unit.
8. Sensor shall incorporate a daylight control. The adjustable ambient light control shall be adjustable from 20 to 420 foot-candles.
9. Sensor shall have a 170 degree field of view. Detection beam shall be horizontal.
10. Sensor shall use a dry contact relay to control the lighting load.
11. Sensor shall be rated for 0 to 600 watts at 120VAC and 277VAC and adapt automatically to the operating voltage.
12. Subject to compliance with the above requirements, provide models of one of the following:
 - a. Hubbell-WS Series
 - b. Sensor Switch-WSD-P Series
 - c. Wattstopper-WS Series
 - d. Mytech-LP Series
 - e. Lithonia - LIRW Series
 - f. Novitas – 01-400/DL401
 - g. Leviton – ODS 10 – ID Series

D. ULTRASONIC (MICROPHONICS) WALL SWITCH: Where units are indicated provide a sensor that meets the following minimum requirements:

1. Sensor shall utilize active ultrasonics to detect motion.
2. Sensor shall have two ultrasonic transmitters and one receiver.
3. Sensor shall incorporate an inrush current limiter circuit to protect the relay contacts.
4. Sensor shall utilize a dry relay contact for control of the lighting load.
5. Sensor shall have a time out adjustment from 8 seconds to 32 minutes. Timer shall be linear and controlled by a timer chip.
6. Sensor shall have automatic sensitivity adjustment and be microprocessor controlled.
7. Sensor shall have automatic gain setback to reduce the sensitivity after the sensor has turned off the lighting to prevent false tripping.
8. Sensor shall have transmitter control adjustments to prevent false tripping from hallway traffic.
9. Sensor shall have a 180 degree field of view, coverage up to 800 square feet, and shall detect six inches of hand movement towards the sensor at a distance of 22 feet. Sensor shall detect body motion towards the sensor at a distance of 32 feet.
10. Sensor shall operate at 120VAC and 277VAC.
11. Sensor shall be rated for 40 to 740 watts at 120VAC and 90 to 1400 watts at 277VAC.
12. Sensor shall be automatic on and shall have an automatic to off override switch

on the unit. Switch shall be an air gap switch to disconnect power to the lighting load.

13. Sensor shall have a real time motion indicator on the front of the unit.
14. Sensor shall mount to a single or double gang switch box.
15. Subject to compliance with the above requirements, provide models of one of the following:
 - a. Hubbell-ATU 1277 Series
 - b. Sensorswitch-WSD-PDT-P Series
 - c. Mytech LH-US Series
 - d. Novitas – 01-250
 - e. Leviton – OSSMT-MD Series

E. DUAL TECHNOLOGY CEILING SENSOR: Where units are indicated, provide a sensor that meets the following minimum requirements:

1. Sensor shall incorporate ultrasonic (microphonics) and infrared technologies in a single unit.
2. Sensor shall be Class 2, low voltage; capable of mounting in the ceiling for maximum coverage.
3. Sensor shall use internal microprocessor for motion signal analysis and automatic self-adjustment.
4. Sensor shall have automatic self-adjustment algorithm which adjusts timer and sensitivity settings to maximize performance and minimize energy usage.
5. Sensor shall have manual time-out adjustment from 8 minutes to 32 minutes and automatic time out from 8 minutes to 100 minutes.
6. Sensor shall have test time-out setting of 8 seconds, with automatic return to 8 minutes after one hour if sensor is left in test mode.
7. Sensor's microprocessor shall automatically extend timer by 1 hour in response to recognition to false off condition. After 5 hours, sensor reduces extended time by 30 minutes and continues to reduce by 30 minute increments over the next few days.
8. Sensor's microprocessor shall automatically reduce either PIR or ultrasonic sensitivity in response to false on condition.
9. Sensor microprocessor will automatically monitor PIR background threshold signal level and makes corresponding sensitivity adjustments automatically.
10. Sensor microprocessor algorithm shall incorporate automatic adaptation to continuous airflow.
11. For airflow which is so intense as to mask motion, sensor shall flash indicator LED code to indicate excessive airflow.
12. Sensor's microprocessor shall use a four week learning period and develop a circadian calendar.
13. An internal 24 hour 7 day clock establishes what periods the room is typically occupied, biasing sensor to keep lights on while normally occupied and off when normally unoccupied.
14. Sensor shall have selection settings for the following dual technology schemes:
 - a. High Sensitivity and High Confidence (miser mode)
15. Sensor shall be available with either 180 degrees or 360 degrees coverage pattern.
16. Infrared lens shall have 360 degree field of view. Two types of lens shall be available, standard and extra dense.
17. Sensor shall have a variety of mask inserts for PIR coverage rejection to prevent false tripping.
18. Transducers shall be protected from tampering.

19. Sensor shall have manual adjustments for timer and sensitivities and override switches to force manual adjustment mode.
20. Sensor shall have adjustable sensitivity from 0% to 100% for both ultrasonic and infrared.
21. Controls shall be behind cover to resist tampering. All adjustments shall be accessible from the front of the sensor.
22. Sensor shall be available with a photocell adjustment from 20 to 3,000 Lux.
23. Sensor shall provide internal operating status and settings confirmation via LED motion lamp indicator.
24. Sensor shall have two (if 180 degree) or three (if 360 degree) real time LED motion indicators visible from the front of the unit: Red = infrared; green = ultrasonic.
25. Subject to compliance with the above requirements, provide models of one of the following:
 - a. Hubbell-ATD Series
 - b. Sensor Switch-CM-PDT Series
 - c. Wattstopper-DT Series
 - d. Mytech-Omni-DT Series
 - e. Lithonia - LMTO Series
 - f. Novitas – 01-300/310
 - g. Leviton – OSC MOW Series

F. **PASSIVE INFRARED CEILING SENSOR:** Where units are indicated, provide a sensor that meets the following minimum requirements:

1. Sensor shall incorporate infrared sensing technology.
2. Sensor shall be Class 2, low voltage; capable of mounting in the ceiling for maximum coverage.
3. Sensor shall use internal microprocessor for signal analysis and automatic self-adjustment.
4. Sensor shall have automatic self-adjustment algorithm which adjusts timer and sensitivity settings to maximize performance and minimize energy usage.
5. Sensor shall have manual time-out adjustment from 8 minutes to 32 minutes and automatic time-out from 8 minutes to 100 minutes.
6. Sensor shall have test time-out setting of 8 seconds, with automatic return to 8 minutes after one hour if sensor is left in test mode.
7. Sensor microprocessor shall automatically extend timer by 1 hour in response to recognition of false off condition.
8. After 5 hours, sensor reduces extended time by 30 minutes and continues to reduce by 30 minute increments over the next few days.
9. Sensor's microprocessor will automatically monitor PIR background threshold signal level and makes corresponding sensitivity adjustments automatically.
10. Sensor's microprocessor shall use a four week learning period and develop a circadian calendar. An internal 24 hour 7 day clock establishes what periods the room is typically occupied, biasing sensor to keep lights on.
11. Sensor shall be available with a 360 degree coverage pattern. Infrared lens shall have 360 degree field of view. Two types of lens shall be available, standard and extra dense.
12. Sensor shall have mask inserts for PIR coverage rejection.
13. Sensor shall have manual adjustments for timer and sensitivities and override switches to force manual adjustment mode.
14. Sensor shall have adjustable sensitivity from 0% to 100% for infrared sensor.
15. Controls shall be behind cover to resist tampering. All adjustments shall be accessible from the front of the sensor.
16. Sensor shall be available with a photocell adjustment from 20 to 3,000 Lux.

17. Sensor shall have one real time LED motion indicator visible from the front of the unit: Red = infrared.
18. Subject to compliance with the above requirements, provide models of one of the following:
 - a. Hubbell-ATP Series
 - b. Sensor Switch-CM-9 Series
 - c. Wattstopper-WPIR CX Series
 - d. Mytech-Omni-IR
 - e. Lithonia - LIRO Series
 - f. Novitas – 01-340/500
 - g. Leviton – OSC IOW Series

G. ULTRASONIC (MICROPHONICS) CEILING SENSOR: Where units indicated, provide a sensor that meets the following minimum requirements:

1. Sensor shall incorporate ultrasonic technology.
2. Sensor shall be Class 2, low voltage; capable of mounting in the ceiling for maximum coverage.
3. Sensor shall use microprocessor for signal analysis and automatic self-adjustment.
4. Sensor shall have automatic self-adjustment algorithm which adjusts timer and sensitivity settings to maximize performance and minimize energy usage.
5. Sensor shall have manual time-out adjustment from 8 minutes to 32 minutes and automatic time-out from 8 minutes to 100 minutes.
6. Sensor shall have test time-out setting of 8 seconds, with automatic return to 8 minutes after one hour if the sensor is left in test mode.
7. Sensor's microprocessor shall automatically extend timer by 1 hour response to recognition of false off condition. After 5 hours, sensor reduces extended time by 30 minutes and continues to reduce by 30 minute increments over the next few days.
8. Sensor's microprocessor shall automatically reduce ultrasonic sensitivity in response to a false off condition.
9. Sensor microprocessor algorithm shall incorporate automatic adaptation to continuous airflow.
10. For airflow which is so intense as to mask motion, sensor shall flash indicator LED code to indicate excessive airflow.
11. Sensor's microprocessor shall use a four week learning period and develop a circadian calendar. An internal 24 hour 7 day clock establishes what periods the room is typically occupied biasing sensor to keep lights on while normally occupied and off when normally unoccupied.
12. Sensor shall be available with either 180 degree or 360 degree coverage pattern.
13. Transducers shall be protected from tampering.
14. Sensor shall have manual adjustments for timer and sensitivities and override switches to force manual adjustment mode.
15. Sensor shall have adjustable sensitivity from 0% to 100%.
16. Controls shall be behind cover to resist tampering. All adjustments shall be accessible from the front of the sensor.
17. Sensor shall be available with photocell adjustment from 20 to 3,000 Lux.
18. Sensor shall have one (if 180 degrees) or two (if 360 degrees) real time LED motion indicators visible from the front of the unit: Green = ultrasonic.
19. Sensor shall provide internal operating status and settings confirmation via LED motion lamp indicator.
20. Subject to compliance with the above requirements, provide models of one of the following:

- a. Hubbell-ATU Series
 - b. Sensor Switch-CM-PDT Series
 - c. Wattstopper-WT Series
 - d. Mytech-Omni-US Series
 - e. Lithonia - LUSO Series
 - f. Novitas – 01-160/100/110/180/190
 - g. Leviton – OSC UOW Series
- H. 24 VDC POWER/CONTROL PACK: Where units are indicated, provide a power/control pack that meets the following minimum requirements:
1. Control module shall consist of a DC power supply and a dry contact relay for switching a lighting load.
 2. Control module shall be available in versions to accept 120, and 277 VAC line voltages.
 3. Output shall be 24VDC nominal, and shall be inherently safe, low voltage, limited power output (Class 2).
 4. Output shall supply 100mA current, in addition to current consumed internally to operate internal relay.
 5. Relay shall utilize normally open, silver alloy dry contacts, and shall be rated for a 20A ballast load at 120V and 277V.
 6. Relay function shall not require more than 5 mA control current to operate.
 7. Control module shall have line voltage wiring, consisting of input voltage and relay contact connections, exiting from one end, and low voltage DC connections, consisting of ground, power, and control wires, exiting from the other end.
 8. Control module shall be sized to fit inside a standard 4" x 4" junction box.
 9. Control module shall be equipped with a 1/2" EMT threaded male fitting on the line voltage end, such that it may be mounted to the outside of a junction box with the line voltage wiring internal to the box and the low voltage wiring external.
 10. Control module shall be equipable with accessory 1/2" EMT threaded male fitting on the low voltage end, such that it may be mounted to the inside of a ballast cavity with the box and line voltage wiring internal to the cavity and the low voltage wiring external.
 11. Slave module shall be available for switching additional circuits. Slave module has same construction and specifications as control module except without power supply function.
 12. Subject to compliance with the above requirements, provide models of one of the following:
 - a. Hubbell-CU Series
 - b. Sensor Switch-PP-20 Series
 - c. Wattstopper-BEP Series
 - d. Mytech-MP Series
 - e. Lithonia - LPCS Series
 - f. Novitas – 13-051
 - g. Leviton – OSC/OSA Series

PART 3 – EXECUTION

3.1 INSTALLATION OF LIGHTING CONTROL EQUIPMENT:

- A. Install occupancy lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements.

- B. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.
- C. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.
- D. Contractor shall be on site as required, to adjust lighting control units for proper operation.
- E. Mount the switchpack in a standard 4" junction box or extension through a ½" KO in the cover plate. Refer to manufacturer supplied mounting instructions.
- F. Provide 5 spare sensors for each type used on project.

3.2 FIELD QUALITY CONTROL:

- A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements.
- B. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.
- C. Contractor shall visit the job site 3 months after the owner has taken occupancy and adjust any units not operating properly, otherwise remove and replace with new units.

3.3 MANUFACTURER AUTHORIZED PERSONNEL TRAINING:

- A. Building Operating Personnel Training: Train Owner's building personnel in procedures for starting-up, testing and operating lighting control system equipment.

END OF SECTION 16561

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of fire alarm and detection systems work is indicated by drawings, schedules and as specified herein.
- B. Comply with NEC as applicable to construction and installation of fire alarm and detection system components and accessories. Provide components and systems which are UL-listed and labeled for fire alarm. Provide fire alarm and detection systems and accessories which are FM approved. Comply with State and local requirements as applicable.
- C. Comply with applicable provisions of current NFPA Standards 72A for Local Protective Signaling Systems, 72B Auxiliary Protective Signaling Systems, 72C Remote Station Protective Signaling Systems (as applicable), local building codes, and meet requirements of local authorities having jurisdiction.

1.3 SUBMITTALS:

- A. **PRODUCT DATA:** Submit manufacturer's data on fire alarm and detection systems including, but not limited to, roughing-in diagrams and instructions for installation, operating and maintenance, suitable for inclusion in maintenance manuals.
- B. **SHOP DRAWINGS:** Provide shop drawings showing equipment/device locations and connecting wiring of entire fire alarm and detection system. Include wiring diagrams and riser diagrams of panel. Provide dimensioned drawing of Fire Alarm Control Panel and Building Graphic.
- C. **CERTIFICATION:** Submit a written statement to the Architect and the state and local Fire Marshal's Office that each device of the fire alarm system will be installed, inspected and tested in accordance with applicable requirements of NFPA Standard 72.
- D. Provide to the Fire Marshall's office the following:
 - 1. A complete set of shop drawings indicating:
 - a. Location of all alarm-initiating and alarm-signaling devices.
 - b. Point-to-point wiring diagrams for all alarm-initiating and alarm-signaling devices.
 - 2. Wiring diagrams for:
 - a. Alarm control panels.
 - b. Auxiliary function relays and solenoids.
 - c. Remote signaling equipment.
 - d. Standby battery calculations, including voltage drop calculation.

3. A complete equipment list identifying:
 - a. Type
 - b. Model
 - c. Manufacturer
 - d. Manufacturer catalog data sheets
 - e. UL Listing and/or FM approval showing compatibility of device with Fire Alarm Control Panel (FACP)
 4. A complete zone list identifying all:
 - a. Alarm-initiating and alarm-signaling devices.
 - b. Remote signaling and auxiliary function zones.
 - c. Specific devices associated with each zone.
- E. Submit to State and Local Fire Marshall, a complete Certificate of Compliance

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. MANUFACTURER: Subject to compliance with requirements, provide fire alarm and detection systems compatible with the existing fire alarm system.

2.2 FIRE ALARM AND DETECTION SYSTEMS:

- A. GENERAL: Provide an electrically operated, electrically supervised fire alarm system as described herein. Include control units, power supplies, alarm initiating and indicating devices, conduit, wire, fittings and accessories required to provide a complete operating system. Enclose entire system in raceway. Provide basic wiring materials which comply with Division 16, Basic Materials and Methods Sections for raceways, conductors, boxes, fittings, supports, etc. Minimum wire size to be #14 AWG copper.
- B. SYSTEM TYPE: Analog addressable, non-coded. Either manual activation of a fire alarm station or activation of an automatic initiating device energizes all fire alarm signaling devices, sounding a non-coded alarm and providing device identification on an annunciator panel.
- C. SYSTEM OPERATION: Provide system such that any manual station or automatic initiating device annunciates all alarm indicating units (bells, horns, buzzers, chimes, visual alarm lamps, etc.) continuously until the manual station or initiating device is restored to normal and the fire alarm control unit reset. Annunciate alarm signals by device at the control panel and all remote annunciators. Provide all conductors, raceway, equipment and labor to accomplish the following:
- D. For fans which are not part of the smoke evacuation system, deactivate air supply and return fan units simultaneously by means of a supervised master fan shutdown relay with slave relays as required. Restart air units automatically after panel has been reset. Provide a bypass switch for master fan shut down relay for drill purposes, and indicate by a locked-in lamp that the circuit has been bypassed.
- E. Selectively activate and/or deactivate fan units as required.
- F. Release all magnetic door holders upon activation of an alarm from any device by use of

a master relay in the control panel.

- G. Provide supervised circuits for the following:
 - 1. Close dampers upon activation of an alarm from any device through the HVAC interface relays at the Fire Command Center.
- H. Central Station Monitoring. Provide a UL listed fire control communicator in accordance with NFPA 71 with a minimum of two reporting zones to the central station. Provide a communicator with dual phone lines for central station reporting by using BFSK or pulsed single round fast format. Provide integral trouble annunciator. Provide with compatibility for automatic test reports every 24 hours. Provide system and components which comply with UL 2635 and UL 864.
- I. Provide manual fire alarm stations in boiler rooms, and main administrative office. Provide external alarm horns sufficient to be heard in all parking areas.
- J. Sprinkler Supervision. Provide a signal initiating and supervisory circuit to each PIV (post indicator) valve, and to each sprinkler riser and subdivision. Provide continuous alarm signal upon actuation of any water flow signal initiating device. Sound alarm until the condition has been corrected and the panel manually reset as required by UL864. Provide separate alarm zones for: (1) alarm zones from "waterflow alarms", (2) alarm zones from "supervisory alarm" indicating sprinkler system trouble. Provide power to all alarm bells furnished under Division 15. Review final fire sprinkler drawings and coordinate for panel, flow and tamper switch locations.
- K. Provide all required wiring from gas shut off valve to the hood suppression control panel. Make all connections to insure a properly operating system. Verify with Mechanical Contractor.

2.3 SCOPE OF THE WORK:

- A. Provide all fire alarm devices.
- B. Provide duct smoke detectors and fan relays at all fan units 2000 CFM and over. Shut down all supply and return fans upon a general alarm signal.
- C. All initiating devices connected to the fire alarm control panel shall be analog addressable.
- D. All wiring shall be in conduit (3/4" minimum). All conduit and connectors, shall be made of steel. All conduit runs shall form a complete loop from the fire alarm control panel.
- E. Provide vandal resistant cages to protect horn/strobes, smoke and heat detectors as indicated and, in gyms whether shown or not. Securely fasten security cages as required. Provide backing and bracing as required to insure that attachment extends beyond the ceiling materials. Cages shall have two pieces, one backplate and one cover to attach to backplate.

2.4 MONITOR MODULE (FCI AMM-2):

- A. Remote identification module devices shall be attached to any single normally open initiating device (heat detector, waterflow switch, duct detectors, sprinkler, tamper switches, kitchen hood, pull station, etc.). The modules shall supply addressing and status information to the Fire Alarm Control Panel through the dual loop module.

2.5 CONTROL POINT MODULE (FCI AOM):

- A. The control point module shall be connected to the same loop as the initiating devices, and shall provide a relay output (Form "C" 2 Amp @ 24 VDC, resistive only).
- B. This relay output shall be used to perform auxiliary functions.
- C. When the AOM is activated, the red "ACTIVE" LED shall be on solid. Under normal conditions, the red "ON LINE" LED shall flash.

2.6 MANUAL FIRE ALARM STATION (FCI, MS-2, W/AMM-2):

- A. Provide red enclosure, manual fire alarm stations with the following features:
 - 1. Die-cast construction, for semi-flush mounting.
 - 2. Addressable alarm type electrically compatible with system requirements.
 - 3. Double Action
 - 4. Break glass design requiring unit to be opened for resetting, and requiring resetting before closing. Provide one spare "glass" for each manual station. Key reset, keyed like fire control panel.

2.7 IONIZATION SMOKE DETECTORS (FCI ASD-I W/ADB-F BASE):

- A. All ionization smoke detectors shall be capable of being replaced without disconnecting any wires or wire connectors from the base of the detector. Each detector shall be installed on a separate base. The detector base shall be capable of receiving a photoelectric, ionization, or electronic thermal detector. All ionization fire detectors shall be UL 268 listed. All detectors shall have (2) viewable LEDs to indicate the status of the device.

2.8 PHOTOELECTRIC DETECTORS (FCI ASD-P W/ADB-F BASE):

- A. All photoelectric detectors shall be capable of being replaced without disconnecting any wires or wire connectors from the base of the detector. Each detector shall be installed on a separate base. The detector base shall be capable of receiving a photoelectric, ionization, or electronic thermal detector. All photoelectric detectors shall be UL 268 listed. All detectors shall have (2) viewable LEDs to indicate the status of the device.

2.9 DUCT FIRE DETECTORS (FCI DH500AC/DC WITH SAMPLING TUBE):

- A. Provide ionization type with UL 268A listings. Each detector shall be equipped with a remote light. Each detector shall have (2) form "c" alarm contacts rated at 10 amps (at 120VAC).

2.10 THERMAL DETECTORS (FCI ATD WITH/ADB-F BASE):

- A. Thermal detectors shall operate on the Rate-of-Rise principal. The detectors shall have a fixed temperature rating of 135 degrees Fahrenheit. Exception: in Boiler rooms, provide temperature rating of 200 degrees Fahrenheit.
 - 1. The heat detector shall consist of a base and a head.
 - 2. The base shall be capable of accepting either a smoke detector or a 135 (or 200) degree heat detector.
 - 3. The head shall automatically restore to its normal standby condition when the temperature returns to its normal range.

2.11 AUDIOVISUAL ALARM HORNS (FCI, HMF/STS SEMI-FLUSH MOUNTED OR EQUAL):

- A. Provide audio-visual alarm horns with the following features:
 - 1. Die cast or stamped steel construction, finished in red enamel, suitable for indoor or outdoor application.
 - 2. Capable of 90 db (UL rating) sound level at 10 feet.
 - 3. Flush mounted
 - 4. Integrally mounted flashing light unit, with Lexan lens with block letters "FIRE", and minimum flash rate of ONE per second, and 110 candela minimum.
 - 5. Electrically compatible with system requirements.
 - 6. Horns shall sound the temporal pattern (code 3) until silenced.
 - 7. Audiovisual alarm horns shall have the ability to silence horns while maintaining the strobe flash, until reset.
 - 8. Mechanical horn mechanism only, electronic horns are not acceptable.
 - 9. Maximum 24 horns per circuit, maximum 8 strobes per circuit.
- B. Strobes shall be synchronized when there are three or more within sight and less than 55 feet of viewer.

2.12 STROBES (FCI Model STS, FLUSH MOUNT, WHITE):

- A. Provide strobe with flashing light unit, with Lexan lens with block letters "FIRE", and minimum flash rate of ONE per second, and high intensity 110 candela minimum. Strobes shall be synchronized when there are three or more within sight and less than 55 feet of viewer.

2.13 INITIATING MODULES:

- A. Provide style "6" initiating modules capable of receiving and annunciating an alarm from any detector, even with a single fault condition on any initiating circuit.
- B. Power all smoke detectors from the "Style 6" initiating loop wiring. For systems which power smoke detectors separately from the "Style 6" loop, provide monitoring for both the power source and the independent initiating wiring, so that complete trouble and alarm indication is achieved by loop. Provide capability to operate all smoke detectors, even with a single fault condition on the smoke detector power wiring. Provide one spare initiating circuit.

2.14 SIGNALING MODULES:

- A. Provide signaling as required. Provide power adequate to sound all signaling devices concurrently. Provide supervised indicating circuits for polarized 24V D.C. alarm signaling devices. Provide 2 spare signaling circuits.
- B. Each signal circuit shall have a separate disconnect switch for servicing the fire alarm system. Each and every indicating circuit shall have a distinct location description. Power supply shall be at fire alarm control panel. Remote power supplies and indicating circuits will not be acceptable.

2.15 SUPPLEMENTAL NOTIFICATION CIRCUITS (FCI SNAC-4):

- A. Provide supplementary notification appliance circuit panel(s) as required. The 'SNAC' shall be capable of supplying up to four Class A, Style Z notification appliance circuits. The panel shall contain its own battery charger, regulated power supply, and shall be supervised for ground fault, overcurrent, open circuits and low battery conditions.

Ground fault, battery and circuit trouble conditions shall transmit a trouble signal to the main fire alarm control panel.

2.16 SYSTEM CONFIGURATION PROGRAMMING:

- A. To help the owner in programming, system changes, and servicing, the fire alarm system shall have the following functions.
 - 1. The FACP shall be capable of an auto-configuration, which via a password, all analog devices and panel modules are automatically programmed into the system. At this point the system will operate as a general alarm system without any other programming.
 - 2. If any two devices are addressed the same, the LED's on both devices will light steady and the panel will read "extra address and the address number".
 - 3. If any device is installed and not programmed into the system the LED will light steady and the panel will read the same as above.

2.17 BATTERIES/POWER SUPPLIES:

- A. Verify that existing standby batteries are capable of operating fire alarm system for minimum of 24 hours, then operating all indicating units for at least five minutes. Locate batteries in fire alarm control unit, or in similar type enclosure located as directed. Provide all interconnecting wiring. Place batteries which vent hydrogen gas in separate enclosure. Provide additional battery capacity if needed to meet minimum requirements.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS:

- A. Install fire alarm and detection systems as indicated, in accordance with equipment manufacturer's written instructions and complying with applicable portions of NEC and NECA's "standard of installation".
- B. Install wiring, raceways, and electrical boxes and fittings in accordance with Division 16 Basic Materials and Methods section, "Raceways", "Wires and Cables", and "Electrical Boxes and Fittings", and in accordance with other sections, as applicable.
- C. All wire used on the fire alarm system shall be U.L. Listed as fire alarm protective signaling circuit cable per NEC, Article 760.
- D. If twisted or shielded wire is required or recommended by the manufacturer it must be used.
- E. Review proper installation procedure for each type of device with equipment supplier before installation. Label each junction box throughout system, "fire alarm", and paint cover of junction boxes red.
- F. Provide a minimum of one 3/4" conduit with (2) Cat 3 telephone cables from FACP to main telephone terminal.
- G. Where smoke or heat detectors are specified, install device a minimum of three feet from adjacent air supply diffusers to ensure proper operation of device.
- H. Refer to NFPA for spacing and exact placement of fire alarm devices.

PART 4 - FINAL ACCEPTANCE AND GUARANTEE

4.1 GUARANTEE:

- A. Furnish a three-year guarantee for all equipment, materials and installation, including all labor, transportation, and equipment.
- B. Emergency Response. The fire alarm equipment supplier shall provide an emergency response within four hours of any reported system failure to resolve the problem on a continuous basis.

4.2 PRE-TEST:

- A. The contractor shall with a representative of the manufacturer conduct a test 3 days before the final test to verify operation of all devices. Any problems must be corrected before the final test.

4.3 FINAL TEST:

- A. Before the installation shall be considered completed and acceptable, a test on the system shall be performed as follows:
 - 1. The contractor's job foreman, a representative of the manufacturer, a representative of the owner, shall operate every building fire alarm device to ensure proper operation and correct annunciation at the control panel. Fan shutdown and door holder circuits shall operate.
 - 2. Conduct a full 24 hour test of battery operation. System shall be put on the batteries for a full 24 hours and all notification appliances shall be operational for a period of 5 minutes.
- B. The supervisory circuitry of the initiating and indicating circuits shall also be verified.
- C. Provide the following spare devices:
 - 1. 2 smoke detectors with base
 - 2. 2 strobe/horns
 - 3. 1 manual pull stations with addressable modules
 - 4. 2 duct smoke detectors
- D. Provide 20 feet of conduit with wiring (completely installed and wired) for each spare device

PART 5 - AS BUILT DRAWINGS AND OPERATION AND MAINTENANCE MANUALS:

5.1 LABELING:

- A. All devices shall be labeled with their appropriate address. The labels shall be 18 point pressure sensitive labels.
- B. All initiating devices shall be programmed to include the device address and a complete user text English location description, i.e. Device L4S76, Smoke Detector, 1st floor Rm.17

5.2 AS BUILT DRAWINGS:

- A. A complete set of CAD "as-built" drawings showing installed wiring, color coding, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of the system. Vendor shall not request drawings from the Engineer. Vendor shall request current architectural drawings from the Architect and include all cost with bid.
- B. A building map shall be supplied to the owner indicating the exact location of all devices along with the addresses of the individual devices. Install building fire alarm map adjacent to the fire alarm panel and all remote operating panels. Provide high quality plastic sign (map holder) with two layers. The back layer shall be painted black. The front layer shall be a clear center for viewing the CAD fire alarm drawing. Edges of the sign shall be colored to match the building interior. The building map shall indicate the various devices and wiring by the use of different colors (minimum of five colors).
- C. Provide a CD to the Owner containing the information specified below. The CD shall include all information required to allow the Owner to change the fire alarm program themselves. The CD shall contain a minimum of the following:
 - 1. CAD drawing files of building fire alarm map.
 - 2. CAD drawing files of as-built fire alarm components and point to point connections.
 - 3. General configuration programming.
 - 4. Job specific configuration programming.
 - 5. Tutorial file on complete programming of fire alarm system.

5.3 OPERATING AND MAINTENANCE MANUALS:

- A. Operating and maintenance manuals shall be submitted prior to testing of the system. Manuals shall include all service, installation, and programming information.

5.4 TRAINING:

- A. Provide four (4) hours training on the operation and installation of fire alarm system, at job site, at no cost to owner.
- B. Provide programming training and software sub-licensing in owner's name. Sub-licensing agreement shall include the U.L. requirement to allow the owner to do any programming that the supplier is allowed to do during commissioning, testing, service and field additions or deletions to the fire alarm system. The fire alarm supplier shall provide this training and licensing at no cost to the owner, including transportation (if outside Salt Lake City), lodging, meals, and training manuals.

END OF SECTION 16721

SECTION 16722 - FIRE SPRINKLER MONITORING SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. Extent of monitoring and annunciation systems work shall comply with NEC as applicable to construction and installation of system components and accessories. Provide components and systems which are UL-listed and labeled. Comply with State and local requirements as applicable.
- B. Comply with applicable provisions of current NFPA Standards for 72A Local Protective Signaling Systems, 72B Auxiliary Protective Signaling Systems, 72C Remote Station Protective Signaling Systems (as applicable), NFPA 71, UL Standards 2635 and 864, local building codes, and meet requirements of local authorities having jurisdiction.

1.3 SUBMITTALS:

- A. **PRODUCT DATA:** Submit manufacturer's data on fire sprinkler monitoring systems including, but not limited to, roughing-in diagrams and instructions for installation, operation and maintenance, suitable for inclusion in maintenance manuals. Also include standard or typical riser and complete wiring diagrams for panel and system.
- B. **SHOP DRAWINGS:** Provide shop drawings showing equipment/device locations and connecting wiring of system. Include wiring diagrams and riser diagrams.
- C. **CERTIFICATION:** Submit a written statement to the Architect, and the state and local Fire Marshal's Office that each device of the system has been installed, inspected and tested in accordance with applicable requirements of NFPA Standard 72. This statement shall be submitted at the time of completion of the system installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. **MANUFACTURER:** Subject to compliance with requirements, provide a sprinkler monitoring system compatible with the existing AutoCall Co. System (Type 8236-379).

2.2 SPRINKLER MONITORING AND ANNUNCIATION SYSTEMS:

- A. **GENERAL:** Provide an electrically operated, electrically supervised central station monitoring system as described herein. Include control units, power supplies, alarm initiating and indicating devices, conduit, wire, fittings and accessories required to provide a complete operating system. Enclose entire system in raceway. Provide basic wiring materials which comply with Division 16, Basic Materials and Methods Sections for raceways, conductors, boxes, fittings, supports, etc. Minimum wire size to be #14 AWG copper.

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- B. **BATTERIES:** Provide sealed standby batteries, in suitable enclosure, capable of operating the unit for 24 hours in supervisory mode, and for 5 minutes at fully functional level.

2.3 WATER FLOW SWITCHES (Honeywell, Model PTRVSRB):

- A. Provide water flow switches for the wet pipe sprinkler system with the following features:
 1. Corrosion resistant vane-type, pressure tested at 300 lbs/sq in. water pressure, operable flow of 10 gpm.
 2. Suitable for mounting in vertical or horizontal pipe runs, with adjustable time delay to avoid false alarms from water hammer, surges, or variation in water pressures.
 3. Electrically compatible with system requirements.

2.4 GATE VALVE SUPERVISORY SWITCHES (Honeywell, Model PTROSYB):

- 1. Constructed of corrosion resistant metal and finished in red enamel paint.
 2. Capable of activating trouble signal upon removal of cover.
 3. Electrically compatible with system requirements.
- B. Provides switches in configuration such that they will not interfere with normal operation of valve; operate in the horizontal or vertical position; and activate alarm between first and second revolution of the valve wheel.

2.5 AUDIOVISUAL ALARM HORNS (FCI, HMF/STS SEMI-FLUSH MOUNTED OR EQUAL):

- A. Provide audio-visual alarm horns with the following features:
 1. Die cast or stamped steel construction, finished in red enamel, suitable for indoor or outdoor application.
 2. Capable of 90 db (UL rating) sound level at 10 feet.
 3. Flush mounted
 4. Integrally mounted flashing light unit, with Lexan lens with block letters "FIRE", and minimum flash rate of ONE per second, and 110 candela minimum.
 5. Electrically compatible with system requirements.
 6. Horns shall sound the temporal pattern (code 3) until silenced.
 7. Audiovisual alarm horns shall have the ability to silence horns while maintaining the strobe flash, until reset.
 8. Mechanical horn mechanism only, electronic horns are not acceptable.
 9. Maximum 24 horns per circuit, maximum 8 strobes per circuit.
 10. Strobes shall be synchronized when there are three or more within sight and less than 55 feet of viewer.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRE SPRINKLER MONITORING SYSTEMS:

- A. Install system as indicated, in accordance with equipment manufacturer's written instructions and complying with applicable portions of NEC and NECA's "Standard of Installation".
- B. Install wiring, raceways, and electrical boxes and fittings in accordance with Division-16 Basic Materials and Methods sections, "Raceways", "Wires and Cables", and "Electrical Boxes and Fittings", and in accordance with other sections, as applicable.

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- C. Wire initiating circuits are four wire, Class A circuits with separate conduit runs for outgoing and return portions of the Class A loop, such that a single fault in the indicating loop does not prevent operation of the indicating devices.
- D. Install all wiring in raceway. Minimum raceway size, 3/4"; minimum conductor size, #14 AWG. Insure that raceway size, and wire quantity, size, and type is suitable for equipment supplied. Review proper installation procedure for each type of device with equipment supplier before installation. Label each junction box throughout system, "Fire Alarm", indicate zone number, and paint cover of junction boxes red. Run 3/4" conduit from communicator to telephone terminal for installation of telephone lines.

3.2 TESTING:

- A. Provide factory trained representative to perform complete system testing upon completion of installation. Test each initiating and annunciating device for proper operation. Test operation of trouble annunciation on each circuit. Perform complete testing of all control panel functions. Conduct full 24 hour test of battery operation. After completion of testing instruct Owner's representative in proper operation and maintenance procedure.

END OF SECTION 16722

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK:

- A. The extent of telephone system work is indicated by drawings and is hereby defined to include, but not be limited to raceway, outlets, device plates, backboards, grounding and miscellaneous items required for complete raceway system.
- B. Refer to other Division-16 sections for requirements for raceways, trays, boxes and fittings, wiring devices (plates), and supporting devices, and other sections, as applicable.

1.3 QUALITY ASSURANCE:

- A. Comply with applicable portions of NEC as to type products used and installation of components. Provide products and materials which have been UL-listed and labeled.

PART 2 - PRODUCTS

- A. GENERAL: Provide complete raceway system for telephone including but not limited to, raceway, outlets, device plates, backboards, grounding and miscellaneous items as required.
- B. Provide 4" square box with appropriate plaster or tile ring.
- C. Provide telephone/data coverplates for wall outlets to match color and material of wiring device plates; for floor outlets, match color and material of floor power outlet covers.
- D. Provide fire treated, or hypalon coated plywood terminal backboards, 4' x 8' x 3/4" unless noted otherwise.
- E. Provide terminal cabinets of code gauge steel, flush or surface, as indicated, with concealed trim clamp, concealed hinges and flush lock, with gray baked enamel finish to match finish of panelboard covers. Construct back boxes of code gauge galvanized steel with removable endwalls.

PART 3 - EXECUTION

3.1 INSTALLATION OF TELEPHONE SYSTEM:

- A. GENERAL: Install raceway system as indicated to comply with NEC and recognized industry practices. Run 1" EMT (No flex) conduit from each telephone/data outlet to backboard, tray, or terminal cabinet. Provide nylon pull cord in all empty raceway.

END OF SECTION 16740

PART 1 – GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
- B. Division-16 Basic Materials and Methods sections apply to work specified in this section.

1.2 DESCRIPTION OF WORK

- A. Extent of security system work is indicated by drawings and is hereby defined to include, but not be limited to raceway, outlets, coverplates, backboards, cabinets, grounding and miscellaneous items required for complete raceway system.
- B. Refer to other Division-16 sections for requirements for raceways, trays, boxes and fittings, and supporting devices, and other sections, as applicable.

1.3 QUALITY ASSURANCE:

- A. Comply with applicable portions of NEC as to type products used and installation of components. Provide products and materials which have been UL-listed and labeled.

PART 2 – PRODUCTS

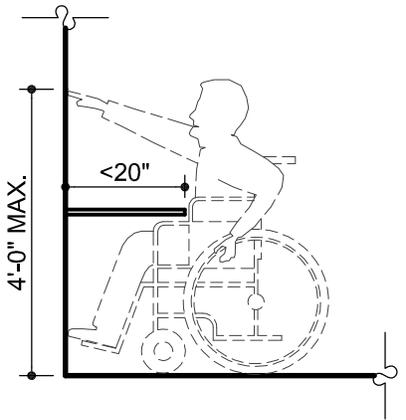
- A. GENERAL: Provide complete raceway system for security system including but not limited to, raceway, outlets, coverplates, backboards, cabinets, grounding and miscellaneous items as required.
- B. Provide plywood terminal backboards, 4' x 8' x 3/4" unless noted otherwise.
- C. Provide terminal cabinets of code gauge steel, flush or surface, as indicated, with concealed trim clamps, concealed hinges and flush lock, with gray baked enamel finish to match finish of panelboard covers. Construct back boxes of code gauge galvanized steel with removable endwalls.

PART 3 - EXECUTION

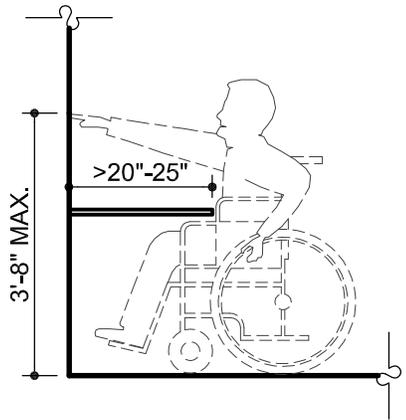
3.1 INSTALLATION OF SECURITY RACEWAY SYSTEM:

- A. GENERAL: Install raceway system as indicated to comply with NEC and recognized industry practices. Run 3/4" conduit in a loop from each security device to terminal backboard, tray, or terminal cabinet. Provide nylon pull cord in all installed raceway.
- B. GROUNDING: Provide one #6 bare copper ground from each security system terminal board to the service entrance ground. Enclose in suitable raceway for entire length. Coil six feet of conductor at each terminal board. Make connection at service entrance ground. See drawings for additional requirements.
- C. POWER: Provide a minimum of one duplex receptacle on dedicated emergency powered circuit adjacent to each terminal backboard or cabinet. See drawings for additional power outlets.

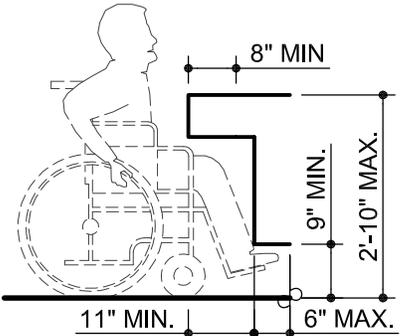
END OF SECTION 16782



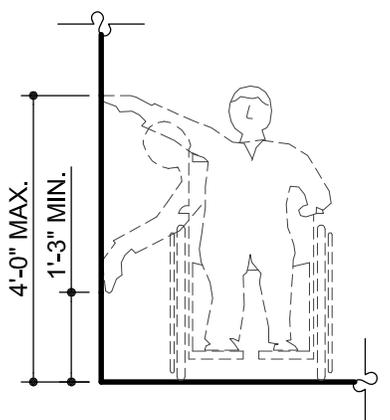
OBSTRUCTED FORWARD REACH



OBSTRUCTED FORWARD REACH

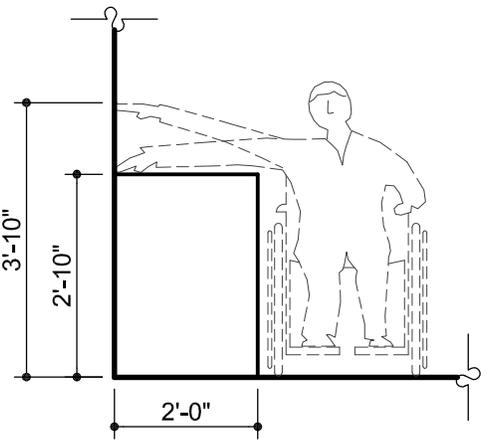


KNEE AND TOE CLEARANCE

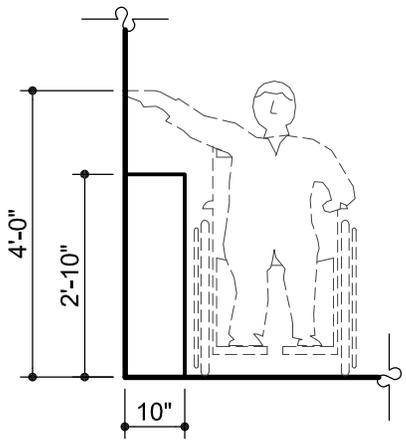


UNOBSTRUCTED SIDE REACH

THE OCCUPANT SHALL PROVIDE ONE ACCESSIBLE TESTING STATION AND ONE ACCESSIBLE SERVICE COUNTER (N.I.C.) WHEN FURNISHING THE BUILDING FOR OPERATION. ALL ACCESSIBLE ELEMENTS PROVIDED SHALL MEET ALL REQUIREMENTS OF ICC/ANSI A117.1-2003.



OBSTRUCTED SIDE REACH



OBSTRUCTED SIDE REACH

ACCESSIBLE APPROACH

DET. NAME:

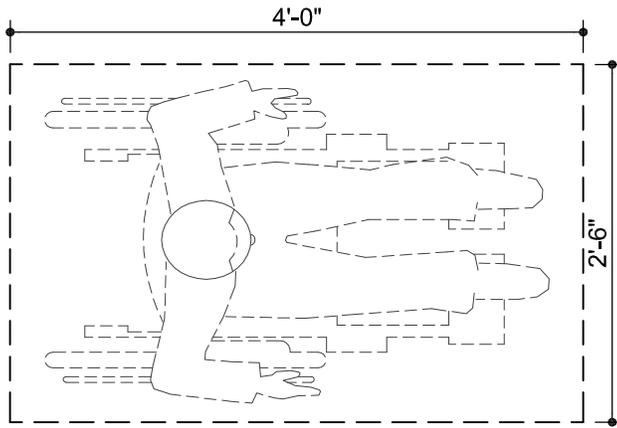
DET NUMBER:

SCALE: 3/8"=1'-0"

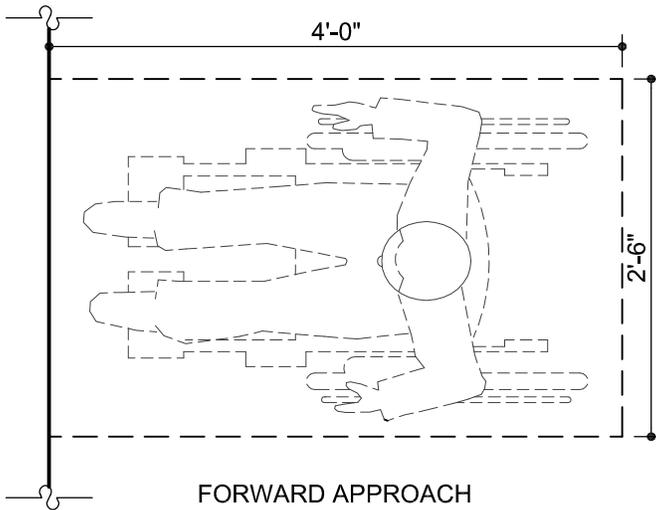
REVISION:

PROJECT:

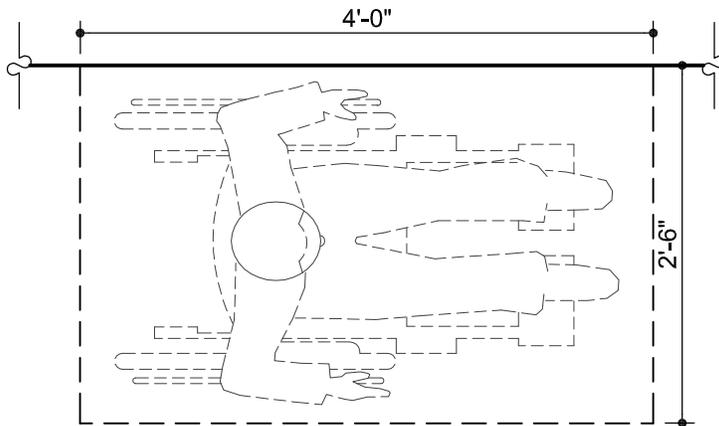
IN-05



CLEAR FLOOR SPACE



FORWARD APPROACH



PARALLEL APPROACH

THE OCCUPANT SHALL PROVIDE ONE ACCESSIBLE TESTING STATION AND ONE ACCESSIBLE SERVICE COUNTER (N.I.C.) WHEN FURNISHING THE BUILDING FOR OPERATION. ALL ACCESSIBLE ELEMENTS PROVIDED SHALL MEET ALL REQUIREMENTS OF ICC/ANSI A117.1-2003.

DET. NAME: **ACCESSIBLE APPROACH**

DET NUMBER:

SCALE: 3/4"=1'-0"

REVISION:

PROJECT:

IN-06



Doing what's right: yesterday, today and tomorrow

Addendum

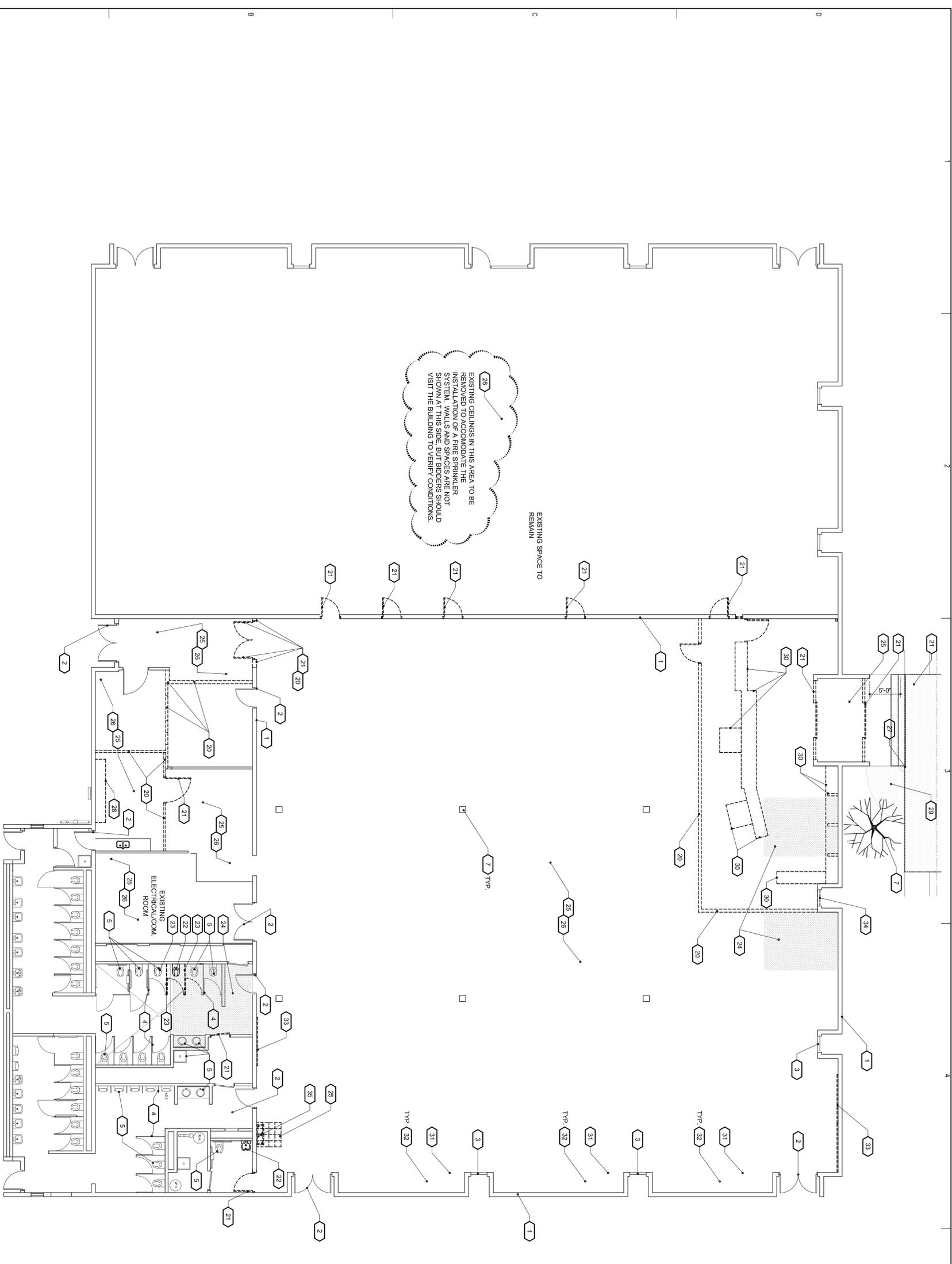
Job: Drivers License Office
Job Number: 20070224
Date: July 31, 2007

MECHANICAL – DIV 15

PRIOR APPROVALS

Approval of equipment from catalog information indicated brand name and general characteristics are acceptable to the Engineer, but does not relieve the Contractor of the responsibility of providing equipment and accessories as specified unless specific mention of departments from specifications was made in the submittal and acknowledged in writing by the Engineer. Quantities and dimensions are not checked. We are retaining one set of submittal data for our files.

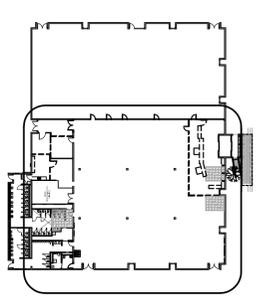
<u>ITEM</u>	<u>MANUFACTURER</u>	<u>COMMENT</u>
Split System AC Units	Daikin AC	Commercial units approved
Backdraft Dampers	Greenheck	Approved
Manual Volume Dampers	Greenheck	Approved
Fire Dampers	Greenheck	Approved
Ceiling Fire Dampers	Greenheck	Approved
Smoke Dampers	Greenheck	Approved
Fire/Smoke Dampers	Greenheck	Approved
Duct Access Doors	Greenheck, Kees	Approved
Flexible Ducts	Flexmaster, Hercules	Approved



DEMOLITION KEYNOTE LEGEND

- 1 EXISTING WALL TO REMAIN
- 2 EXISTING DOOR AND FRAME TO REMAIN
- 3 EXISTING WINDOW TO REMAIN
- 4 EXISTING PARTITION TO REMAIN
- 5 EXISTING PLUMBING FIXTURE TO REMAIN
- 6 EXISTING WALL TILE TO REMAIN
- 7 EXISTING TO REMAIN
- 20 REMOVE WALL
- 21 REMOVE DOOR AND FRAME AND SALVAGE FOR OWNER
- 22 REMOVE PLUMBING FIXTURES AND ASSOCIATED PLUMBING - CAP OFF - SALVAGE FOR OWNER
- 23 REMOVE TOILET COMPARTMENT PARTITION
- 24 REMOVE CONCRETE SLAB - REMOVE UNUSED PLUMBING TYP AT HATCHED AREA
- 25 REMOVE CARPET AND OTHER FLOOR FINISH
- 26 REMOVE CEILING TILE OR OTHER CEILING
- 27 REMOVE EXISTING CONCRETE RAMP, AND CURB
- 28 REMOVE CABINET AND PLUMBING
- 29 REMOVE BOLLARD & GUARDRAIL
- 30 REMOVE CABINET
- 31 REMOVE DISPLAY CABINET
- 32 REMOVE AND SALVAGE LIGHT FIXTURES, PROTECT AND STORE UNTIL TURNED OVER TO OWNERS REPRESENTATIVE.
- 33 REMOVE SLAT BOARD DISPLAY.
- 34 REMOVE WINDOW & FRAME - SALVAGE FOR OWNER
- 35 REMOVE EXISTING WATER COOLER & ASSOCIATED PLUMBING. CAP OFF PLUMBING. STORE FIXTURE UNTIL REINSTALLATION PER MECHANICAL.
- 36 CUT AND REMOVE EXISTING STAIR NOSINGS AND TREADS AS SHOWN.

KEY PLAN



NOTES

1. CONTRACTOR TO PROTECT EXISTING BLDG. DURING CONSTRUCTION INCLUDING FINISHES, DOORS AND FRAMES ETC.
2. SEE ELECTRICAL AND MECHANICAL FOR ADDITIONAL DEMOLITION INFORMATION & DRAWINGS.

B3 DEMOLITION PLAN

SCALE: 1/8"=1'-0"



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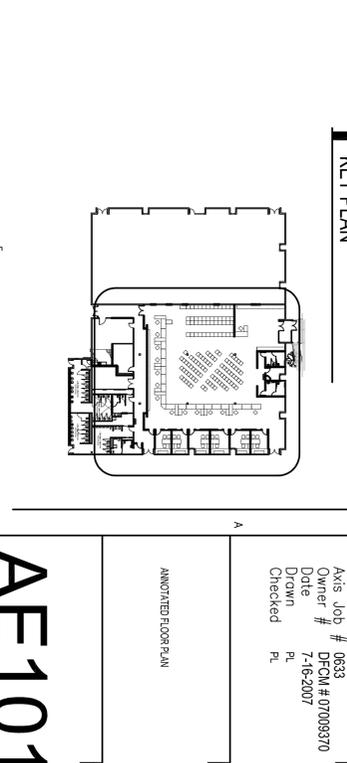
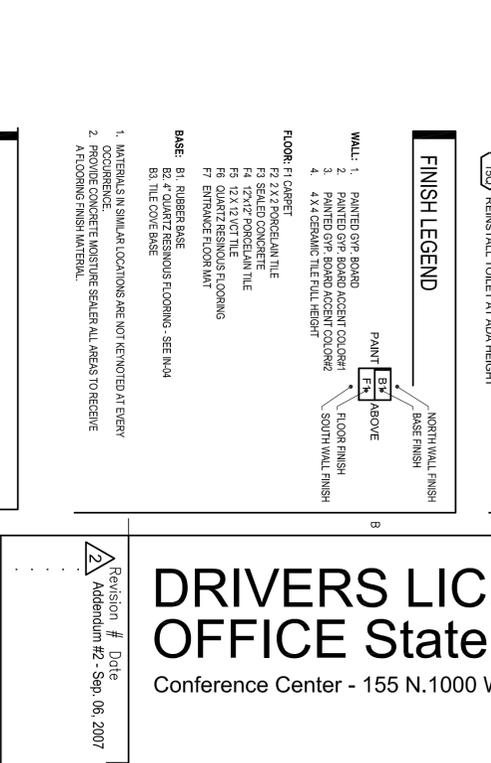
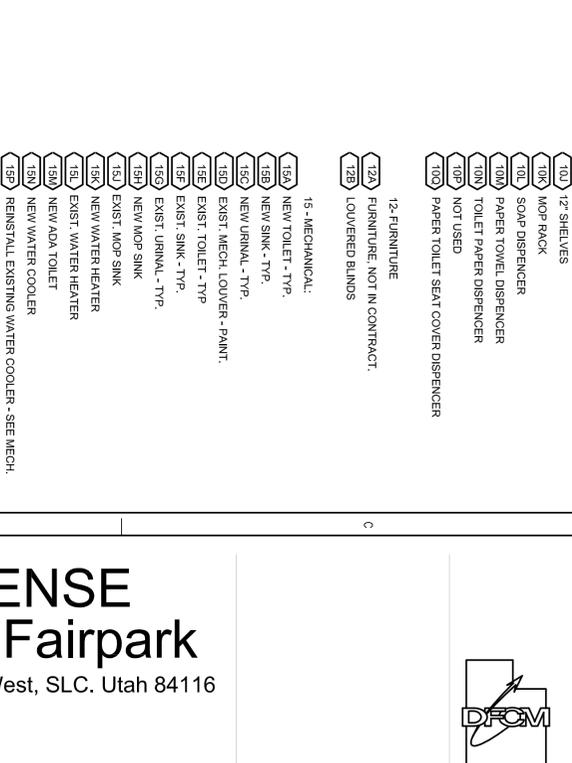
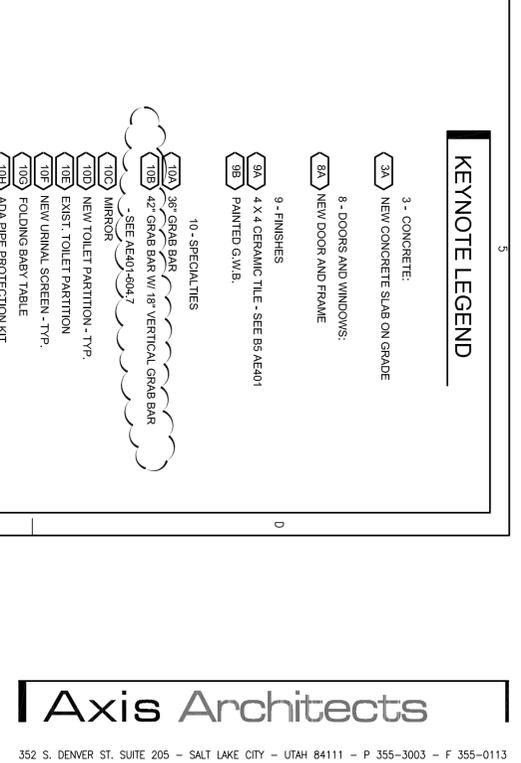
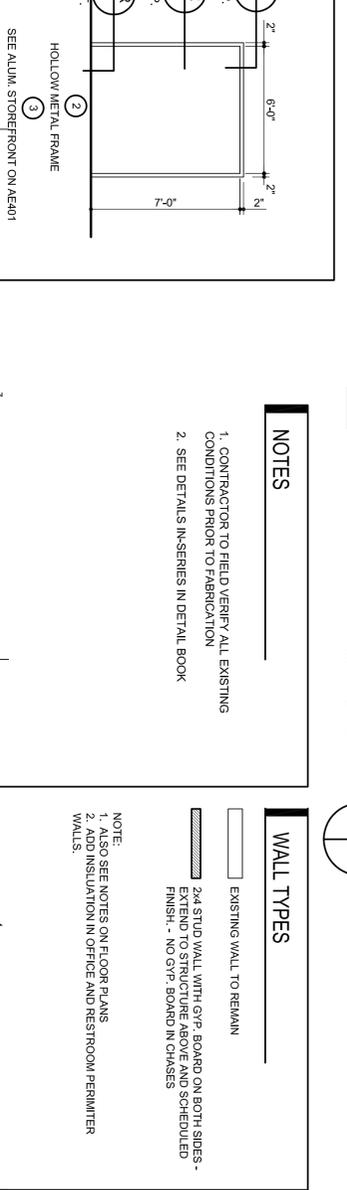
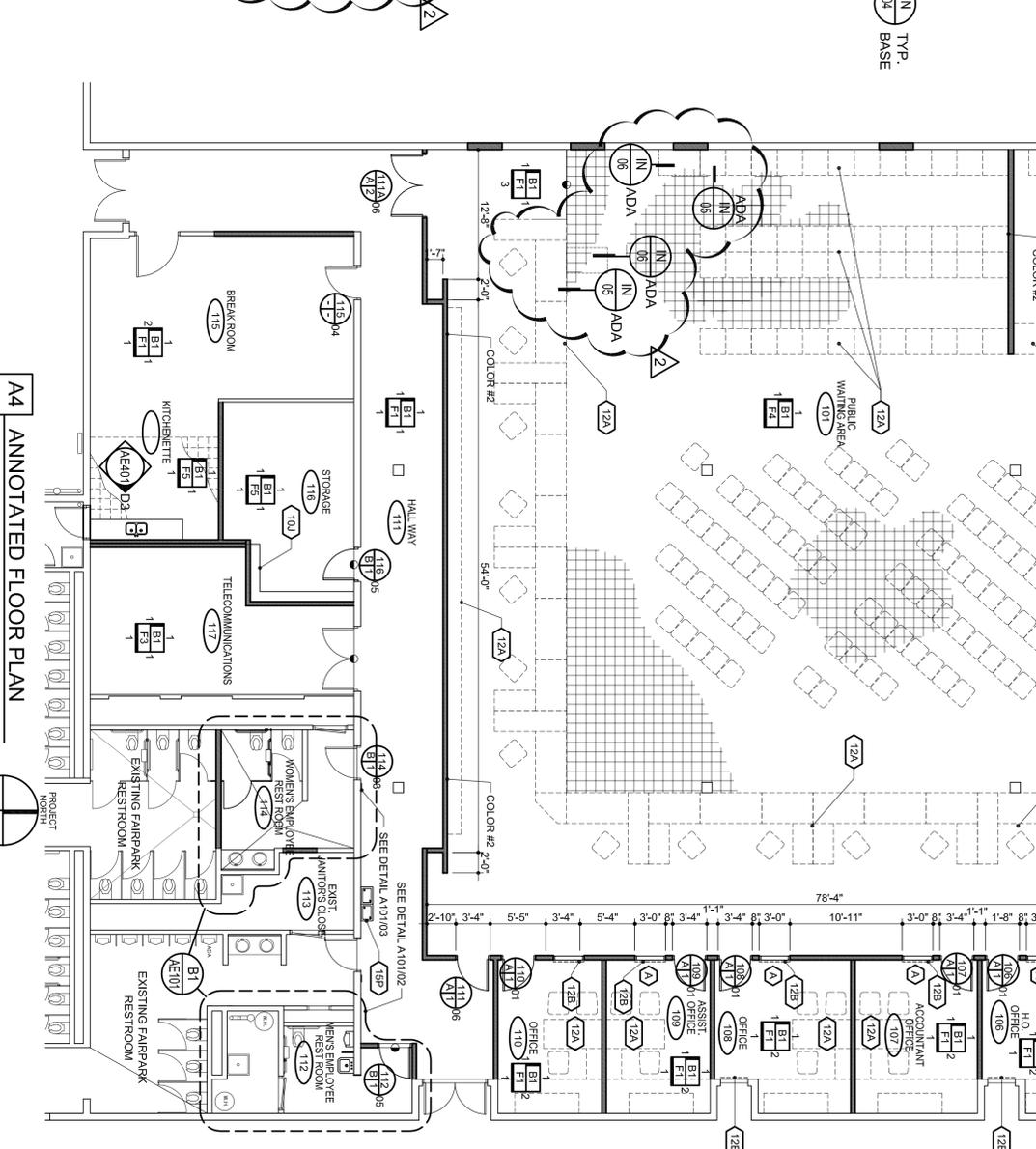
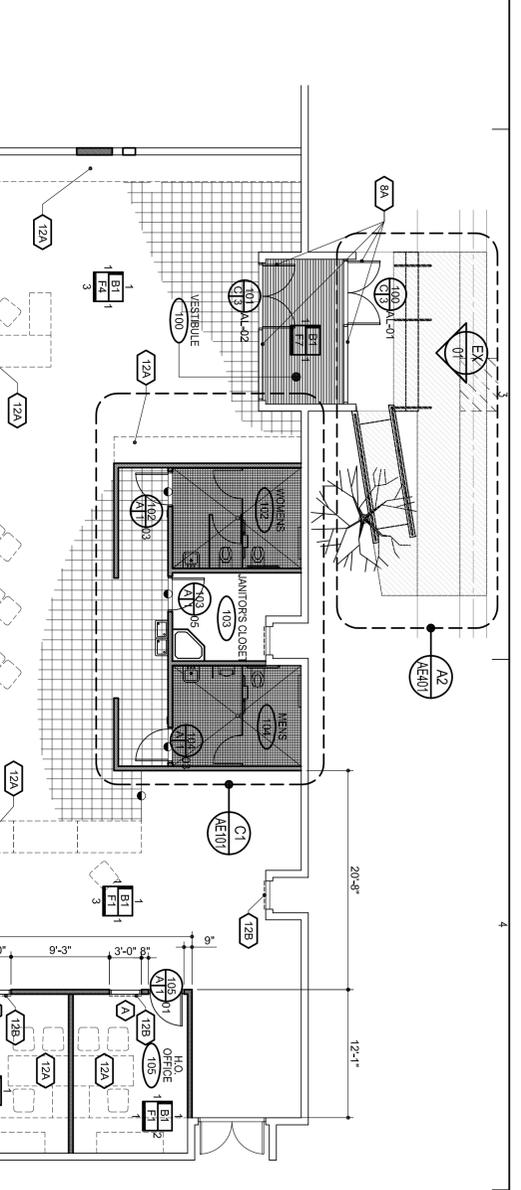
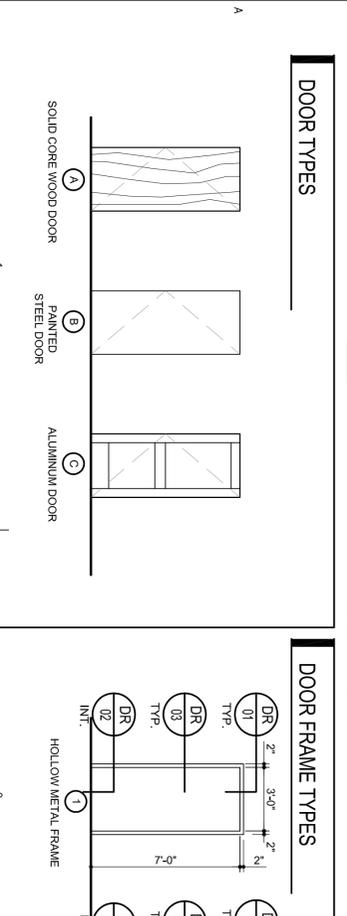
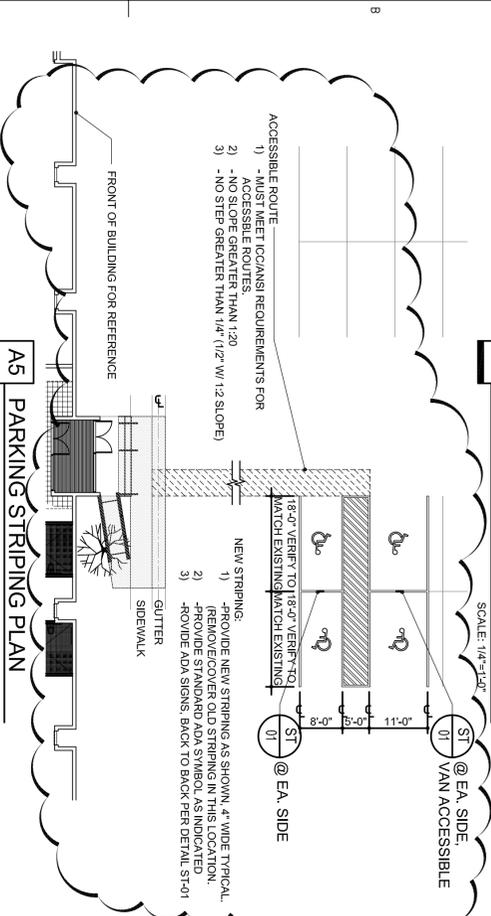
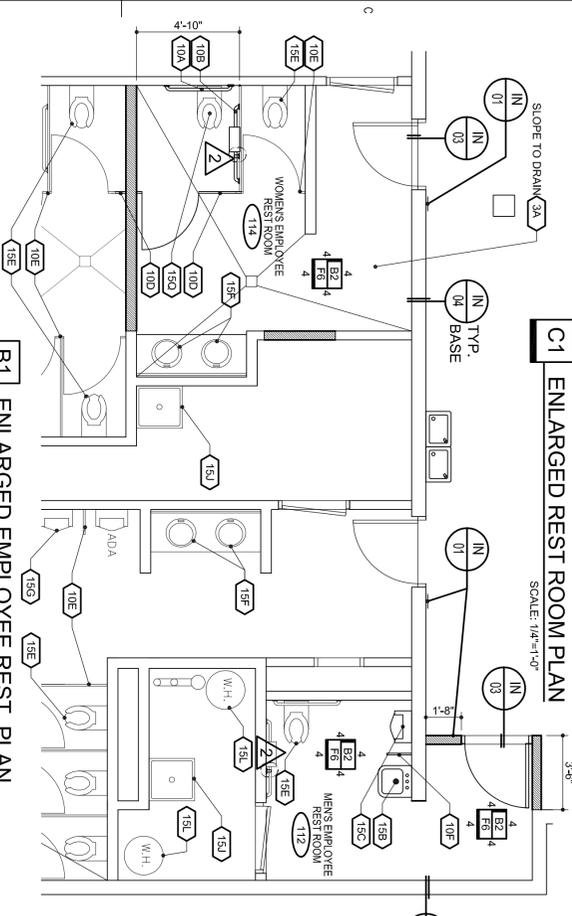
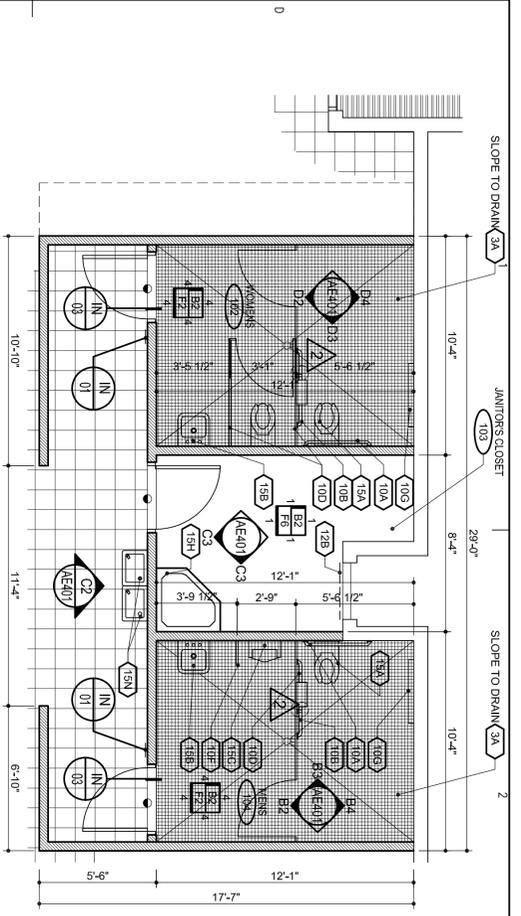
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AD101

Axis Job # 0633
 Owner # DFCM # 07009370
 Date 7-16-2007
 Dgwn PL
 Checked PL
 DEMOLITION
 FLOOR PLAN

Revision # Date
 2 Addendum #2 - Sep. 06, 2007

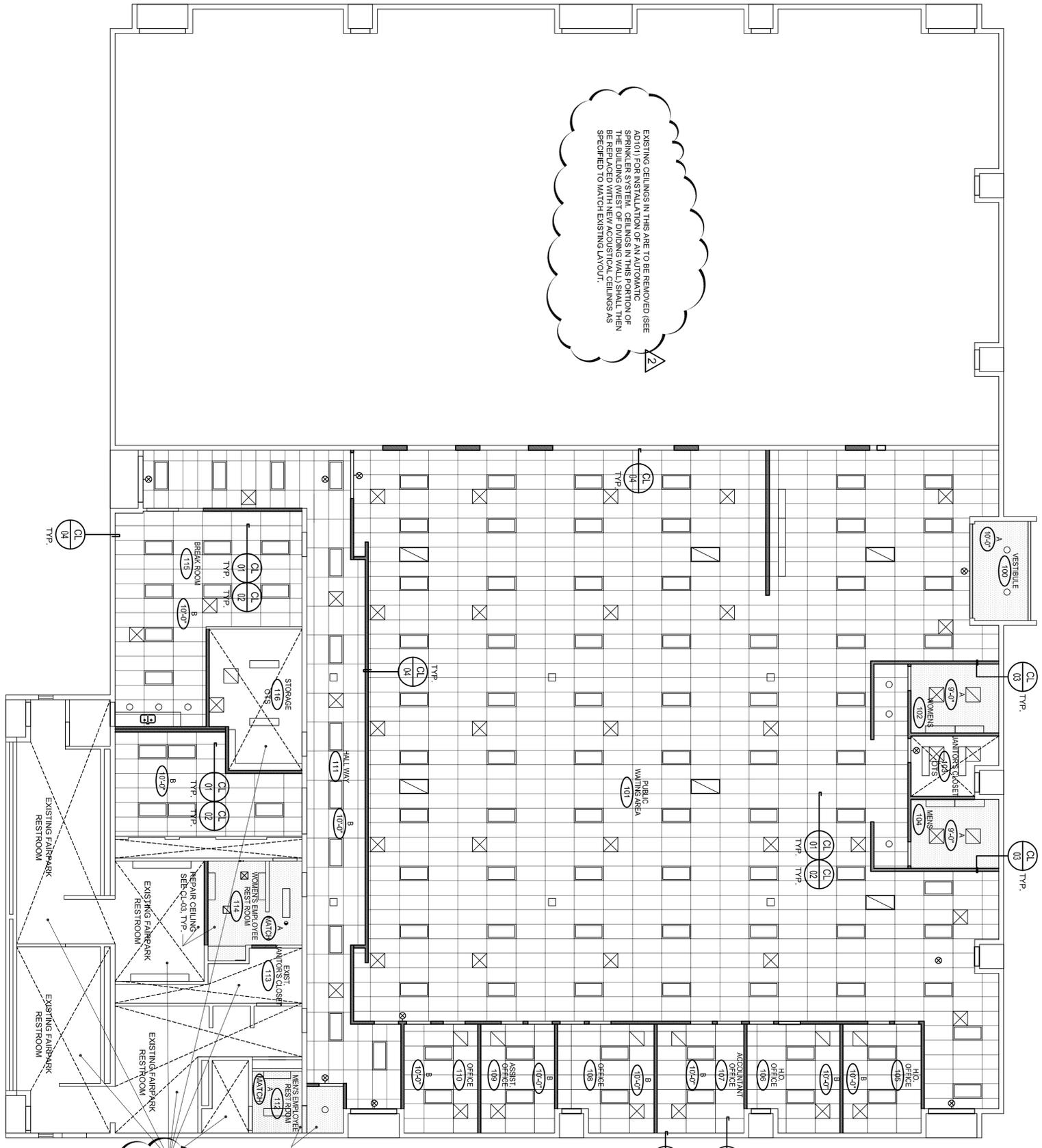


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AE101

EXISTING CEILING IN THIS AREA TO BE REMOVED (SEE A310) FOR INSTALLATION OF AN AUTOMATIC SPRINKLER SYSTEM. THE BUILDING WEST OF DIVIDING WALL SHALL THEN BE REPLACED WITH NEW ACOUSTICAL CEILING AS SPECIFIED TO MATCH EXISTING LAYOUT.



EXISTING HARD SURFACE CEILING TO REMAIN. COORDINATE INSTALLATION OF AUTOMATIC FIRE SPRINKLER SYSTEM FOR MINIMAL DISTURBANCE OF EXISTING CEILING AND PROVIDE FOR PATCHING AND REPAIR AS NECESSARY.

REPAIR CEILING SEE CL-03, TYPICAL

CEILING SYMBOL LEGEND

- 2 X 2 FLUORESCENT LIGHT FIXTURE. REFER TO ELECTRICAL DRAWINGS.
- 2 X 4 FLUORESCENT LIGHT FIXTURE. REFER TO ELECTRICAL DRAWINGS.
- 1 X 4 FLUORESCENT LIGHT FIXTURE. REFER TO ELECTRICAL DRAWINGS.
- RECESSED DOWNLIGHT FIXTURE. REFER TO ELECTRICAL DRAWINGS.
- WALL MOUNTED LUMINAIRE. REFER TO ELECTRICAL DRAWINGS.
- PENDANT FIXTURE
- WALL SCONCE
- WALL MOUNTED FIXTURE
- EMERGENCY EXIT LIGHTING
- RETURN AIR REGISTER. REFER TO ELECTRICAL DRAWINGS.
- SUPPLY AIR DIFFUSER. REFER TO ELECTRICAL DRAWINGS.
- ACCESS PANEL. SEE MECH FOR FINAL SIZE AND LOCATION AND REFER TO MECH. DRAWINGS FOR COORD. WITH MECH. AND ELECT. REQUIRED COORD. WITH MECH. AND ELECT.

ALSO REFER TO ELECTRICAL AND MECHANICAL DRAWINGS

CEILING SCHEDULE

- A - MATERIAL ELEVATION ABOVE FF
- A - NEW PAINTED GYP. BOARD CEILING LINE UP WITH EXISTING HEIGHT
- B - 2 X 4 ACOUSTIC PANEL CEILING
- O/S - OPEN TO STRUCTURE - EXISTING TO REMAIN

NOTES

1. SEE DETAILS CL-SERIES IN DETAIL BOOK.
2. SEE CL-01 & CL-02 FOR TYPICAL BRACING DETAILS @ ALL SUSPENDED CEILING.
3. SEE CL-04 FOR TYPICAL LAV-IN CEILING EDGE DETAIL.
4. SEE CL-03 FOR TYPICAL CEILING TO WALL DETAIL.
5. SEE CL-05 FOR TYPICAL CEILING TO WALL DETAIL.
6. REPAIR CEILING AS NEEDED FOR NEW WORK.

B3 REFLECTED CEILING PLAN

SCALE: 1/4"=1'-0"



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Revision # Date
2 Addendum #2 - Sep. 06, 2007

Axis Job # 0633
Owner # DFCM # 07009370
Date 7-16-2007
Dgwn P.
Checked R.

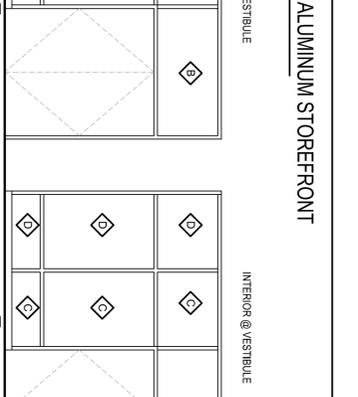
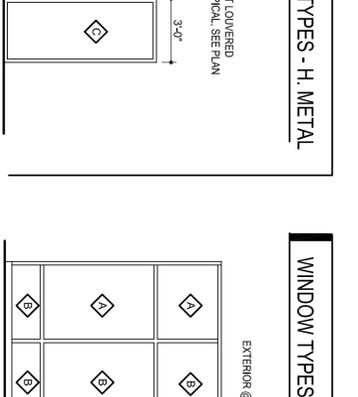
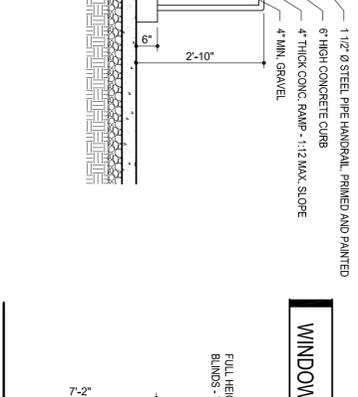
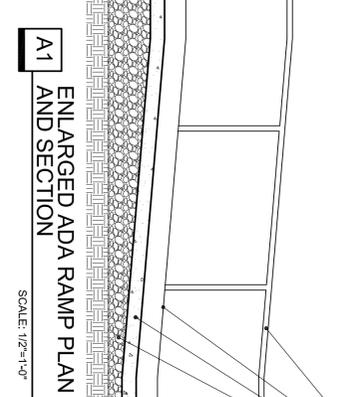
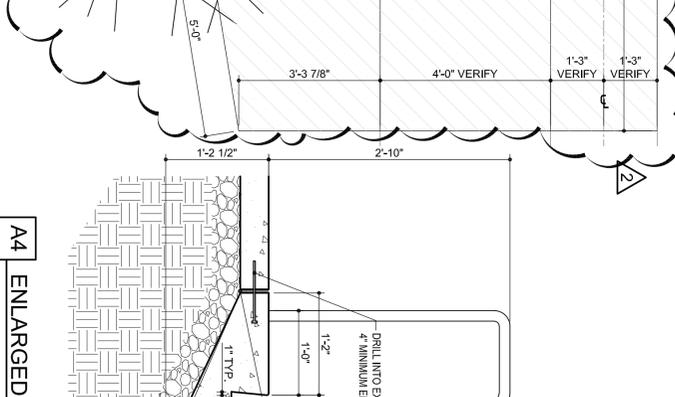
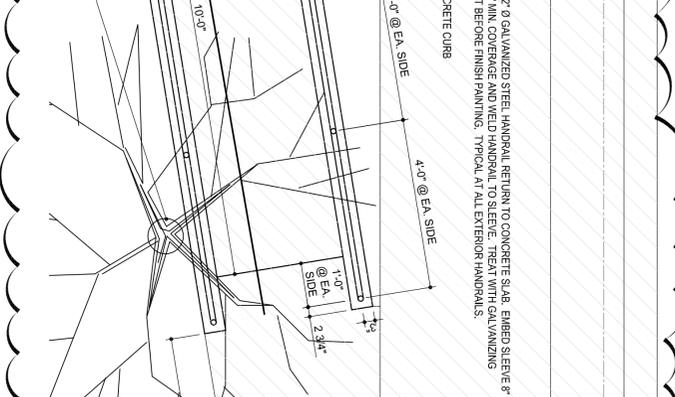
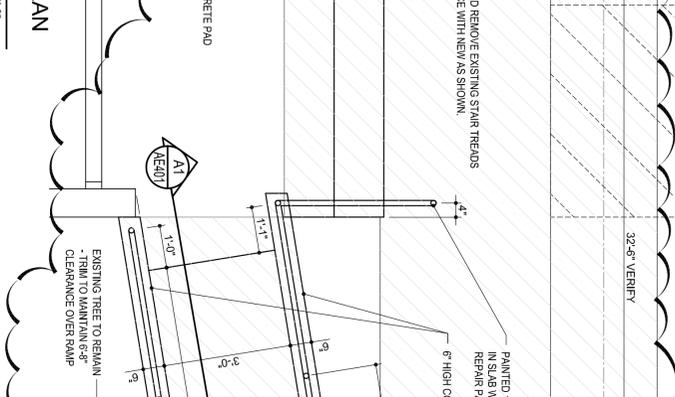
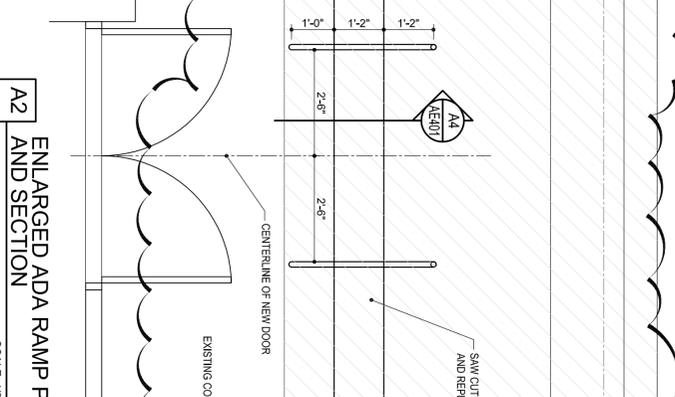
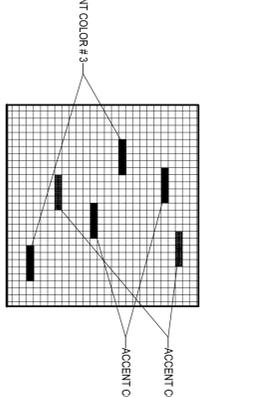
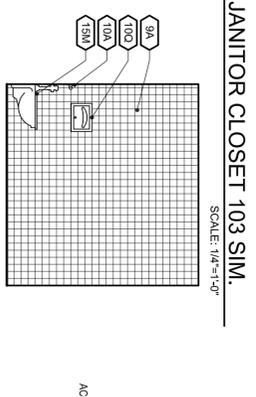
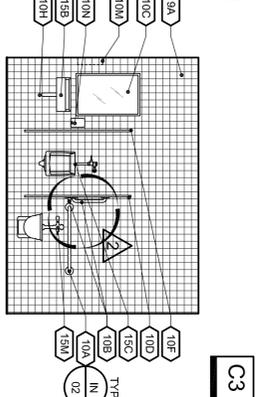
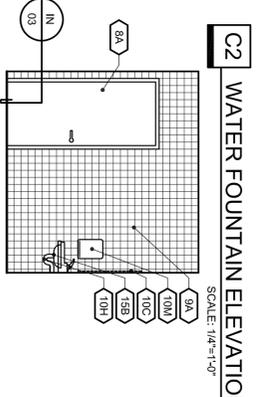
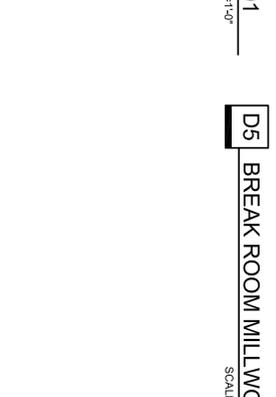
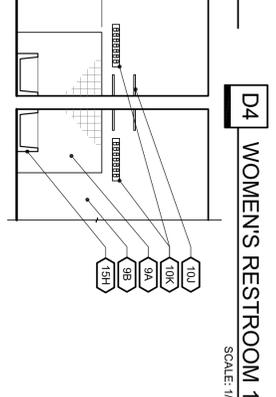
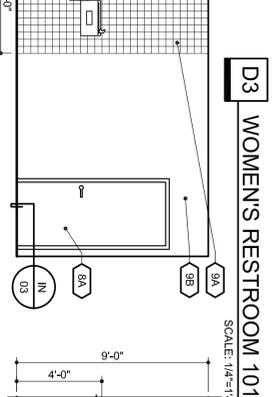
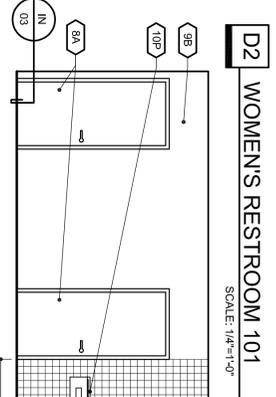
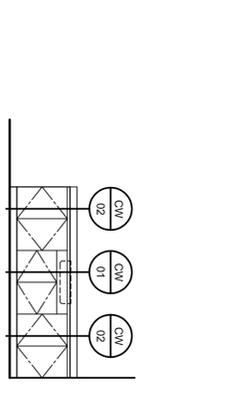
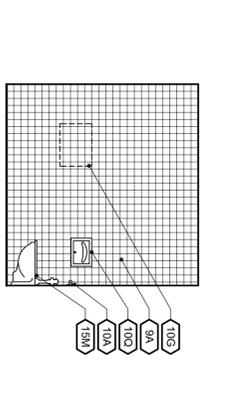
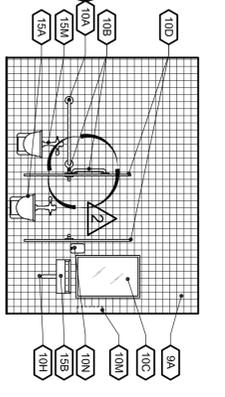
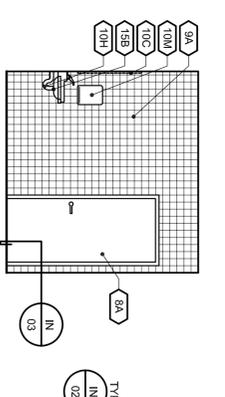
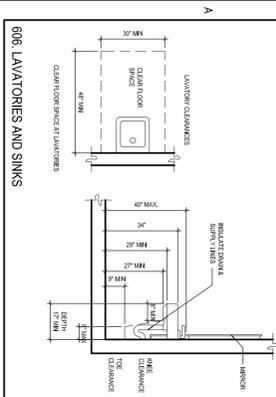
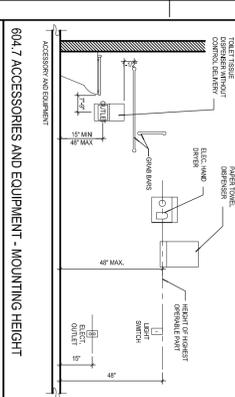
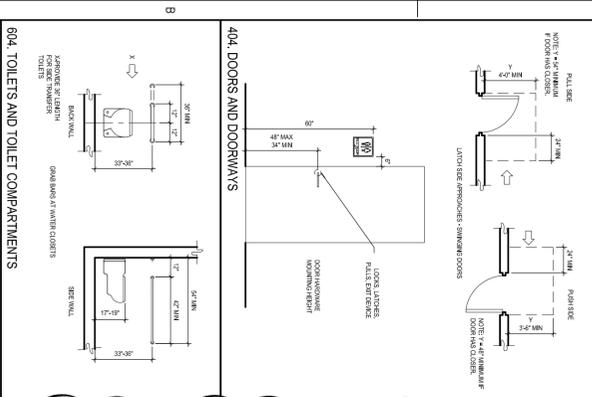
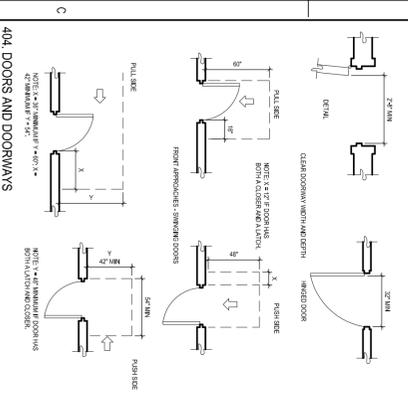
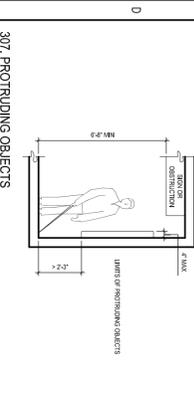
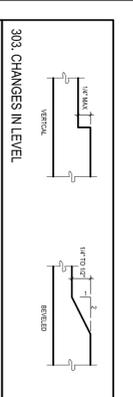
REFLECTED CEILING PLAN

AE111



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KEYNOTE LEGEND

- 3 - CONCRETE
- 3A - NEW CONCRETE SLAB ON GRADE
- 8 - DOORS AND WINDOWS
- 8A - NEW DOOR AND FRAME
- 9 - FINISHES
- 9A - 4 X 4 CERAMIC TILE - SEE 95 AE401
- 9B - PAINTED G.W.B.

- 10 - SPECIALTIES
- 10A - 36" GRAB BAR
- 10B - 42" GRAB BAR W/ 18" VERTICAL GRAB BAR - SEE AE401-604.7
- 10C - MIRROR
- 10D - NEW TOILET PARTITION - TYP.
- 10E - EXIST. TOILET PARTITION
- 10F - NEW URINAL SCREEN - TYP.
- 10G - FOLDING BABY TABLE
- 10H - ADA PIPE PROTECTION KIT
- 10I - 12" SHELVES
- 10J - MOP RACK
- 10K - SOAP DISPENSER
- 10L - PAPER TOWEL DISPENSER
- 10M - TOILET PAPER DISPENSER
- 10N - NOT USED
- 10O - PAPER TOILET SEAT COVER DISPENSER

- 12 - FURNITURE
- 12A - FURNITURE, NOT IN CONTRACT
- 12B - LOUVERED BLINDS

- 15 - MECHANICAL
- 15A - NEW TOILET - TYP.
- 15B - NEW SINK - TYP.
- 15C - NEW URINAL - TYP.
- 15D - EXIST. MECH. LOUVER - PAINT.
- 15E - EXIST. TOILET - TYP.
- 15F - EXIST. SINK - TYP.
- 15G - EXIST. URINAL - TYP.
- 15H - NEW MOP SINK
- 15I - EXIST. MOP SINK
- 15J - NEW WATER HEATER
- 15K - EXIST. WATER HEATER
- 15L - NEW ADA TOILET
- 15M - NEW WATER COOLER
- 15N - RENOVATE EXISTING WATER COOLER - SEE MECH.
- 15O - RENOVATE TOILET AT ADA HEIGHT

- 11 - FINISHES
- 11A - 1/2" GALVANIZED STEEL HANDRAIL RETURN TO CONCRETE SLAB, EMBED STEEL @ 2" MIN. COVERAGE AND REDUCE HANDRAIL TO SELECT, PAINT WITH GALVANIZING REPAIR PAINT BEFORE FINISHING. TYPICAL AT ALL EXTERIOR HANDRAILS.
- 11B - 6" HIGH CONCRETE CURB
- 11C - 4" @ EA. SIDE
- 11D - 4" @ EA. SIDE
- 11E - 1" @ EA. SIDE
- 11F - 2.34" @ EA. SIDE
- 11G - 1" @ EA. SIDE
- 11H - 1" @ EA. SIDE
- 11I - 1" @ EA. SIDE
- 11J - 1" @ EA. SIDE
- 11K - 1" @ EA. SIDE
- 11L - 1" @ EA. SIDE
- 11M - 1" @ EA. SIDE
- 11N - 1" @ EA. SIDE
- 11O - 1" @ EA. SIDE
- 11P - 1" @ EA. SIDE
- 11Q - 1" @ EA. SIDE
- 11R - 1" @ EA. SIDE
- 11S - 1" @ EA. SIDE
- 11T - 1" @ EA. SIDE
- 11U - 1" @ EA. SIDE
- 11V - 1" @ EA. SIDE
- 11W - 1" @ EA. SIDE
- 11X - 1" @ EA. SIDE
- 11Y - 1" @ EA. SIDE
- 11Z - 1" @ EA. SIDE

NOTES

1. CONTRACTOR TO FIELD VERIFY ALL EXISTING CONDITIONS PRIOR TO FABRICATION
2. SEE DETAILS INSERIE FOR SIGNAGE

GLAZING SCHEDULE

- A. 1" INSULATED LOW-E GLASS
- B. 1" INSULATED LOW-E TEMPERED GLASS
- C. 1/4" TEMPERED GLASS
- D. 1/4" FLOAT GLASS

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Revision # Date
2 Addendum #2 - Sep. 06. 2007

Axis Job # 0633
Owner # DFCM # 07009370
Date 7-16-2007
Drawn P.
Checked R.

INTERIOR ELEVATIONS

AE401

FIXTURE SCHEDULE				
TYPE	DESCRIPTION	CATALOG NUMBER	VOLTS	LAMPS
B	4' STRIP FLUORESCENT WITH WIRE GUARD	LITHONIA: C 232 120 WCGUN COLUMBIA: CS4-232-EBB120-GLR-CSWG4	120	(2) F32 T8 835K
D1	RECESSED FLUORESCENT DOWNLIGHT, 6" APERTURE	LITHONIA: AF 1/26TR7 6AR 120	120	(1) 26W TR7 835K
G1	2X4 RECESSED ACRYLIC LENS TROFFER GRID MOUNT, 3-LAMP, ELECTRONIC BALLAST	LITHONIA: 2SP8 G 3 32 A12125 120 1/3 GEB COLUMBIA: ST824-332G-FAA12.125-3EBB120-GLR	120	(3) F32 T8 835K
G1E	SAME AS G1 WITH BATTERY PACK	LITHONIA: 2SP8 G 3 32 A12125 120 1/3 GEB EL6 COLUMBIA: ST824-332G-FAA12.125-3EBB120-GLR-EL	120	(3) F32 T8 835K
G2	2X4 RECESSED ACRYLIC LENS TROFFER GRID MOUNT, 2-LAMP, ELECTRONIC BALLAST	LITHONIA: 2SP8 G 2 32 A12125 120 1/3 GEB COLUMBIA: ST824-232G-FAA12.125-EBB120-GLR	120	(2) F32 T8 835K
G2E	SAME AS G2 WITH BATTERY PACK	LITHONIA: 2SP8 G 2 32 A12125 120 1/3 GEB EL6 COLUMBIA: ST824-232G-FAA12.125-EBB120-GLR-EL	120	(2) F32 T8 835K
G3	2X4 RECESSED ACRYLIC LENS TROFFER GRID MOUNT, 2-LAMP, ELECTRONIC BALLAST	LITHONIA: 2AV G 3 32 MDF 120 1/3 GEB COLUMBIA: STR24-332G-MPO-EBB120-GLR	120	(2) F32 T8 835K
W1	WALL MOUNTED 8" LINEAR FLUORESCENT 2-LAMP, ELECTRONIC BALLAST	KENALL: MLHAB 48 F LG PP 232 EB 1 120	120	(2) F32 T8 835K
W1E	CONTINUOUS MOUNT AS SHOWN PER DRAWINGS SAME AS W1 WITH BATTERY PACK	KENALL: MLHAB 48 F LG PP 232 EB 1 120 PEL	120	(2) F32 T8 835K
WW	CONTINUOUS MOUNT AS SHOWN PER DRAWINGS 4" RECESSED WALL WASH FIXTURE GRID MOUNT, 1-LAMP, DIMMING BALLAST	PEERLESS LIGHTING: LWAR9 G1 54T5HO HOL U4 120 OSDIM L/LP	120	(1) F54 T5HO 835K
X1	DIECAST LED EXIT LIGHT, SINGLE FACE WHITE FACE, GREEN LETTERS	LITHONIA: LE S W1G 120 EL N	120	INCLUDED

EQUIPMENT SCHEDULE													
UNIT #	FUNCTION	LOAD	VOLT	PHASE	FULL LOAD AMPS	CONDUIT SIZE	NO. SETS	WIRES				REF. NOTES	REMARKS
								NO.	SIZE	TYPE	AMPS		
CU-1	CONDENSING UNIT	13.6 FLA	208	1	13.6	3/4"	1	2	12	CB	25	1A	
EF-1	EXHAUST FAN	500 W	120	1	4.90	3/4"	1	2	12	CB	20		11A FACTORY THERMAL OVER. AND DISCONNECT
HP-1	SPLIT SYSTEM A/C	1 FLA	208	1	1	3/4"	1	2	12	CB	15	4A	
RTU-1	ROOF TOP UNIT	20 FLA	208	3	20	3/4"	1	3	10	CB	40		11A FACTORY FUSED DISCONNECT
RTU-2	ROOF TOP UNIT	23.2 FLA	208	3	23.2	3/4"	1	3	10	CB	45		11A FACTORY FUSED DISCONNECT
RTU-3	ROOF TOP UNIT	55.2 FLA	208	3	55.2	1"	1	3	4	CB	90		11A FACTORY FUSED DISCONNECT (BID AS ALTERNATE)
WH-1	WATER HEATER	4 KW	208	3	13.06	3/4"	1	3	10	CB	20	1A	

NOTES:

- NON-FUSED DISCONNECT SWITCH
- FUSED DISCONNECT SWITCH
- BREAKER IN ENCLOSURE
- MANUAL STARTER W/THERMAL OVERLOAD
- MAGNETIC STARTER
- MAGNETIC STARTER/NON-FUSED DISCONNECT COMBINATION
- MAGNETIC STARTER/BREAKER COMBINATION
- VARIABLE FREQUENCY DRIVE
- REDUCED VOLTAGE STARTER
- DIRECT CONNECTION
- RECEPTACLE/SPECIAL PURPOSE OUTLET/ETC.
- TWO-SPEED STARTER, COORDINATE W/MOTOR TYPE

A. FURNISHED, INSTALLED, AND CONNECTED UNDER DIVISION 16
 B. FURNISHED AND INSTALLED UNDER ANOTHER DIVISION REQUIRING CONNECTION UNDER DIVISION 16
 C. FURNISHED UNDER ANOTHER DIVISION BUT INSTALLED AND CONNECTED UNDER DIVISION 16
 D. FURNISHED, INSTALLED AND CONNECTED UNDER ANOTHER DIVISION.

OVER CURRENT PROTECTIVE DEVICES
 CB = CIRCUIT BREAKER - THERMAL MAGNETIC
 FN = FUSE - NON INDUCTIVE LOAD
 FI = FUSE - INDUCTIVE LOAD
 MO = MAGNETIC ONLY CIRCUIT BREAKER

GENERAL NOTES	
1.	CONSULT ARCHITECTURAL REFLECTED CEILING PLANS FOR EXACT LOCATION OF ALL LIGHTING FIXTURES.
2.	VERIFY ALL EQUIPMENT DIMENSIONS AND LOCATIONS BEFORE BEGINNING ROUGH IN. CONSULT ALL APPLICABLE CONTRACT DRAWINGS AND SHOP DRAWINGS TO INSURE NEC CODE CLEARANCES REQUIRED AROUND ALL ELECTRICAL EQUIPMENT.
3.	CONTRACTOR SHALL VERIFY ALL ELECTRICAL LOADS (VOLTAGE, PHASE, CONNECTION REQUIREMENTS, ETC.) OF EQUIPMENT FURNISHED UNDER DIVISION 15 WITH APPROVED MECHANICAL SHOP DRAWINGS BEFORE BEGINNING ROUGH IN.
4.	SEE SECTION 16510 OF THE SPECIFICATION REQUIRED COORDINATION MEETINGS WITH MECHANICAL AND CEILING CONTRACTORS.
5.	SEE APPLICABLE SHOP DRAWINGS FOR ROUGH IN LOCATION OF ALL EQUIPMENT, WIRING DEVICES, ETC. WHERE APPLICABLE MOUNT ALL WIRING DEVICES ABOVE BACK SPLASH EXCEPT THOSE SERVING UNDER COUNTER EQUIPMENT.
6.	SEE SPECIFICATION FOR ENERGY SAVING LAMP AND BALLAST REQUIREMENTS.
7.	FINISHES OF ALL LIGHT FIXTURES SHALL BE AS SELECTED BY ARCHITECT.
8.	THE ELECTRICAL CONTRACTOR SHALL NOTIFY AND COOPERATE WITH THE MECHANICAL CONTRACTOR SUCH THAT NO PIPING, DUCTS, OR EQUIPMENT FOREIGN TO THE OPERATION OF THE ELECTRICAL EQUIPMENT SHALL BE PERMITTED TO BE INSTALLED IN, ENTER OR PASS THRU ELECTRICAL ROOMS OR SPACES, OR ABOVE OR BELOW ELECTRICAL EQUIPMENT IN OTHER AREAS.
9.	ELECTRICAL BOXES SHALL NOT BE LOCATED IN MASONRY COLUMNS IN BRICK WALLS OR IN GROUDED CELLS ADJACENT TO OPENINGS. COORDINATE LOCATION OF BOXES WITH MASONRY CONTRACTOR.
10.	ALL PENETRATIONS OF FIRE RATED FLOORS, WALLS, AND CEILINGS SHALL BE SEALED WITH APPROVED MATERIAL TO MAINTAIN FIRE RATING OF SURFACE PENETRATED.
11.	CIRCUITS EXTENDING OVER 70' FOR 120 VOLT, 20 AMP CIRCUITS SHALL BE RUN WITH MINIMUM #10 CONDUCTORS.

ELECTRICAL SYMBOL SCHEDULE				
SYMBOL	DESCRIPTION	MOUNTING HEIGHT	NOTES	
	ONE CIRCUIT, TWO WIRE HOME RUN TO PANEL			
	2 CIRCUIT, 3 WIRE, COMMON NEUTRAL HOME RUN			
	3 CIRCUIT, 4 WIRE, COMMON NEUTRAL HOME RUN			
	CONDUIT RUN CONCEALED IN WALL OR CEILING			
	CONDUIT RUN CONCEALED IN FLOOR OR GROUND			
	CONDUIT UP			
	CONDUIT DOWN			
	CONDUIT STUB LOCATION	CAP CONDUIT		
	CABLE TRAY	AS NOTED		
	CEILING LIGHT FIXTURE	CEILING	1.	
	WALL LIGHT FIXTURE	AS NOTED	1.	
	RECESSED DOWNLIGHT FIXTURE	CEILING	1.	
	FLUORESCENT LIGHT FIXTURE	AS NOTED	1	
	FLUORESCENT EGRESS LIGHT FIXTURE	AS NOTED	UNSWITCHED	
	AREA LIGHT POLE AND FIXTURE	CONCRETE BASE	SEE DIAGRAM	
	FLOOD OR TRACK FIXTURE	AS NOTED		
	CEILING MOUNTED EXIT LIGHT	CEILING	1.3.B.	
	WALL MOUNTED EXIT LIGHT	AS NOTED	1.3.B.	
	SINGLE POLE SWITCH	+4'-0"	2.	
	SINGLE POLE SWITCH	+4'-0"	4. 2.	
	THREE-WAY SWITCH	+4'-0"	2.	
	FOUR-WAY SWITCH	+4'-0"	2.	
	KEY OPERATED SWITCH	+4'-0"	2.	
	SWITCH WITH PILOT LIGHT	+4'-0"	2.	
	VARIABLE INTENSITY SWITCH	+4'-0"	2.	
	TIMER SWITCH	+4'-0"	2.	
	MOMENTARY CONTACT SWITCH, CENTER POSITION OFF	+4'-0"	2.	
	OCCUPANCY SENSOR	CEILING		
	OCCUPANCY SENSOR	+4'-0"	2.	
	POWER PACK	CEILING	SEE DIAGRAM, SPEC.	
	AUTOMATIC RELAY PACK	CEILING	SEE DIAGRAM, SPEC.	
	LOW VOLTAGE TRANSFORMER			
	DUPLEX RECEPTACLE UPPER OUTLET SWITCH CONTROLLED	+16" OR AS NOTED	9. 11.	
	SIMPLEX RECEPTACLE	+16" OR AS NOTED	9. 11.	
	DUPLEX RECEPTACLE	+16" OR AS NOTED	9. 11.	
	DUPLEX RECEPTACLE		9.	
	ELECTRIC WATER COOLER RECEPTACLE		SEE DIAGRAM	
	WEATHERPROOF RECEPTACLE	+24" OR AS NOTED	2. 9.	
	ISOLATED GROUND RECEPTACLE	+16" OR AS NOTED	9. 11.	
	GROUND FAULT INTERRUPTER DUPLEX RECEPTACLE	+16" OR AS NOTED	9. 11.	
	DUPLEX RECEPTACLE EMERGENCY POWER (RED)	+16" OR AS NOTED	9. 11.	
	FOURPLEX RECEPTACLE	+16" OR AS NOTED	9. 11.	
	FOURPLEX RECEPTACLE EMERGENCY POWER (RED)	+16" OR AS NOTED	9. 11.	
	FLOOR OUTLET WITH 20A DEVICE	FLOOR		
	MULTIPLE SERVICE FLOOR BOX	FLOOR		
	SPECIAL PURPOSE OUTLET	+16" OR AS NOTED	10. WITH CAP. 11.	
	CORD DROP		SEE DIAGRAM	
	PLUGMOLD	+46" OR AS NOTED		
	TELEVISION OUTLET	+16" OR AS NOTED	11.	
	DATA OUTLET	+16" OR AS NOTED	9. 11.	
	TELEPHONE OUTLET	+16" OR AS NOTED	9. 11.	
	TELEPHONE/DATA OUTLET	+16" OR AS NOTED	9. 11.	
	TELEPHONE OUTLET	FLOOR		
	CALL SWITCH	+4'-0"	2.	
	CLOCK OUTLET	+7'-6"	8.	
	CLOCK/SPEAKER COMBINATION	+7'-6"		

1. SEE FIXTURE SCHEDULE FOR TYPE, MOUNTING AND WATTAGE.
 2. HEIGHT MEASURED TO CENTER LINE OF THE BOX FROM THE FINISH FLOOR.
 3. REFER TO DRAWINGS FOR DIRECTIONAL ARROWS.
 4. SUBSCRIPT KEYS SWITCH TO FIXTURES CONTROLLED.
 5. NEMA TYPE 'ND' NON-FUSED UNLESS NOTED 'F' (FUSED). USE 'HD' 480 V.
 6. HEIGHT TO BE THE LOWER OF EITHER 80" A.F.F. OR 6" BELOW CEILING.
 7. PROVIDE H.O.A. AND S.S. PUSHBUTTONS AS REQUIRED.
 8. DOUBLE ARROWS DENOTE A DOUBLE FACE UNIT.
 9. COORDINATE WITH MILLWORK SHOP DRAWINGS AND ELEVATIONS FOR HEIGHT.
 10. SUBSCRIPT DENOTES NEMA CONFIGURATION.
 11. HEIGHT MEASURED TO BOTTOM OF THE BOX FROM FINISH FLOOR.

* TYPICAL SYMBOL SCHEDULE. SOME SYMBOLS MAY NOT BE USED IN THIS SET OF DRAWINGS.

INDEX OF ELECTRICAL DRAWINGS	
E001	SYMBOLS, SCHEDULES, AND NOTES
E101	ELECTRICAL DEMOLITION PLAN
E201	LIGHTING PLAN
E301	POWER PLAN
E401	PANELBOARD SCHEDULES AND ONE-LINE DIAGRAM
E501	ELECTRICAL DIAGRAMS
E502	ELECTRICAL DIAGRAMS
E503	ELECTRICAL DIAGRAMS



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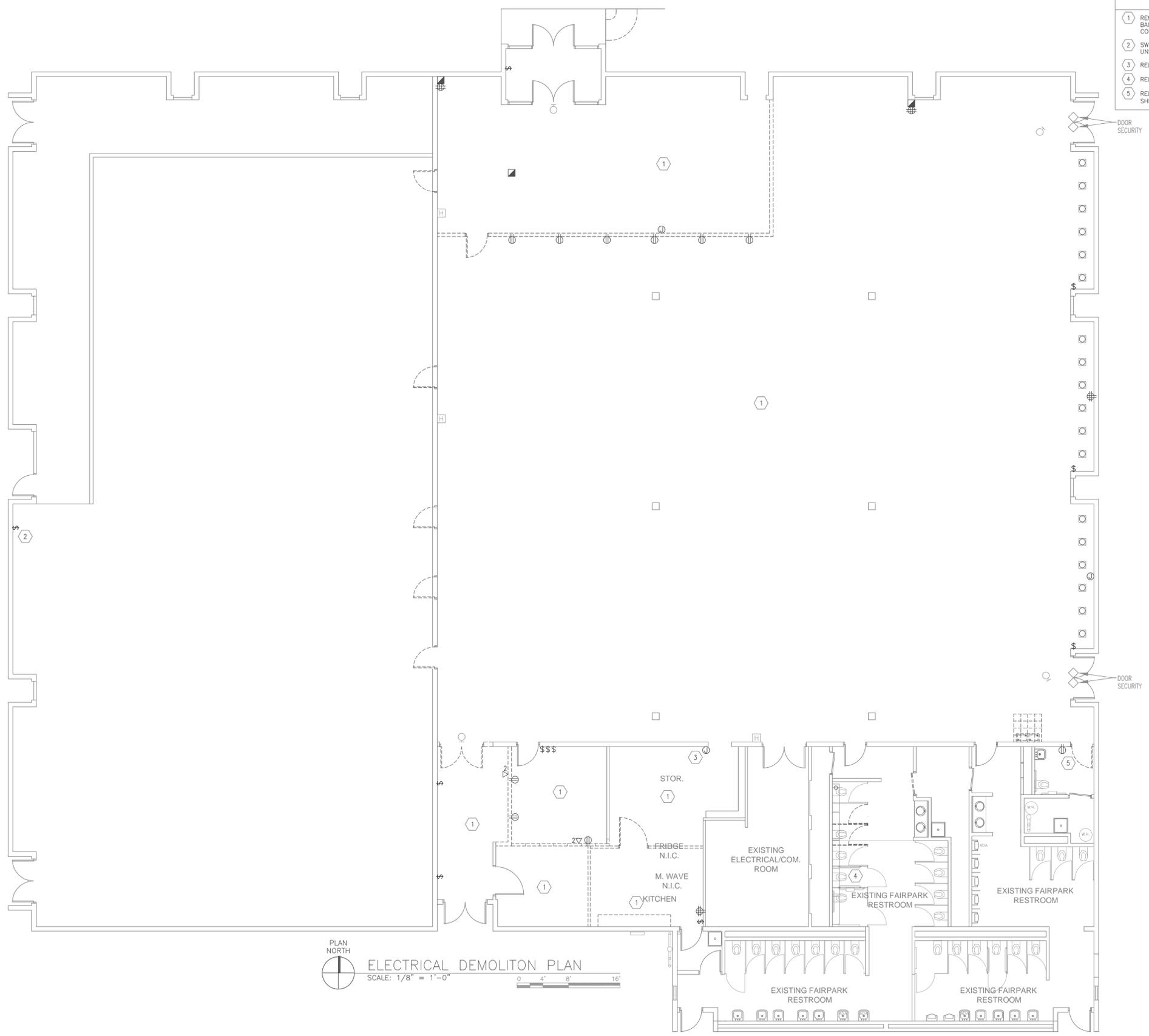
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Revision # Date
 ADDENDUM 1 31 JUL 2007
 ADDENDUM 2 28 AUG 2007

Axis Job # 0518
 BNA Job # 07242A
 Owner # DFCM # 07009370
 Date 06-19-07
 Drawn BNA
 Checked E.F.

SYMBOLS, SCHEDULES AND NOTES

E001



GENERAL SHEET NOTES

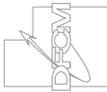
- REMOVE EQUIPMENT SHOWN, UNLESS OTHERWISE NOTED. REMOVE ALL WIRE AND ABANDONED CONDUIT BACK TO ELECTRICAL PANEL. TURN OFF UNUSED BREAKERS AND UPDATE DOOR PANEL SCHEDULES.
- COORDINATE ALL DEMOLITION WITH THE DEPARTMENT OF TELECOMMUNICATION SERVICES. (LOREN.CASTERLINE@P538-3319. LCASTERLINE@UTAH.GOV)

SHEET KEYNOTES

- REMOVE ALL GRID MOUNTED LIGHT FIXTURES IN ROOM. REMOVE WIRE AND ABANDONED CONDUIT BACK TO ELECTRICAL PANEL. REMOVE ALL SMOKE DETECTORS INCLUDING ALL WIRE AND CONDUIT BACK TO FIRE PANEL.
- SWITCH CONTROLS LIGHTING IN BOTH LARGE OPEN AREAS. REMOVE SWITCH WIRING TO UNSHADED AREA. NEW LIGHTING CONTROL FOR UNSHADED REGION WILL BE ADDED.
- RELOCATE JUNCTION BOX AND CONDUIT TO ALLOW FOR NEW ENTRANCE TO STORAGE ROOM.
- RELOCATE (4) FIXTURES (SEE SHEET E201).
- RELOCATE AT 42". COORDINATE WITH NEW LOCATION OF BATHROOM PLUMBING FIXTURES. (SEE SHEET E301).

PLAN NORTH
ELECTRICAL DEMOLITON PLAN
 SCALE: 1/8" = 1'-0"
 0 4' 8' 16'

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ELECTRICAL DEMOLITION PLAN

E101

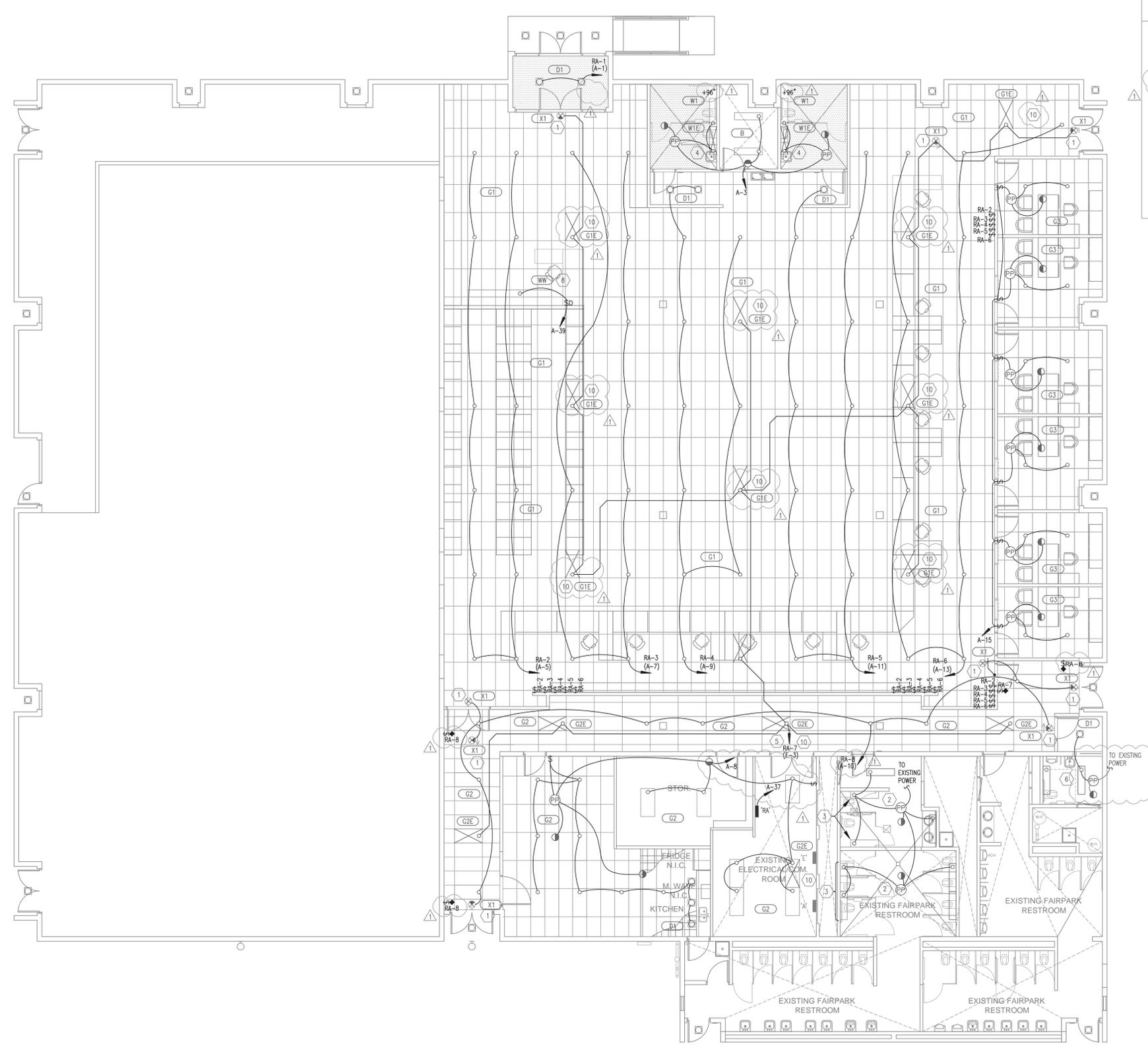
By: poul, Aug 27, 2007 - 9:22am
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GENERAL SHEET NOTES

1. ALL CIRCUIT BREAKERS FOR LIGHTING ARE EXISTING AND WILL BE REUSED.
2. ALL LIGHT FIXTURES SHOWN IN LIGHT LINE TYPE ARE EXISTING AND SHOWN ONLY FOR REFERENCE.

SHEET KEYNOTES

- 1 CONNECT EXIT SIGN TO UNSWITCHED LEG OF CIRCUIT FROM LINE SIDE OF RELAY.
- 2 PROVIDE ADDITIONAL POWER PACK AND RECONFIGURE WIRING TO ALLOW FOR SEPARATE CONTROL IN NEWLY DIVIDED RESTROOM. OCCUPANCY SENSORS AND 1 POWER PACK ARE EXISTING.
- 3 EXISTING FIXTURES TO BE RELOCATED AS SHOWN. SEE E101. MATCH MOUNTING HEIGHT OF EXISTING FIXTURE.
- 4 BATTERY PACK TO BE CONNECTED TO UNSWITCHED CIRCUIT.
- 5 (2) #10 CU WITH GND TO PANEL 'E' IN 3/4" CONDUIT. CIRCUIT BREAKER IN PANEL TO BE REUSED.
- 6 VERIFY COVERAGE OF OCCUPANCY SENSOR FOR NEW ENTRYWAY. ADD ADDITIONAL SENSOR IF NEEDED.
- 7 NOT USED.
- 8 LOCATE FIXTURES 2' FROM WALL.
- 9 NOT USED.
- 10 CONNECT BATTERY PACKS TO UNSWITCHED LEG OF CIRCUIT.



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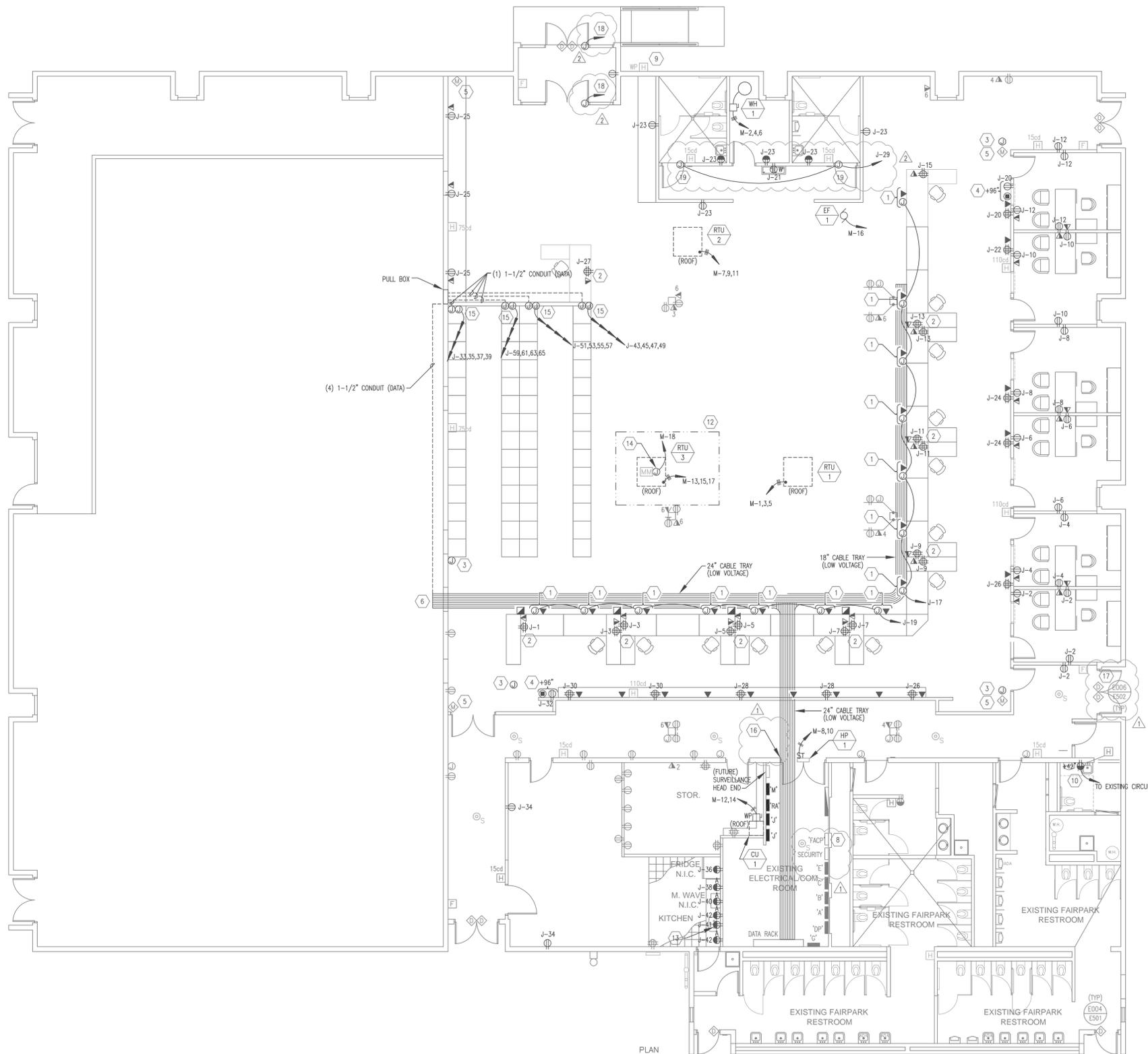
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Owner #	DFCM # 07009370
Date	06-19-07
Drawn	BNA
Checked	E.F.

LIGHTING PLAN

E201

By: poul, Aug 27, 2007 - 9:22am
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- ### GENERAL SHEET NOTES
1. ALL EQUIPMENT SHOWN IN LIGHT TYPE FACE IS EXISTING AND SHOWN FOR REFERENCE ONLY.
 2. ALL POWER AND DATA FOR OFFICE FURNITURE ON EAST SIDE OF OPEN PUBLIC AREA TO BE ROUTED DOWN EXISTING COLUMNS AND THROUGH FURNITURE RACEWAY.
 3. ALL SECURITY/CAMERA INSTALLATION TO INCLUDE RACEWAY ONLY.
 4. ALL VOICE/DATA INSTALLATION TO INCLUDE RACEWAY ONLY. PROVIDE J-EMT CONDUIT FROM EACH OUTLET TO CABLETRAY/VOICE/DATA CABLE TO BE INSTALLED BY OWNER.

- ### SHEET KEYNOTES
- 1 NUMBER DISPLAY DEVICE IN CEILING.
 - 2 POWER/DATA DEVICES INSTALLED IN OFFICE FURNITURE.
 - 3 FUTURE CCTV CAMERA LOCATION. PROVIDE 3/4" CONDUIT BACK TO SURVEILLANCE HEAD END IN EXISTING ELECTRICAL/COM ROOM. COORDINATE EXACT CAMERA LOCATION WITH OWNER/ARCHITECT PRIOR TO ROUGH-IN.
 - 4 FUTURE TV MONITOR LOCATION. COORDINATE EXACT LOCATION WITH OWNER/ARCHITECT PRIOR TO ROUGH-IN. PROVIDE 3/4" CONDUIT BACK TO SURVEILLANCE HEAD END IN EXISTING ELECTRICAL/COM ROOM.
 - 5 FUTURE MOTION SENSOR LOCATION. PROVIDE JUNCTION BOX WITH 3/4" CONDUIT ROUTED BACK TO SECURITY PANEL. COORDINATE EXACT LOCATION WITH OWNER/ARCHITECT PRIOR TO ROUGH-IN.
 - 6 STUB CABLE TRAY THROUGH WALL.
 - 7 SURVEILLANCE HEAD END (BY OWNER).
 - 8 EXISTING FIRE ALARM SYSTEM TO BE MODIFIED FOR NEW REMODEL AS SHOWN. AUTOMATIC SPRINKLERS WILL BE ADDED. PROVIDE MONITOR MODULES AT ALL TAMPER AND FLOW SWITCHES AND WIRING BACK TO FIRE PANEL (AS NEEDED). ALL NEW FIRE DEVICES TO BE COMPATIBLE WITH EXISTING THORN AUTOCALL FIRE SYSTEM. (TYPE 8236-379).
 - 9 COORDINATE EXACT LOCATION OF EXTERIOR HORN/STROBE WITH FIRE MARSHALL AND OWNER/ARCHITECT PRIOR TO INSTALLATION.
 - 10 RECEPTACLE TO BE RELOCATED. SEE SHEET E101.
 - 11 NOT USED.
 - 12 BID WORK AS ALTERNATE.
 - 13 DISPOSAL RECEPTACLE BELOW SINK. PROVIDE SWITCH ON WALL ABOVE BACKSPASH.
 - 14 MONITOR MODULE FOR DUCT SMOKE DETECTOR. PROVIDE 120V TO DUCT SMOKE DETECTOR AS SHOWN DUCT DETECTOR PROVIDED WITH MECHANICAL EQUIPMENT.
 - 15 PROVIDE POWER WHIRL INTO OFFICE FURNITURE.
 - 16 CUT ELECTRICAL ROOM WALL TO ALLOW FOR CABLE TRAY PENETRATION.
 - 17 PROVIDE 3/4" CONDUIT TO CABLE TRAY.
 - 18 ENSURE THAT POWER REMAINS TO POWER OPERATED DOORS.
 - 19 POWER OPERATED DOORS.



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Owner # DFCM # 07009370
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Drawn BNA
Checked E.F.

POWER PLAN

E301

PANELBOARD SCHEDULE

PANEL A TYPE NOOD 120/208 VOLTS 3 PH 4 W

(EXISTING PANEL) MOUNTING: FLUSH, SURFACE (X) DIMENSIONS: 20 W, 5.75 D (in.), H LOCATION: EXISTING ELEC/COMM ROOM MAINS: BREAKER, SUBFEED LUGS, ISO GROUND, 200% NEUTRAL

BRANCH BREAKERS															
ITEM	AMPS	POLE	WIRE SIZE	CIR. NO.	LEFT PHASE LOAD			RIGHT PHASE LOAD			CIR. NO.	AMPS	POLE	WIRE SIZE	ITEM
					A	B	C	A	B	C					
PUBLIC AREA LIGHTING	20	1	12	1	100			XX			2	20	1	EXISTING EQUIPMENT	
PUBLIC AREA LIGHTING	20	1	10	3	384			XX			4	20	1	EXISTING EQUIPMENT	
PUBLIC AREA LIGHTING	20	1	10	5		1344				XX	6	20	1	EXISTING EQUIPMENT	
PUBLIC AREA LIGHTING	20	1	10	7	1344				640		8	20	1	BREAK. RM/STORAGE LTG	
PUBLIC AREA LIGHTING	20	1	10	9		960			768		10	20	1	HALLWAY LIGHTING	
PUBLIC AREA LIGHTING	20	1	10	11			1344			XX	12	20	1	EXISTING EQUIPMENT	
PUBLIC AREA LIGHTING	20	1	10	13	1152			XX			14	20	1	EXISTING EQUIPMENT	
EAST OFFICE LIGHTING	20	1	10	15		1152			XX		16	20	1	EXISTING EQUIPMENT	
EXISTING EQUIPMENT	20	1	17				XX			XX	18	20	1	EXISTING EQUIPMENT	
EXISTING EQUIPMENT	20	1	19	XX			XX			XX	20	20	1	EXISTING EQUIPMENT	
EXISTING EQUIPMENT	20	1	21		XX			XX		XX	22	20	1	EXISTING EQUIPMENT	
EXISTING EQUIPMENT	20	1	23			XX			XX	XX	24	20	1	EXISTING EQUIPMENT	
EXISTING EQUIPMENT	20	1	25	XX			XX			XX	26	20	1	EXISTING EQUIPMENT	
EXISTING EQUIPMENT	30	1	27		XX			XX		XX	28	20	1	EXISTING EQUIPMENT	
EXISTING EQUIPMENT	30	1	29			XX				XX	30			SPACE ONLY	
EXISTING EQUIPMENT	20	1	31	XX						XX	32			SPACE ONLY	
EXISTING EQUIPMENT	20	1	33			XX					34			SPACE ONLY	
EXISTING EQUIPMENT	20	1	35				XX				36			SPACE ONLY	
RELAY PANEL 'RA' CTRL	20	1	12	37	500						38			SPACE ONLY	
ACCENT LITG	20	1	12	39		200			XX		40	50	2	EXISTING EQUIPMENT	
SPACE ONLY										XX	42				
					3096	2696	2688	640	768	0	CONNECTED LOAD TOTAL				
					31.13	28.87	22.40	AMPS/PHASE			9888 VA				
					EQUIP RATING					10,000 AMPS RMS SYM.					

PANELBOARD SCHEDULE

PANEL J TYPE NOOD 120/208 VOLTS 3 PH 4 W

(SECTION 1) MOUNTING: FLUSH, SURFACE (X) DIMENSIONS: 20 W, 5.75 D (in.), H LOCATION: EXISTING ELEC/COMM ROOM MAINS: BREAKER, SUBFEED LUGS, ISO GROUND, 200% NEUTRAL

BRANCH BREAKERS															
ITEM	AMPS	POLE	WIRE SIZE	CIR. NO.	LEFT PHASE LOAD			RIGHT PHASE LOAD			CIR. NO.	AMPS	POLE	WIRE SIZE	ITEM
					A	B	C	A	B	C					
WORK STATION RECEIPT	20	1	12	1	360						2	20	1	OFFICE RECEPTACLES	
WORK STATION RECEIPT	20	1	12	3		720			720		4	20	1	OFFICE RECEPTACLES	
WORK STATION RECEIPT	20	1	12	5			720			540	6	20	1	OFFICE RECEPTACLES	
WORK STATION RECEIPT	20	1	12	7	720					540	8	20	1	OFFICE RECEPTACLES	
WORK STATION RECEIPT	20	1	12	9		720				540	10	20	1	OFFICE RECEPTACLES	
WORK STATION RECEIPT	20	1	12	11			720			720	12	20	1	OFFICE RECEPTACLES	
WORK STATION RECEIPT	20	1	12	13	720						14	20	1	SPARE	
WORK STATION RECEIPT	20	1	12	15		360					16	20	1	SPARE	
NUMBER SYSTEM - EAST	20	1	12	17			700			700	18	20	1	SPARE	
NUMBER SYSTEM - SO.	20	1	12	19	700					540	20	20	1	WALL RECEPT - EAST	
WATER COOLER	20	1	12	21			1000			360	22	20	1	WALL RECEPT - EAST	
RESTROOM RECEIPTS	20	1	12	23				1080			24	20	1	WALL RECEPT - EAST	
WALL RECEPT - WEST	20	1	12	25	540				720		26	20	1	WALL RECEPT - EAST	
INFO DESK RECEIPT	20	1	12	27		360				720	28	20	1	WALL RECEPT - SOUTH	
POWER OP DOORS	20	1	12	29			1500			720	30	20	1	WALL RECEPT - SOUTH	
SPARE	20	1	12	31					180		32	20	1	WALL RECEPT - SOUTH	
TEST STATION RECEIPTS	20	1	12	33			720			180	34	20	1	WALL RECEPT - SOUTH	
TEST STATION RECEIPTS	20	1	12	35				720			36	20	1	REFRIGERATOR	
TEST STATION RECEIPTS	20	1	12	37	720				1200		38	20	1	SMALL APPLIANCE	
TEST STATION RECEIPTS	20	1	12	39		360				1200	40	20	1	MICROWAVE	
DISPOSAL	20	1	12	41			1000				42	20	1	SMALL APPLIANCE	
					3760	4240	6440	3900	3540	5100	CONNECTED LOAD SUBTOTAL				
					7860	7780	11540	SEC 1 SUBTOTAL			26980 VA				
					63.83	64.83	96.17	SEC 1 AMPS/PHASE			EQUIP RATING				
					10540	10660	14420	TOTAL			10,000 AMPS RMS SYM.				
					87.83	88.83	120.17	AMPS/PHASE							

CONTROL RELAY SCHEDULE

Panel Name: RA
Location: ELECTRICAL / COM ROOM
Transformer Voltage: 120V-24V
Control Circuit: A-37

Relay #	Description	Panel & Circuit	Load
1	ENTRANCE LIGHTING	A-1	100
2	OPEN PUBLIC AREA LIGHTING 1	A-5	1344
3	OPEN PUBLIC AREA LIGHTING 2	A-7	1344
4	OPEN PUBLIC AREA LIGHTING 3	A-9	960
5	OPEN PUBLIC AREA LIGHTING 4	A-11	1344
6	OPEN PUBLIC AREA LIGHTING 5	A-13	1152
7	EGRESS/NIGHT LIGHT	E-3	1500
8	CORRIDOR LIGHTING	A-10	768
9	SPARE		
10	SPARE		
11	SPARE		
12	SPARE		
13	SPACE ONLY		
14	SPACE ONLY		
15	SPACE ONLY		
16	SPACE ONLY		
17	SPACE ONLY		
18	SPACE ONLY		
19	SPACE ONLY		
20	SPACE ONLY		
21	SPACE ONLY		
22	SPACE ONLY		
23	SPACE ONLY		
24	SPACE ONLY		

COPPER CONDUCTOR & CONDUIT SCHEDULE

TYPE	AMP.	COND. SIZE	CONDUCTOR QUAN.	CONDUIT SIZE	INSUL-ATION	EQ. GND. COND.
20	30	3/4"	2	10	THHN	10
30	30	3/4"	3	10	THHN	10
40	30	3/4"	4	10	THHN	10
28	40	3/4"	2	8	THHN	10
38	40	3/4"	3	8	THHN	10
48	40	3/4"	4	8	THHN	10
26	55	3/4"	2	6	THHN	8
36	55	3/4"	3	6	THHN	8
46	55	3/4"	4	6	THHN	8
24	70	3/4"	2	4	THHN	8
34	70	1"	3	4	THHN	8
44	70	1-1/4"	4	4	THHN	8
23	85	1"	2	3	THHN	8
33	85	1"	3	3	THHN	8
43	85	1-1/4"	4	3	THHN	8
32	95	1-1/4"	3	2	THHN	6
42	95	1-1/4"	4	2	THHN	6
31	110	1-1/4"	3	1	THHN	6
41	110	1-1/2"	4	1	THHN	6
51	110	2"	5	1	THHN	6
31X	150	1-1/2"	3	1/0	THHN	6
41X	150	1-1/2"	4	1/0	THHN	6
51X	150	2"	5	1/0	THHN	6
32X	175	1-1/2"	3	2/0	THHN	6
42X	175	2"	4	2/0	THHN	6
52X	175	2"	5	2/0	THHN	6
33X	200	2"	3	3/0	THHN	6
43X	200	2"	4	3/0	THHN	6
53X	200	2-1/2"	5	3/0	THHN	6
34X	230	2"	3	4/0	THHN	4
44X	230	2-1/2"	4	4/0	THHN	4
54X	230	2-1/2"	5	4/0	THHN	4
325	255	2"	3	250	THHN	4
425	255	2-1/2"	4	250	THHN	4
525	255	2-1/2"	5	250	THHN	4
335	310	2-1/2"	3	350	THHN	3
435	310	3"	4	350	THHN	3
535	310	3"	5	350	THHN	3
340	335	3"	3	400	THHN	3
440	335	3"	4	400	THHN	3
540	335	3"	5	400	THHN	3
350	380	3-1/2"	3	500	XHHW	3
450	380	3-1/2"	4	500	XHHW	3
550	380	3-1/2"	5	500	XHHW	3

GENERAL SHEET NOTES

1. ALL LIGHT LINE TYPES DENOTE EXISTING EQUIPMENT. (SHOWN FOR REFERENCE ONLY)

PANELBOARD SCHEDULE

PANEL M TYPE NOOD 120/208 VOLTS 3 PH 4 W

MOUNTING: FLUSH, SURFACE (X) DIMENSIONS: 20 W, 5.75 D (in.), H LOCATION: EXISTING ELEC/COMM ROOM MAINS: BREAKER, SUBFEED LUGS, ISO GROUND, 200% NEUTRAL

BRANCH BREAKERS															
ITEM	AMPS	POLE	WIRE SIZE	CIR. NO.	LEFT PHASE LOAD			RIGHT PHASE LOAD			CIR. NO.	AMPS	POLE	WIRE SIZE	ITEM
					A	B	C	A	B	C					
RTU-1, ROOFTOP UNIT	40	3	10	1	2400			1567	1567		2	20	3	10	WH-1, WATER HEATER
--	--	--	--	3		2400				1567	4	--	--	--	--
--	--	--	--	5			2400				6	--	--	--	--
RTU-2, ROOFTOP UNIT	45	3	10	7	2784			120	120		8	15	2	12	HP-1, SPLIT SYSTEM A/C
--	--	--	--	9		2784					10	--	--	--	--
--	--	--	--	11			2784			1632	12	25	2	10	CU-1, CONDENSING UNIT
RTU-3, ROOFTOP UNIT	90	3	4	13	6624			1632			14	--	--	--	--
(BID AS ALTERNATE)	--	--	--	15		6624			500		16	20	1	12	EXHAUST FAN
SPARE	--	--	--	17			6624			100	18	20	1	12	DUCT DETECTOR
SPARE	20	3	19							20	20	1			SPARE
SPARE	--	--	--	21						22	20	2			SPARE
SPARE	--	--	--	23						24	--	--	--	--	SPARE
SPACE ONLY	--	--	--	25						26	--	--	--	--	SPACE ONLY
SPACE ONLY	--	--	--	27						28	--	--	--	--	SPACE ONLY
SPACE ONLY	--	--	--	29						30	--	--	--	--	SPACE ONLY
SPACE ONLY	--	--	--	31						32	--	--	--	--	SPACE ONLY
SPACE ONLY	--	--	--	33						34	--	--	--	--	SPACE ONLY
SPACE ONLY	--	--	--	35						36	--	--	--	--	SPACE ONLY
SPACE ONLY	--	--	--	37						38	--	--	--	--	SPACE ONLY
SPACE ONLY	--	--	--	39						40	--	--	--	--	SPACE ONLY
SPACE ONLY	--	--	--	41						42	--	--	--	--	SPACE ONLY
					11808	11808	11808	3319	2187	3299	CONNECTED LOAD TOTAL				
					15127	13995	15107	TOTAL			44229 VA				
					126.06	116.63	125.89	AMPS/PHASE			EQUIP RATING				
					10,000 AMPS RMS SYM.										

PANELBOARD SCHEDULE

PANEL J TYPE NOOD 120/208 VOLTS 3 PH 4 W

(SECTION 2) MOUNTING: FLUSH, SURFACE (X) DIMENSIONS: 20 W, 5.75 D (in.), H LOCATION: EXISTING ELEC/COMM ROOM MAINS: BREAKER, SUBFEED LUGS, ISO GROUND, 200% NEUTRAL

BRANCH BREAKERS															
ITEM	AMPS	POLE	WIRE SIZE	CIR. NO.	LEFT PHASE LOAD			RIGHT PHASE LOAD			CIR. NO.	AMPS	POLE	WIRE SIZE	ITEM
					A	B	C	A	B	C					
TEST STATION RECEIPTS	20	1	12	43	720						44	20	1	12	SPACE ONLY
TEST STATION RECEIPTS	20	1	12	45		720					46				SPACE ONLY
TEST STATION RECEIPTS	20	1	12	47			720				48				

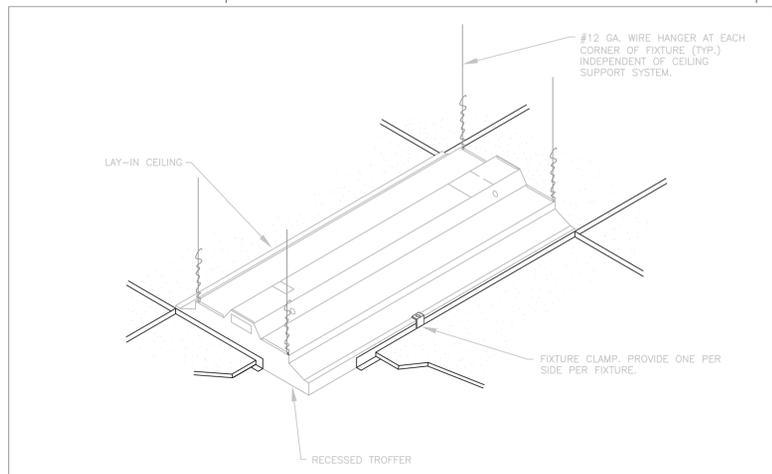
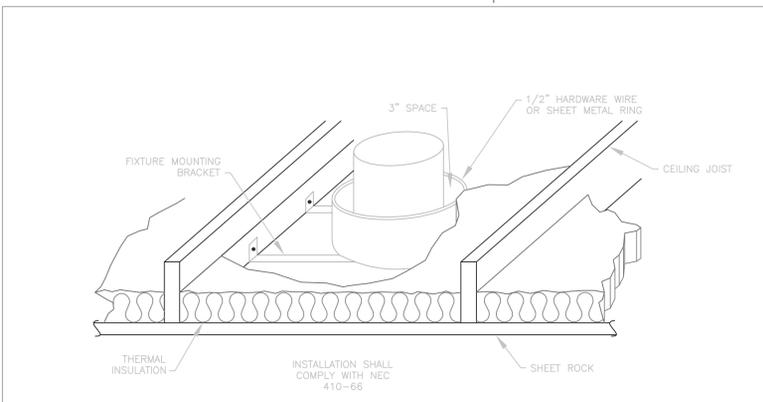
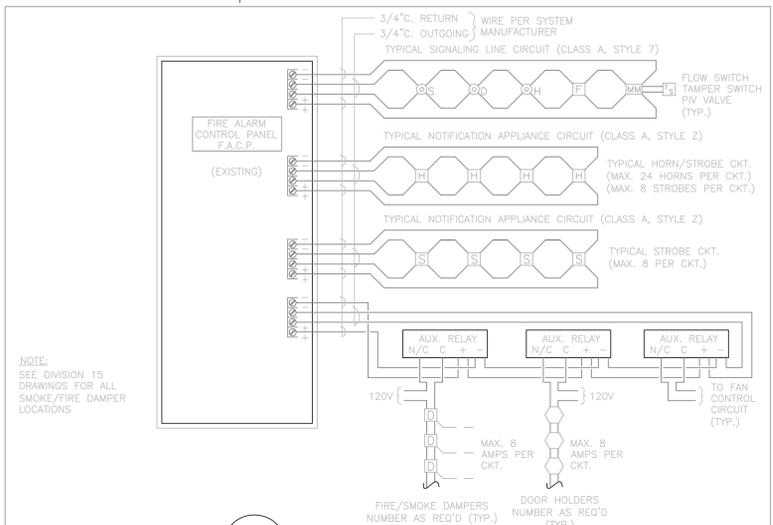


DIAGRAM A001 TYP. RECESSED FIXTURE MOUNTING
NTS



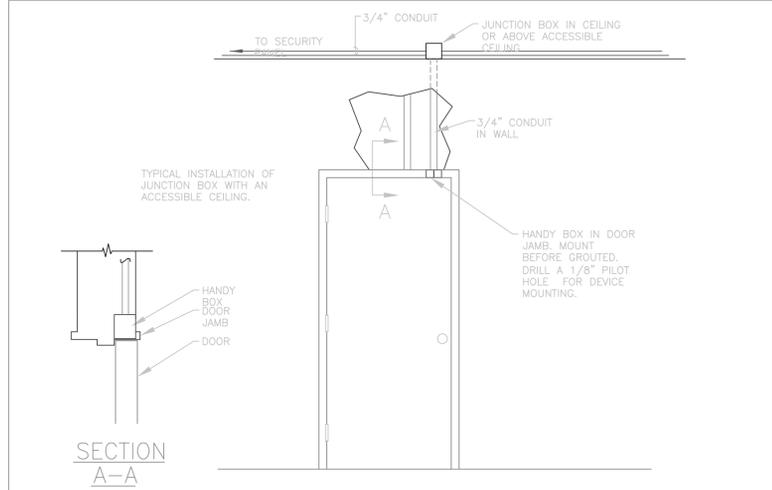
NOTE: THIS REQUIREMENT IS FOR ALL DOWN LIGHT FIXTURES THAT ARE NOT "IC" RATED

DIAGRAM A013 RECESSED DOWN LIGHT
NTS



NOTE: SEE DIVISION 15 DRAWINGS FOR ALL SMOKE/FIRE DAMPER LOCATIONS

DIAGRAM D002 TYPICAL FIRE ALARM RISER
NTS



SECTION A-A

DIAGRAM E004 SECURITY SYSTEM DOOR SWITCH
NTS

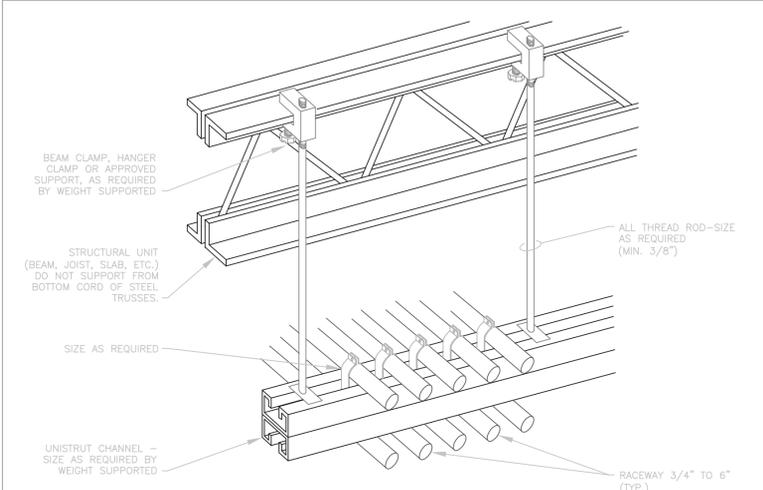
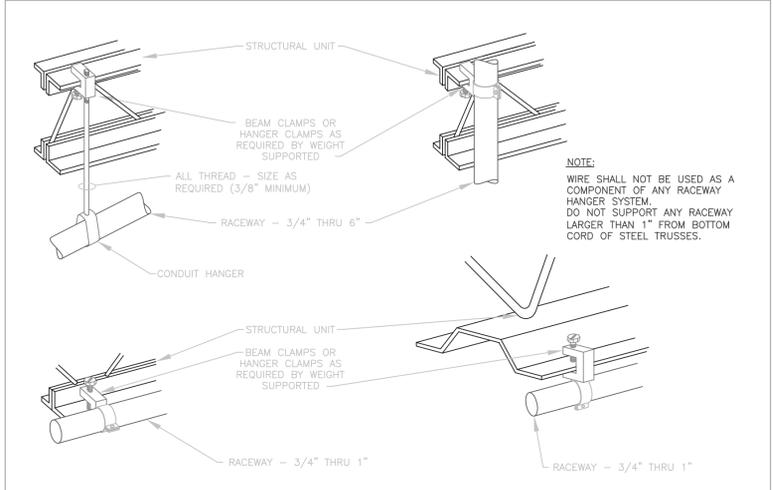
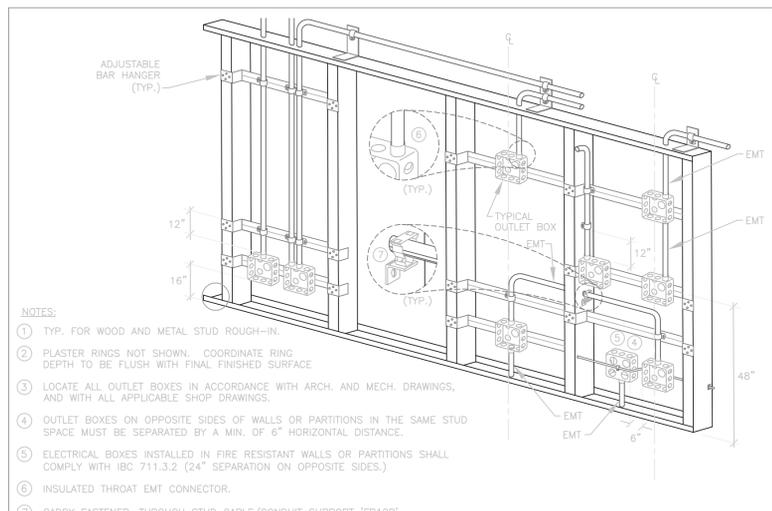


DIAGRAM H001 TYPICAL TRAPEZE CONDUIT RACK
NTS



NOTE: WIRE SHALL NOT BE USED AS A COMPONENT OF ANY RACEWAY HANGER SYSTEM. DO NOT SUPPORT ANY RACEWAY LARGER THAN 1\"/>

DIAGRAM H003 TYPICAL RACEWAY SUPPORT METHODS
NTS



NOTES:
 1 TYP. FOR WOOD AND METAL STUD ROUGH-IN.
 2 PLASTER RINGS NOT SHOWN. COORDINATE RING DEPTH TO BE FLUSH WITH FINAL FINISHED SURFACE.
 3 LOCATE ALL OUTLET BOXES IN ACCORDANCE WITH ARCH. AND MECH. DRAWINGS, AND WITH ALL APPLICABLE SHOP DRAWINGS.
 4 OUTLET BOXES ON OPPOSITE SIDES OF WALLS OR PARTITIONS IN THE SAME STUD SPACE MUST BE SEPARATED BY A MIN. OF 6\"/>

DIAGRAM H004 TYPICAL ROUGH IN REQUIREMENTS
NTS

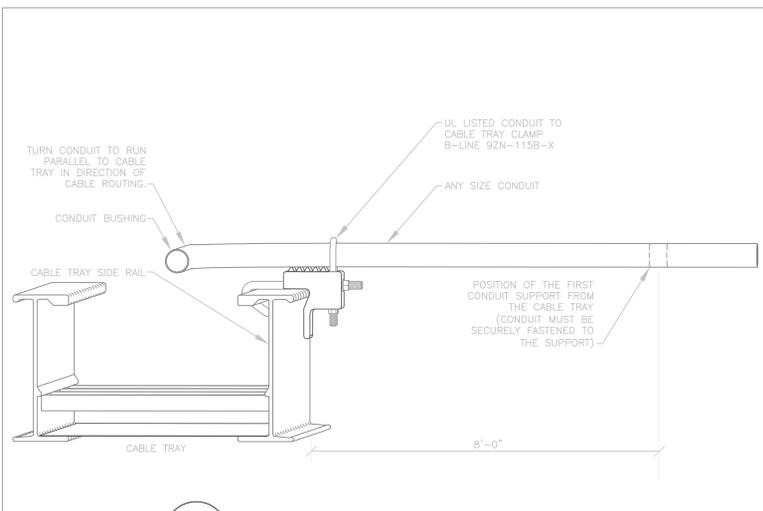
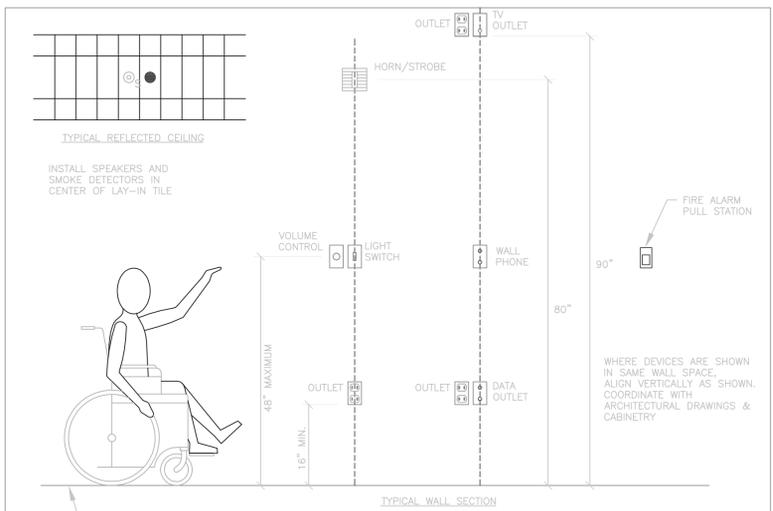


DIAGRAM 1006 CONDUIT TO CABLE TRAY
NTS



WHERE DEVICES ARE SHOWN IN SAME WALL SPACE, ALIGN VERTICALLY AS SHOWN. COORDINATE WITH ARCHITECTURAL DRAWINGS & CABINETS.

DIAGRAM R001 DEVICE MOUNTING HEIGHTS
NTS

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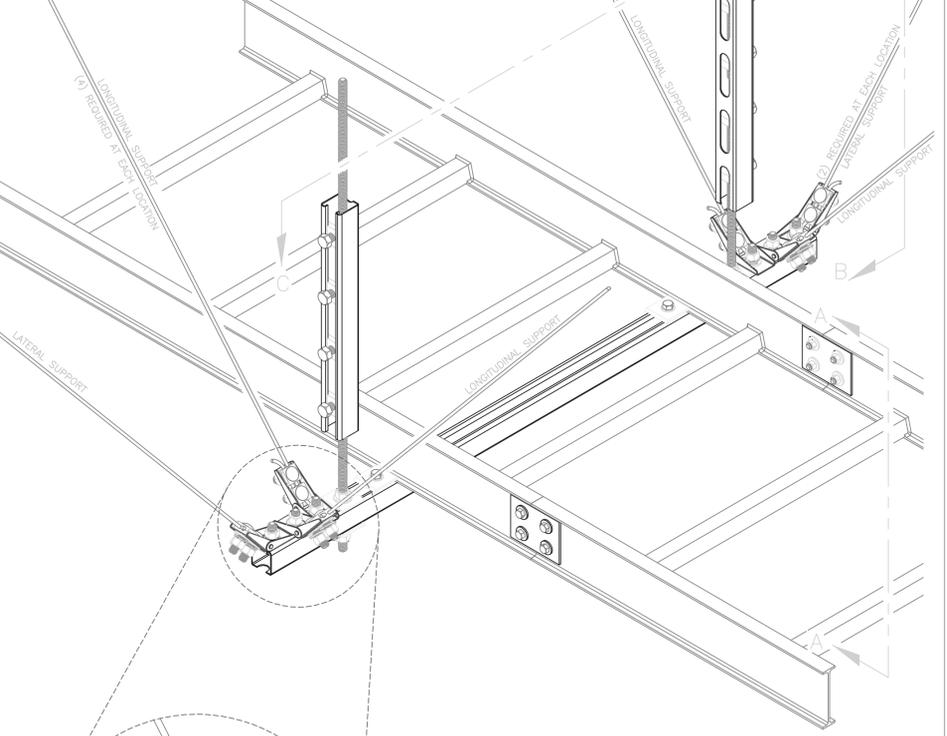
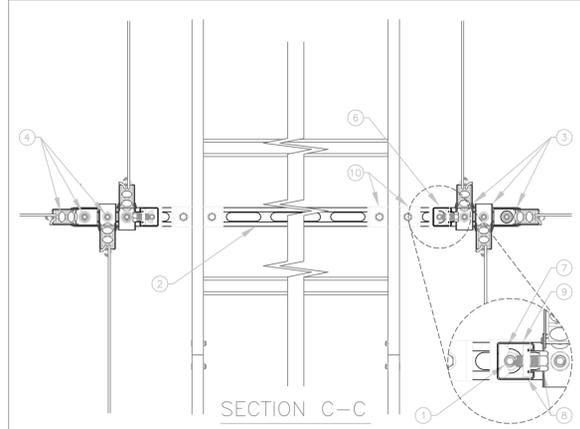
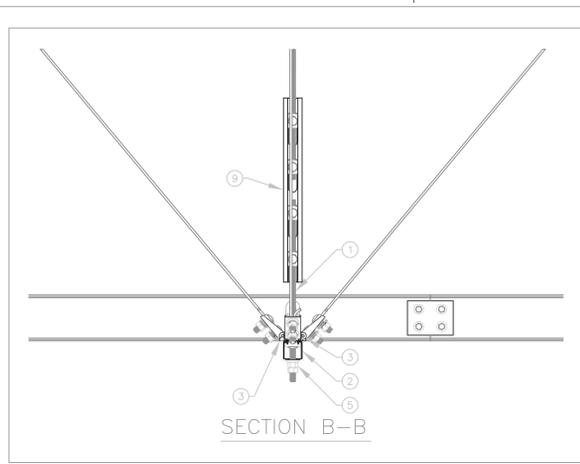
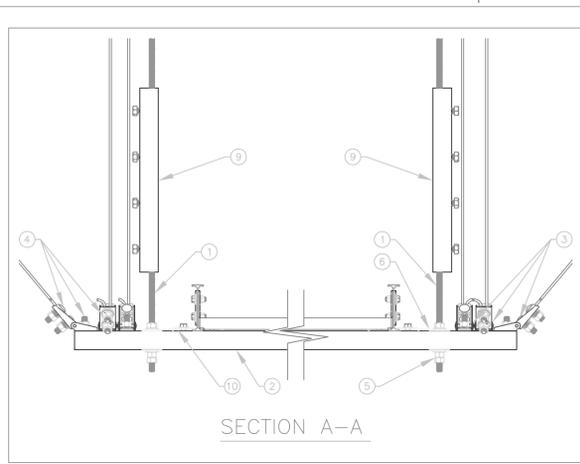
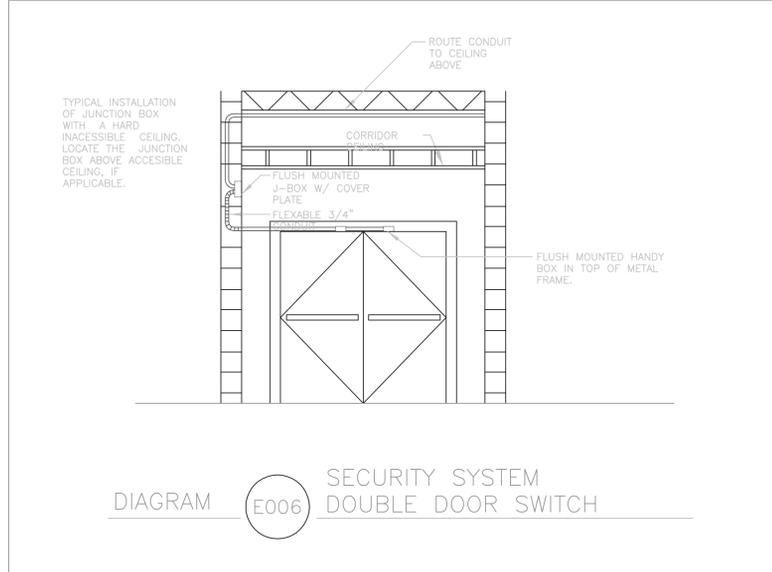
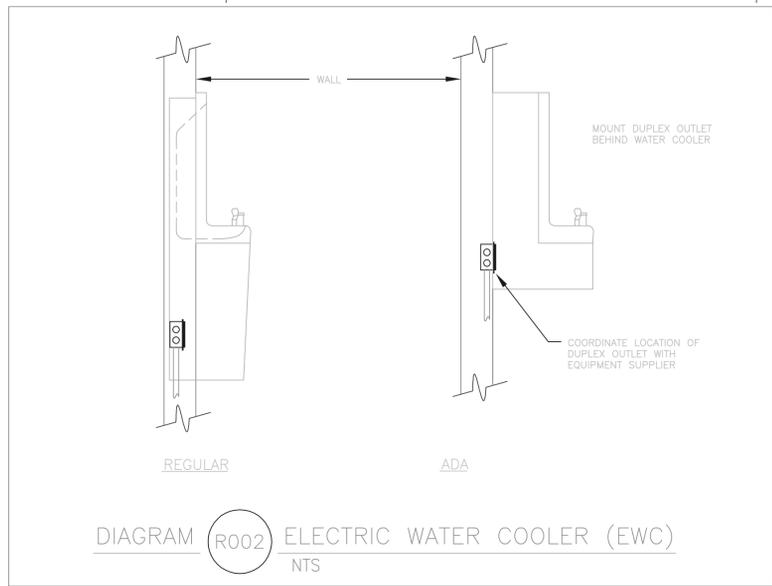
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Revision # Date
 ADDENDUM 1 31 JUL 2007
 ADDENDUM 2 28 AUG 2007

Axis Job # 0518
 BNA Job # 07242A
 Owner # DFCM # 07009370
 Date 06-19-07
 Drawn BNA
 Checked E.F.

ELECTRICAL DIAGRAMS

E501



PARTS LIST

ITEM No.	DESCRIPTION	SIZE	CATALOG No. UNISTRUT
1	THREADED ROD (MIN. MODULUS OF ELASTICITY = 29x10 ⁶ LBS/IN)	SEE SCHEDULE FOR DIAMETER	-
2	METAL FRAMING CHANNEL	1-5/8"x1-5/8"	P1000
3	CABLE BRACE SWIVEL ANCHOR	SEE TABLE	MASON IND. SCB-X
4	HEX HEAD CAP SCREW WITH SPRING NUT	1/2"-13"	HHCS/P1010
5	FLAT WASHER WITH HEX NUT	3/8"	-
6	FLAT PLATE FITTING WITH HEX NUT	3/8" OR 1/2" AS REQ'D	P1063 OR P1064
7	CRADLE	-	P2485
8	HEX HEAD CAP SCREW WITH NUT	3/8"x1"	HHCS/P2008
9	SLOTTED METAL FRAMING CHANNEL	1-5/8"x1-5/8"	P1000T
10	CABLE TRAY ATTACHMENT CLIP W/CAP SCREW & NUT	-	-

- NOTES:**
- PROVIDE LONGITUDINAL AND LATERAL SUPPORT SPACING IN ACCORDANCE WITH THE FOLLOWING:
- | MAX CABLE TRAY PLUS CABLE WT. POUNDS/FOOT | VERTICAL SUPPORT SPACING FEET | LATERAL SUPPORT SPACING FEET | LONGITUDINAL SUPPORT SPACING FEET | ROD DIAMETER INCHES | CABLE BRACE SWIVEL ANCHOR & CABLE |
|-------------------------------------------|-------------------------------|------------------------------|-----------------------------------|---------------------|-----------------------------------|
| 25 | 10 | 10 | 20 | .375 | SCB2 |
| 50 | 10 | 10 | 20 | .500 | SCB3 |
- PROVIDE METAL FRAMING CHANNEL ON ALL VERTICAL SUPPORTS WHEN ROD LENGTH EXCEEDS 14". STIFFENER CLIP SPACING SHALL BE 12".
 - SEE SPECIFICATIONS FOR APPROVED FITTINGS FOR ATTACHMENT TO STRUCTURE.

- GENERAL NOTES**
- COORDINATE ROUTING OF CABLE TRAYS AND SUPPORT SYSTEMS WITH DIVISION 15.
 - DO NOT SUPPORT FROM BOTTOM CORD OF STEEL TRUSSES.

DIAGRAM **H006** SEISMIC BRACING FOR CABLE TRAY/CABLES
(EXPOSED STRUCTURE OR ABOVE CEILING ONLY)

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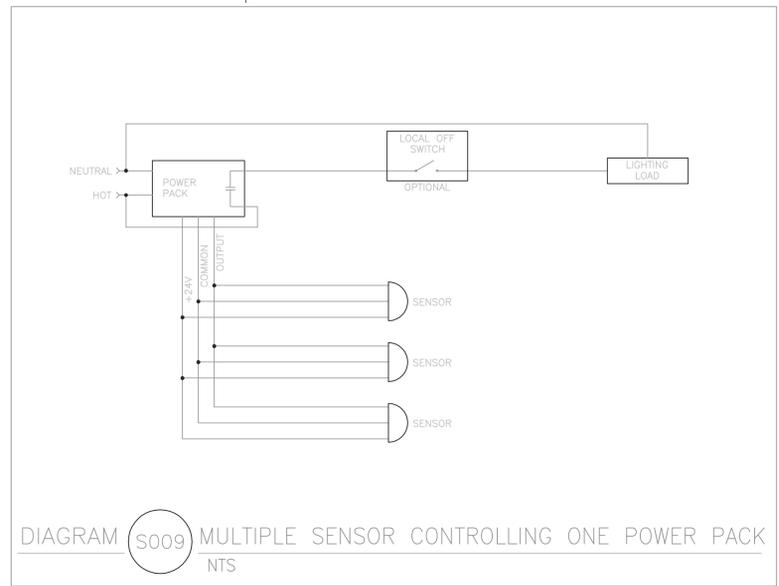
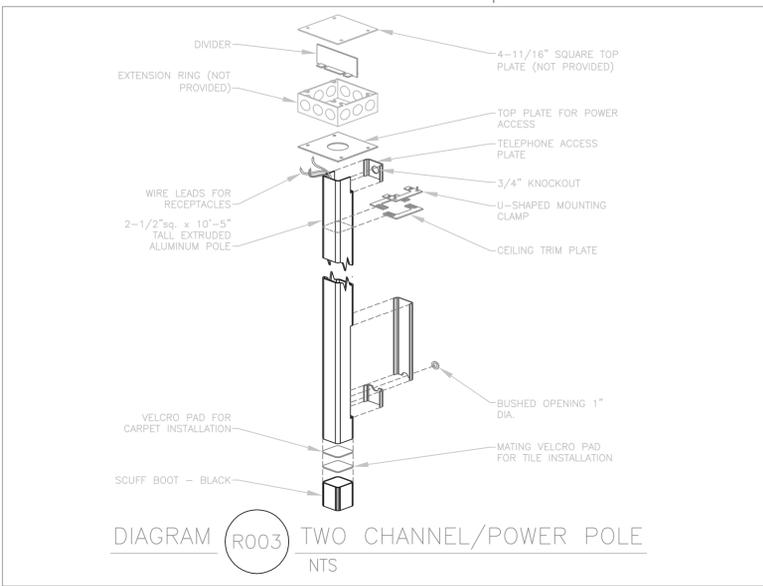
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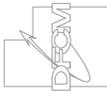
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 Owner # DFCM # 07009370
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ELECTRICAL DIAGRAMS

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E503