



NATIONWIDE CHILDREN'S®
When your child needs a hospital, everything matters.

Design Requirements for Architects & Engineers 2025 v14

Higgins - 5/27/25

Hallowell - 6/23/2025

Prepared By:

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The intent of this document is to establish standard requirements for Nationwide Children's Hospital design and construction. Designers shall discuss all deviations from this document with the Engineering Project Manager and then proceed based upon the direction given.

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DIVISION 00: NCH REQUIREMENTS

Division 00 is intended to be inserted verbatim into the AE's Construction Documents (Spec book or Drawings), AE to coordinate placement with NCH PM.

00.00.10 – Summary of Work:

PART 1 GENERAL

- 1.1 See NCH Contract Agreements and Supplementary Conditions for Design Professional and Contractor Requirements
- 1.2 NCH Project Manager shall provide the NCH Reference Standards to the Design Professional
- 1.3 Design Professional shall verify issue date with NCH Project Manager

00.00.11 – NCH Reference Standards:

PART 1 GENERAL

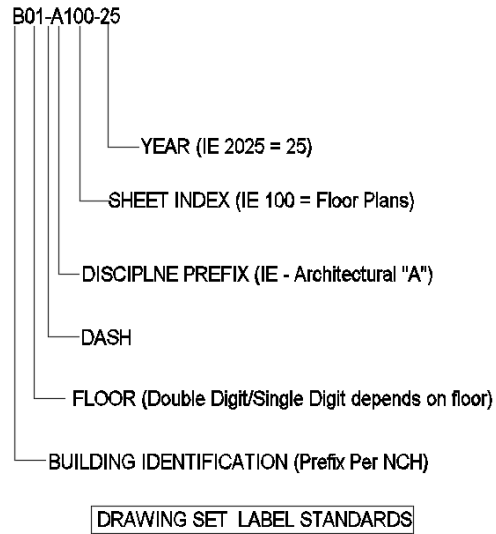
- 1.1 **Engineering Requirements**
 - A. Maintainable Assets List (MAL) and Valve Tag Template
 - B. Water Management Plan – (All plumbing system design, installation, chlorination, testing & start up procedures to align with current NCH Water Management Plan. Design & contracting teams to validate current standards with NCH Plumbing Trades Supervisor via the NCH Project Manager)
 - C. Master Lighting Schedule
 - D. ASHE Healthcare Facility Design Checklist
- 1.2 **Interiors Requirements**
 - A. Space Allocation Guidelines.
 - B. Master Aesthetics Design Guidelines
 - C. Master Finish Schedule
 - D. FFE Schedule
 - E. Leased Offsite Guidelines
- 1.3 **Signage Requirements**
 - A. Interior Sign Standards
 - B. Exterior Sign Standards
 - C. Digital Sign Standards

00.42.19 – Reference Standards:

PART 1 GENERAL

- 1.1 Document Set
 - A. Design Requirement Version: Indicate on drawings and specs (Ex: 2015 v4)
 - B. Drawing Order: Group by **Building, Floor, Discipline, Sheet Index, Year** (no multiple buildings per sheet)
 - 1. (Ex: ED02-A100-25, ED02-A400-25, ED06-A100-25, ED06-A400-25)
 - 2. Floor Level Index is as follows.
 - a. (-2) Below Grade = SL
 - b. (-1) Below Grade = 00

- c. Grade/Street Level = 01
- d. Floor 2 -9 (Double Digits) = 02, 03, 04 ,05 etc.
- e. Floor 10 Plus(Single Digit) = 10, 11,12



- C. Sheet Size Options: ARCH C = 18"x24", ARCH D = 24"x36", or ARCH E1 = 30"x42"
- D. Sheet Layout: From right to left to allow for binding edge along left North always orientated to the top of the sheet
- E. Text Block, all sheets: NCH Logo Engineering Services Address/Phone Project Manager for each Consultant
- F. Dimensioning: From the structural faces not to finished face of wallboard except on details

1.2 Design Requisites

- A. NCH Core Edit Files: NCH provides available electronic files. Design Professional responsible for verification of field conditions
- B. Documents: Provide PDF's and Editable Files - each phase
- C. Specs: PDF's - each phase. Any Owner/Field printed copies are in 3-ring binders (not spiral bound).
- D. Facility Coordination: Room numbering provided by NCH during SD, not assigned by A/E
 - 1. Coordinate equipment ID's during DD, assigned by NCH.

1.3 Construction

- A. Contractor(s): Maintain Field Set with red marks, always current Facility Integration – valve tags, etc.
- B. Design Professional(s): Integrate RFI's, Bulletins, etc. in documents, always current

DRAWING SHEET INDEX (ORDER OF SECTIONS IS BY DESIGN PROFESSIONAL BASED ON INDUSTRY STANDARDS)

X Project Information		S Structural		P Plumbing	
G00	Project Cover Sheet	G10	Structural Cover / Index	G50	Specifications
G10	Index, Notes, Symbols, Legends, etc.	G50	Specifications	D00	Demolition
100	Life Safety Plans	D00	Demolition	100	Floor Plans
110	Phasing Plans	100	Floor Plans	200	Elevations
120	Overall Plans	200	Elevations	300	Sections
130	Accessibility Info (Mounting Heights)	300	Sections	400	Enlarged Plans & Sections
C Civil		500	Details	500	Details
G10	Site Cover, Index	550	Stair & Elevator Details	600	Schedules / Diagrams
G50	Civil	600	Schedules / Diagrams	700	Medical Gas Plans
D00	Site Demo Plan	900	3D Representations & Isometrics	900	Plumbing Stacks & Riser Isometrics
100	Survey, Plot Plan	A Architectural		M Mechanical	
110	Site Layout	G50	Specifications	G50	Specifications
120	Storm, Grading	D00	Demolition	D00	Demolition
130	Water, Utility Plans	100	Floor Plans	100	Floor Plans
140	Pollution, Erosion & Sediment Control	120	Furniture Plans	120	Equipment Plans
150	Site Electric, Lighting	140	Signage Plan & Schedule	150	Piping Plans
200	Storm, Sanitary Profiles	150	Reflected Ceiling Plans	200	Elevations
400	Enlarged Plans	200	Exterior Elevations	300	Sections
500	Site Details	250	Interior Elevations	400	Enlarged Plans & Sections
L Landscape		300	Building Sections	500	Details
G50	Specifications	350	Wall Sections	600	Schedules / Diagrams
D00	Demolition	400	Enlarged Plans	900	3D Representations & Isometrics
100	Planting Plans	450	Enlarged Sections	E Electrical	
110	Irrigation Plan	500	Architecture Details	G50	Specifications
400	Enlarged Planting Areas	550	Casework Details	D00	Demolition
500	Planting Details	600	Schedules / Diagrams	100	Power Floor Plans
550	Irrigation Details	700	Finishes Floor Plans	150	Lighting Plans
F Fire Protection		900	3D Representations & Isometrics	200	Elevations
G10	Fire Protection Cover / Index	Q Equipment		300	Sections
G50	Specifications	G10	Equipment Cover / Index	400	Enlarged Plans & Sections
D00	Demolition	G50	Equipment Specifications	500	Details
100	Sprinkler Areas (Arch/Eng.)	D00	Equipment Demolition	600	Schedules / Diagrams
150	Sprinkler Plans(Submittals)	100	Equipment Floor Plans	700	Fire Alarm Plans
600	Schedules / Details	120	Depression & Sleeving	900	3D Representations & Isometrics
		130	Plumbing Connections	T Technology	
		150	Mechanical Connections	G10	Technology Cover / Index
		170	Electrical Connections	G50	Specifications
		200	Equipment Elevations	D00	Demolition
		500	Equipment Details	100	Floor plans
		550	Exhaust Hood Details	200	Elevations
		600	Schedules / Diagrams	500	Details
		900	3D Representations & Isometrics	600	Schedules / Diagrams

00.60.10 Document Standards - Layer & Drafting Standard:

PART 1 GENERAL

- 1.1 Implementation of Layer and Drafting Standards are intended to streamline the Facility Integration Process. Use layer management with no overwriting individual object properties (color, line type, line weight, etc.) Use elevated layer awareness when creating and using blocks, etc.. Three-part layer identifier, based on the national CAD Standard:

Discipline	Major Group	Minor Group
—	- — — — —	— — — — —
Examples:	A-CLNG A-FLOR-WDWK A- WALL-PRHT C-NGAS C-PRKG-CURB E-LITE-EMRG E- POWR-CIRC S-COLS	architectural; ceiling architectural; woodwork architectural; partial height walls civil; natural gas civil; parking lot curbs electrical; emergency lighting electrical; power circuits structural; columns

Questions? Contact the NCH Project Manager or Pat Ritch, Project Coordinator-Facilities:
Patrick.Ritch@nationwidechildrens.org

00.78.00 – Project Closeout Deliverables:

PART 1 GENERAL

- 1.1 Project Closeout Deliverables from the AE and Contractor are due to NCH at each phase of construction. Deliverables required and the time they are due are indicated in the following 2 charts.
- A. Early Deliverable Turnover (EDT): This is documentation NCH needs early to begin updating master databases to be complete before spaces are turned over. Any change to deliverables after turnover is to be revised, tracked as a change, and resubmitted to NCH.
 - B. Substantial Completion (SC) - Construction Turnover: This is generally when the C of O or TCO has been received, construction is mostly (substantially) complete, and NCH can begin fitup. Any remaining construction happening after Substantial Completion (punch list and day-2 items) should be tracked by the AE on a Rolling Completion List, with due dates and assignments.
 - C. Occupancy - Go Lives, Move-in or Patient Care start: This is when occupants begin to move into the building or area. ICRA/PCRA policies for any ongoing work begins.
 - D. Final Completion (FC) - Contractor Demobilizes, Project Closes: This is when all final deliverables are received, remaining “day-2” work is complete, contractor has left building, project can be closed
- 1.2 Electronic Documents

ELECTRONIC DOCUMENTS (eDOCs) From the A&E Team

All documents to be submitted using the A&E Deliverables SETUP.

Deliverable	Format	Notes	Due	Date Received	Date Approved
A. System Updates	PDF	A&E to markup NCH supplied One Line System drawings	EDT		
B. Room List	Excel	List of room number, department, category, and type.	EDT		
C. CAD Floor Plan Backgrounds	DWG	These are basic drawings used to update the Facility Management Systems. Only these items provided on separate layers. ○ Walls (external, internal, cubicles) ○ Doors ○ Glazing ○ Rooms (names and numbers) ○ Plumbing (sinks, toilets) ○ Simplified structural ○ Outline of major equipment ○ Simple counter tops	EDT		
D. Record Drawings PDF Title Format: BLDG Floor Level-Discipline Sequence-2 Digit Year of Occupancy Floor Plan Example: A04-A100-13	PDF, DWG, Revit	A&E incorporates bulletins and as-built markups. Separate PDF of each sheet. Single combined PDF of all sheets. All final CAD base files (floor, ceiling plans)	FC		
E. Record Specs PDF Title Format: BLDG Floor Level-Year-Division Description_SPEC Floor Plan Example: A04-13-Record_SPEC	PDF	Single combined PDF	FC		
F. Punch List	Excel	List of any work not completed or not completed correctly.	SC		

ELECTRONIC DOCUMENTS (eDOCs) From Each Contractor

All documents should be submitted using the Contractor Deliverables SETUP.

Deliverable	Format	Notes	Due	Date Received	Date Approved
A. Project Contacts	Excel	All primes and subs (Company, Person, Title, Email, Phone)	EDT		
B. Maintainable Assets (Must use NCH Template "MAINTAINABLE ASSET CHART_TEMPLATE" only)	Excel	All removed/added/changed equipment	EDT		
C. Valve Tags (Must use NCH Template "VALVE TAG LIST_TEMPLATE" only)	Excel	All removed/added/changed valves. Tags must be reserved ahead of time with the CC.	EDT		
D. System Training Title Format: BLDG Floor Level-Year-System Description TRAINING Example: AB07-22-Generator Operation TRAINING	PDF	Reference docs provided at time of training. AE review with NCH OPS based on in-scope systems	EDT		
E. Warranties Title Format: BLDG Floor Level-Expiration Date-Description WARRANTY Example: A04-13-Restaurant Partitions WARRANTY	PDF	Separate PDF of each warranty. Review specs for extended warranties	SC		
F. Testing Results PDF Title Format: BLDG Floor Level-Year-Description TESTING Example: A04-13-Air Balance TESTING	PDF	Commissioning reports	SC		
	PDF	Equipment startup	SC		
	PDF	TAB reports: water mgmt, med gas, HVAC & CW balance reports	SC		
	PDF	IS data test results	SC		
	PDF	Electrical coordination study (if required)	SC		
	PDF	Glycol test results	SC		
	PDF	Final water samples Coliform bacteria testing (i.e. OPC required.)	SC		
	PDF	Legionella test results (CM coord timing based on go-live.)	SC		
G. Building Automation Graphics			SC		
H. Fire Alarm Graphics			SC		
I. O&M Manuals Title Format: BLDG Floor Level-Year-Description_O&M Example: A04-13-Restaurant Partitions_O&M	PDF	Separate PDF of each O&M section	FC		
J. As-Built Drawings Title Format: Project Number_Discipline_AS BUILT Example: A1-19-138_Electrical_AS BUILT	PDF	Single combined PDF	SC		
K. Approved Submittals PDF Title Format: BLDG Floor Level-Year-Division Description_SUBMITTAL Example: A04-13-092100 Gypsum Board_SUBMITTAL	PDF	Separate PDF of each submittal with approval stamps. Submittal Log as basis to assure all are received	SC		

1.3 Maintainable Assets List (MAL) and Valve Tag List

- A. AE to fill in design portion of MAL and submit to NCH prior to end of Construction Document Phase.
- B. See APPENDIX D For the full MAL and Valve Tag List Templates obtain editable version from NCH PM C. Example MAL template below.



Electrical

Date:		LEGEND	
Project Name:		Examples	
Project Number:		Filled in by AE Team and Verified by NCH Project Manager	
Contractor Name:		Filled in by Contractor and Verified by NCH Construction Manager	
		Filled in by NCH Operations Supervisor	

Phase	Added or Demo A or D	Room Number	Drawing Label	Equipment Label Format Bldg Floor - Equip - ##	Description	Manufacturer	Model	Serial Number	Warranty Expiration	Notes
3	A	WC3683	WC3-A300	WC3-BC-02	Battery Charger	LaMarche	A12B	6294	3/18/2028	
3	A	JW2638	JW2-A200	JW2-BFF-01	Bypass Filter Feeder	Neptune	FTF-SHP	6923-V-34	7/14/2027	
6	A	ABSL034	ABSL-A90	ABSL-MCC-01	Motor Control Center	Neptune	FTF-SHP	6988-V-27	3/18/2028	
6	A	AB0007	AB00-A90	AB00-UPS-01	Uninterruptable Power Supply	RussElectric	647	21000A/B	7/14/2027	
6	A	LB7283	LB7-A700	LB7-VFD-02	Variable Frequency Drive	Helix	A96687ut7	6294	3/18/2028	
6	A	AB0007	AB00-A91	AB00-EXL-024	Emergency Egress Light	Hornaday	738	3009488301	7/14/2027	
6	A	AB0007	AB00-A92	AB00-GEN-02	Generator	Catapillar	A12B	6294	7/14/2027	
6	A	AB0007	AB00-A93	AB00-SWGR-04	Switchgear	Eaton	FTF-SHP	6923-V-34	7/14/2027	

Filled in the by AE Team and
Verified by the NCH Project Manager

Filled in the by Contractor and
Verified by the NCH Construction
Manager

1.4 System Documents

- A. NCH Engineering maintains content rich electronic Facility Drawings and Diagrams, including below:
 1. Civil
 - a. Civil layout including major landscape elements
 - b. Infrastructure locations - sanitary, storm, water, electric, communications, etc.
 - c. Irrigation system layout
 - d. Valve and control locations
 2. Structural
 - a. Structural columns
 - b. Structural grid
 - c. Cast in place concrete
 3. Architectural
 - a. Wall and opening locations
 - b. Stair, elevator, and chase locations
 - c. Fixed and specialty FF&E locations
 - d. Plumbing fixture locations
 - e. Smoke/fire rating locations
 4. Fire Suppression
 - a. Fire department connection locations
 - b. Hydrant locations
 - c. Fire suppression valve locations and spreadsheet
 - d. Sprinkler coverage areas
 - e. Hydraulic calculations (Entire System/Modified Systems)
 - f. Operation Pressure (PSI) for Standpipes and meet the CFD signage

- requirements.
- 5. Plumbing
 - a. Medical gas port, valve, and monitoring locations
 - b. Medical gas infrastructure routing
 - c. Steam routing
 - d. Steam 1-line diagram
 - e. Plumbing stacking diagram
 - f. Valve tag locations and spreadsheet
- 6. Mechanical
 - a. Equipment locations
 - b. AHU coverage areas
 - c. Intake and exhaust locations
 - d. Damper locations
 - e. Chilled water routing for 24/7 systems and centralized energy plant / building specific systems.
 - f. Chilled water valve locations and spreadsheet
 - g. Fuel system equipment and valve locations
- 7. Pneumatic Tube
 - a. System layout
 - b. 1-line diagrams
 - c. Station Directory
 - d. Network Jack and Electrical Circuit Information
- 8. Electrical
 - a. Equipment locations – switches, panels, transformers, generators, etc.
 - b. Lighting layout and schedule
 - c. Campus power distribution diagram
 - d. Panel schedule spreadsheet
 - e. Power 1-line diagram (normal and emergency) with arc flash tag
- 9. Communications
 - a. Equipment locations – data communication, voice, structured cabling, AV, etc.
 - b. Elevator Phones
 - c. Area of Rescue Phones/Call Boxes
 - d. Code Blue Phones / Call Boxes
- 10. Electronic Safety & Security
 - a. Equipment locations – electronic surveillance, electronic detection, and alarm (fire, radiation, gas, fuel-oil, refrigerant, etc.), badge reader controls
 - b. Fire alarm 1-line diagram

00.79.00 – Above Ceiling System Identification Matrix:

PART 1 GENERAL

- 1.1 Architect/Engineer to include this requirement in the project specifications.
- 1.2 The intent is to provide a method of identifying and locating various above-ceiling system devices (valves, dampers, etc.), to limit unnecessary damage to ceiling systems and speed up device location in emergent situations.
- 1.3 Colored round dots are to be placed on the ceiling grid closest to the location of the device. In the case of lay-in metal pan ceiling, the dots are to be placed at the metal edge with the metal pan lining up with the device. Dots are not used at hard ceilings with access doors. Colored dots to be 1/2" dia. and can be ordered through AsLabeled.com (877-275-2235), Item #C500.

- 1.4 The designer is to verify the dot installation has been performed and is accurate, prior to ceiling tile installation.
- 1.5 Signifier for fire suppression system to be “FIRE”
- 1.6 Color Coding:

-  Red Dot: Fire Damper
-  Red Dot: Fire/Smoke Damper
-  Red Dot: Smoke Damper
-  Gray Dot: VAV Box
-  Orange Dot: HVAC Valves (Hot water heating or chilled water valves)
-  Green Dot: Medical Gas & Laboratory Gas Valves
-  Yellow Dot: Natural Gas Valves
-  Blue Dot: Domestic Water Valves (Hot or Cold)

DIVISION 01: GENERAL REQUIREMENT

01.00.12 – Facility Remediation:

PART 1 GENERAL

- 1.1 Asbestos Remediation – Verify with NCH Project Manager – Study typically paid for by NCH. Where abatement is required, NCH requires copies of all paperwork pertaining to the removal, including copies of air sampling tests and landfill manifests.

DIVISION 03: CONCRETE

03.00.00 – General Design Conditions:

PART 1 GENERAL

- 1.1 Provide a minimum 8” concrete curb at base of all glazing systems

03.36.50 – Post Tensioning:

PART 1 GENERAL

- 1.1 Post tension cable locations shall be identified with 2" wide yellow stripe on underside of deck at all such occurrences.

DIVISION 04: MASONRY

04.00.00 – General Design Conditions:

PART 1 GENERAL

- 1.1 Provide a minimum 8” masonry curb at base of all glazing systems

DIVISION 05: METALS

05.10.00 – Structural Metal Framing:

PART 1 GENERAL

- 1.1 Architecturally-Exposed Structural Steel Framing (Rooftop Steel) – All to be hot dipped galvanized or similar non-corrosive protection. Add adequate servicing platforms, permanent ladders, guards, typically unpainted.

05.50.00 – Metal Fabrication:

PART 1 GENERAL

- 1.1 Metal Stairs - Steel pan with concrete fill, or prefabricated similar type available from various sources. Painted risers and stringers. Exterior stairs exposed to the weather to be “non-skid” type, with abrasive metal nosing inset into the concrete.

DIVISION 06: WOOD, PLASTICS AND COMPOSITES

06.05.00 – Common Work Results for Wood, Plastics, and Composites:

PART 1 GENERAL

- 1.1 Fire Retardant Treated (FRT) generally required for all uses. (Blocking, backer boards, etc.)

06.10.00 – Rough Carpentry:

PART 1 GENERAL

- 1.1 Misc. Rough Carpentry – (Blocking) - 2x wood used at all nailers; metal (16ga strap type) for most other blocking needs unless deemed inadequate for loads.
- 1.2 Technology Rooms – refer to Division 27 requirements for special requirements

06.41.00 – Architectural Wood Casework:

PART 1 GENERAL

- 1.1 Architectural Wood Casework (All Wood-Veneer and Plastic Lam. Cabinets)
- 1.2 AWI Premium grade standards (All wood grain laminates are to run vertical)

PART 2 PRODUCTS

- 2.1 Cabinet box / drawer / shelves /doors: 3/4" MDF construction, Plastic Laminate on all exposed edges. Provide 3mm PVC edge banding on all shelves, drawers, and door edges.

Shelves (melamine finish) on metal adjustable "pins". All doors have magnetic catches. Upper cabinets to have either a veneer extension panel or GWB soffit to close off the top on the cabinet. Verify with NCH project manager correct application.
- 2.2 Cabinet hinges: Reveal Overlay Style, 5 knuckle hinges, US-26D Satin Chrome finish

Rockford Process Control #456 series or approved equal by E- Line. Stainless Steel hinges are not typical but may be required in certain circumstances. Verify with NCH project manager.
- 2.3 Cabinet drawer glides: Full extension drawer glides.

Stanley No. 4484 pulls; 5/16 inch diameter x 4 inch long with 1-5/16 inch projection, aluminum satin finish. Verify with NCH project manager.

2.4 Cabinet door pull / magnetic hinges:

Stanley No. 4484 pulls; 5/16 inch diameter x 4 inch long with 1-5/16 inch projection, aluminum satin finish or approved equal

Baer MF250 (Or approved Equal) Magnetic catch for all cabinet doors o

2.5 Cabinet locks: Manual keyed cabinet locks to be National C8053 or C8055 (All locks keyed alike). Electronic/Cipher-type cabinet locks, are to be CompX Regulator REG-S-R-3. Verify with NCH Project Manager.

2.6 Cabinet grommet and wire management:

Small Grommet (Computers/Desktop Phone) 1-3/4 " SG By Doug Mockett (or Approved Equal)

Medium Grommet (Large Machines or Large Computer equipment) 2" TG By Doug Mockett (or Approved Equal)

Large Grommet (Very Large Equipment) 2-1/4" EDP By Doug Mockett (or Approved Equal)

2.7 Wire Management - WM4 Black by Doug Mockett – Length TBD by Millwork (or Approved Equal)

2.8 Cabinet Counter Tops:

A. Solid Surface Counter Tops Used in: Wet areas, Public/Patient areas, Public/Staff shared amenity areas (i.e., Exam Rooms, Break Rooms, Reception desks, copier areas, etc.) - See Master Finish Schedule for additional information on Solid surface specifications.

B. P-LAM Veneer Counter Tops Used **in**: Back-of-house DRY areas, Storage rooms and utility areas. 1-1/2" thick substrate top with 3mm PVC edge banding on all exposed edges. See Master Finish Schedule for additional information on P-Lam Specifications

C. All Counter tops to be set first with back touching wall or adjacent surfaces. Side and backsplashes to be set on top of counter and sealed with clear sealant. All edges and corners to be square and eased. Seal all cuts (at sinks, etc.), with clear sealant before final assembly. Verify with NCH Project Manager. See Master Finish Schedule for Additional information.

DIVISION 07: THERMAL AND MOISTURE PROTECTION

07.05.00 – Common Work Results for Thermal & Moisture Protection:

PART 1 GENERAL

- 1.1 ALL Slabs on Grade shall utilize a sub-grade drainage system (perforated pipe) routed to a sump pit and ejector system. This is especially true of SOG below the first-floor level.

07.10.00 – Damp proofing and Waterproofing:

PART 2 PRODUCTS

- 2.1 Bentonite Waterproofing – “DRILOK” spray on type for all waterproofing below grade. No substitutions.

07.21.00 – Thermal Insulation:

PART 1 GENERAL

- 1.1 Due to mold concerns, building envelope to be investigated and recommendations discussed with PM prior to detailing.

07.21.16 – Blanket Insulation:

PART 1 GENERAL

- 1.1 Sound batts in all walls. Typically, unfaced fiberglass for full wall height and depth.

07.70.00 – Roof and Wall Specialties and Accessories:

PART 1 GENERAL

- 1.1 EACH trade is responsible for their penetrations through roofing. Verify warranty requirements with NCH for each roof. Certain roof contractors may be mandated to maintain warranty coverage.
- 1.2 Manufactured Curbs – Typically 16" minimum height

PART 2 PRODUCTS

- 2.1 **Manufactured Copings** – W.P. Hickman “PermaSnap” – Aluminum, min. 050”, with zinc-coated steel anchor plate or cleat at coping joint and formed aluminum gutter chair or gutter/splice plate or compression pad/gutter; prefabricated inside and outside corners, miters welded prior to finishing – no exposed fasteners. Provide shop-welded ends and corners - Equals by Metal Era “Anchor-Tite Coping”, or Petersen Aluminum Pac-Clad “Tite-Loc”.
- 2.2 **Manufactured Fascia** – W.P. Hickman “EconoSnap 3” – Formed aluminum, 6.3” face height, 0.075” thick, zinc-coated steel anchor plate or cleat at coping joint, and formed aluminum gutter chair or gutter/splice plate or compression pad/gutter; prefabricated inside and outside corners, miters welded prior to finishing.
 - A. No exposed fasteners. Provide shop-welded ends and corners. Equals by Metal Era or Petersen.

07.80.00 – Fire and Smoke Protection:

PART 1 GENERAL

- 1.1 **Each trade is responsible for their penetrations through ANY/ALL fire rated assemblies.** Each Trade is responsible for providing applicable produce submittal cut sheets and product information for review and approval prior to installation. This submission should also include fire stopping training manuals / documentation for the staff.
- 1.2 Use Cementitious or Duty Rated type for exposed components or steel. For penetrations, Hilti Firestop FS-1 and STI Firestop is the only acceptable manufacturer in addition to applicable support systems.

07.84.00 – Technology Room Firestopping:

PART 1 GENERAL

- 1.1 Technology Rooms – refer to Division 27 requirements for special requirements

07.90.00 – Joint Protection:

PART 1 GENERAL

1.1 Expansion Joint Cover Assemblies

- A. Stainless steel, brushed finish, surface screwed if possible, to facilitate maintenance, FLUSH with adjoining floor surfaces adjusting, etc.

DIVISION 08: OPENINGS

08.06.00 – Schedules for Openings:

PART 1 GENERAL

1.1 Door Schedule / Hardware Schedules are to appear on the drawings, not in the specifications.

1.2 Door Schedule is to include columns for all doors:

DOOR IDENTIFIER:

- A. Mark of Door # (To Comply with Design Requirements on Labeling.
- B. From Room Name:

DOOR SIZE AND MATERIAL:

- C. Door Size (W x H x T)
- D. Door Material (Separate Columns for: Material /Type/STC/Louver W x H)

FRAME SIZE AND MATERIAL:

- E. Separate Columns for: (Material / Type Number)
- F. DETAIL: (Separate Sub Section) Head/Jamb Detail Number

FIRE RATING LABEL:

- G. Total Door/Frame rating requirement in minutes.

HARDWARE:

- H. Hardware Set #
- I. Keyside Room #
- J. Access Control (Key in a separate coded note list on the sheet that calls out various functions and options)
- K. Power Operation

COMMENTS :

- L. Key in a separate coded note list on the sheet that calls out various functions and options.

REVISION #:

- M. Indicates revision version if modified from bid documents.

1.4 Technology Rooms – refer to Division 27 requirements for special requirements

- 1.5 Rooms with Adult Changing Tables – If building code allows, please provide an automatic door operator to enter room. Confirm with NCH project Manager
- 1.6 Pharmacy Clean rooms – Require automatic sliding doors to maintain pressure. Coordinate locations with NCH Project Manager

08.12.13 – Hollow Metal Frames:

PART 1 GENERAL

- 1.1 Hollow Metal Frames
 - A. All metal door frames to be reinforced at the head for automatic door closer, even if a closer is not specified for use in the project.
 - B. All new ground up buildings (not renovation of existing or new spaces) should only have welded door frames (WD).
 - C. For renovation projects (of new or existing spaces) 16 ga, KD (with typical reinforcements) should be utilized for openings 3'-0" or less. Hospital stops are NOT required. Final discretion on KD vs WD granted by NCH Project Manager.
 - D. Double Leaf Interior Door Frames, Borrowed Lights - 16 ga WELDED construction, 6" high bases at borrowed light frames or sidelight frames at floors
 - E. Fire ratings - permanently attached, in an exposed location (not inside the frame or hidden by hinges).
 - F. Door frames are not to be concrete filled or mudded, unless discussed with the PM. A typical location where the frame might be grouted is a high-abuse area where the frame attaches to a CMU wall.
 - G. See Division 09.22.16 for additional information.
 - H. Door frames which are indicated to be painted shall be shop-finished with standard performance paints. Epoxy & baked applications are not accepted.
 - I. Internal Steel Frame reinforcement needed at closer attachment point on Door Frames (Only in Behavioral Health Door Locations)

08.31.00 – Access Doors and Panels:

PART 1 GENERAL

- 1.1 High abuse areas – Discuss fiberglass or steel, non-wood options with PM prior to specification.
- 1.2 Masonry frame type, with screw cam closures. Typically provided by the trade requiring the access, installed by the GTC.
- 1.3 Architect to review specifications for sliding aluminum doors and framing with NCH Project Manager.
- 1.4 Automatic (key) reset shall be provided in lieu of McCabe resets on all overhead fire rated doors, Keyed to NCH Engineering Key.

08.14.16 – Flush Wood Doors:

PART 1 GENERAL

1.1 Flush Wood Doors

- A. Plain Sliced wood veneer, verify species with NCH project manager (Maple or Red Oak Typical). Type is dependent on location. Doors to be 5-ply particle, or gypsum core, solid wood stile (no particle board) sealed 6 sides typical. Edge banding to be same species as face veneer. Paint grade birch in some locations. HC doors at bi-passing, bi-folding, and pocket door locations; typical door to be CLEAR finish with satin polyurethane topcoats.
- B. Window Kits - Frame to match door material & finish. If window glass is rated, the frame must also carry the appropriate rating and label.
- C. All conference rooms to have Window Kits unless directed by NCH project manager during protective services review.
- D. All new and/or existing doors within the project boundary are to be cleaned. Remove any tape, glue residue, pencil, ink, or marks, to the satisfaction of owner rep. Infill any holes with matching wood putty and stain or paint as required. Notify owner if there are any holes or marks too large to fill/patch, as to provide a satisfactory appearance (as defined by owner). Clean and polish hardware as required. After cleaning, wipe existing doors with a matching stain, to hide any scratches.
- E. Internal Steel Frame reinforcement needed at closer attachment point on Door leaf (Only in Behavioral Health Door Locations)

08.33.23 – Overhead Coiling Doors:

PART 1 GENERAL:

- 1.1 Specific model to be determined by application. Verify with NCH project manager. Type is dependent on location.
- 1.2 Approved vendors: High Speed Overhead doors Rytech. Flexion is not an approved manufacturer.
- 1.3 Special consideration to be made by designer to ensure override locations & safety devices are easily accessible
- 1.4 Automatic (key) reset shall be provided in lieu of McCabe resets on all overhead fire rated doors, Keyed to NCH Engineering Key

08.35.00 – Folding Doors and Grilles:

PART 1 GENERAL

- 1.1 Accordion doors, etc. verify with NCH Project Manager.

08.71.00 – Door Hardware:

PART 1 GENERAL

- 1.1 Confirm project is main campus or off site. Location will dictate cylinder and lockset part numbers.
- 1.2 Main campus keying:

A. All cylinders for main campus to be factory keyed to owners existing Sargent xc key system, r-family and la keyways determined by owner.

1.3 Offsite keying:

A. All cylinders for off-sites to be factory keyed owners existing Schlage SL key system.

B. Schlage full size interchangeable core with temporary construction cores.

1.4 Construction keying:

A. Sargent XC (11-) conventional patented core cylinders used at interior locations and to include lost- ball (21-) construction keying - only non-removable cores will be accepted.

B. All construction keys to be shipped to the CM/GC.

1.5 Permanent keying:

A. All permanent XC Series cylinders/cores to be ordered and shipped with locking hardware.

B. All permanent keys to be packaged separately from locks and shipped directly to the owner, no exceptions. Shipping and recipient address to be confirmed in keying meeting.

C. Bitting lists to be provided for all registries used on Disc, in text format, compatible with SimpleK and in Paper form shipped directly to the owner, no exceptions.

D. 5% additional change-key bittings are required under each master key.

1.6 All keys to include Visual Key Control (VKS) stamping of keysets on keys only.

1.7 Key quantities:

A. 4 Master keys per keyset

B. 10 Construction Master keys

C. 4 Change keys per cylinder

PART 2 PRODUCTS

2.1 All doors

A. Confirm project is main campus or off site. Location will dictate cylinder and lockset part numbers.

B. All cylinders for main campus to be factory keyed to owners existing Sargent xc key system, r-family and la keyways determined by owner.

2.2 Hinges:

A. 4.5"x4.5" ball bearing type, finish us-26d, (Hager bb1279 or equal)

2.3 Door closer:

A. LCN 4041 closer (typical with ADA delay - no substitutions, sex bolted);

1. All interior doors to have closers set at 5-6lbs of force to operate door.

2. All delayed assist doors to be set "open" for 10 seconds

- 2.4 Automatic door operators:
- A. Assa Abloy electric power operators only – verify with NCH project manager
- 2.5 Regular door handle (locks below):
- A. Schlage ND Series, RH0, 2-3/4" Backset ,
 - B. No removable cores (only for on campus locations)
 - C. IC cores, (only for off campus locations)
 - D. For electric strikes use 24v DC powered electric strikes. HES 1600 or Von Duprin (field reversible type) at all bored lock sets. (Typical installation: Fail Secure, but verify per situation)
- 2.6 Hospital door handle
- A. Hospital latch – Schlage HL6 – no substitutions.
- 2.7 Panic hardware:
- A. Von Duprin, no exceptions, verify type as exposed rod or concealed cable, but concealed preferred, etc.);
 - 1. For electric strikes use 24v dc powered electric strikes. HES 1600 or Von Duprin (field reversible type) at all bored lock sets. (typical installation: fail secure, but verify per situation)
 - 2. For low voltage use 24-volt is required. H.e.s. "smart pacs" are to be used at all electric strikes, to induce voltage drop during inactive periods

2.8 Locking requirements organized by use:

OWNED ON CAMPUS SITES ONLY

A. Keypads:

- 1. Keypad Cylindrical Locks – Schlage CO100CYL-SA – No Substitutions.
- 2. Keypad Mortise series – Schlage CO100MSI-SA – No Substitutions.

B. Manual key locks:

- 1. All patient rooms - passage – Schlage ND10S – No Substitutions
- 2. Storeroom / Closet – Schlage ND80L-SA – No Substitutions.
- 3. Entrance/Office – Schlage ND53L-SA – No Substitutions.
- 4. Classroom – Schlage ND70L-SA – No Substitutions.
- 5. Passage – Schlage ND10S – No Substitutions.
- 6. Multi fixture bathrooms – Schlage ND40S – no substitutions.
- 7. Single fixture bathrooms / Lactation Room - Schlage ND40-SOS-OCC. No Substitutions.

8. Normal Panic Room (See Security Section) - Schlage ND53L-SA-IS-OCC No Substitutions

9. Clinical Panic Room (See Security Section) - Schlage ND53L-SA- IS-OCC – No Substitutions.

C. Electrified locks:

1. Electrified Lockset – Schlage ND80EUL-SA – No Substitutions.

2. For electric strikes use 24v DC powered electric strikes. HES 1600 or Von Duprin (field reversible type) at all bored lock sets. (Typical installation: Fail Secure, but verify per situation)

OWNED/ LEASED OFF CAMPUS SITES ONLY

A. Keypads:

1. Keypad Cylindrical Locks – Schlage CO100CYL-JD – No Substitutions.

2. Keypad Mortise series – Schlage CO100MSL-SA – No Substitutions.

B. Manual key locks:

1. All patient rooms - Passage – Schlage ND10S – No Substitutions

2. Storeroom / Closet – Schlage ND80L-JD – No Substitutions.

3. Entrance/Office – Schlage ND53L-JD– No Substitutions.

4. Classroom – Schlage ND70L-JD – No Substitutions.

5. Passage – Schlage ND10S – No Substitutions

6. Multi Fixture Bathrooms – Schlage ND40S – no substitutions.

7. Single fixture bathrooms / Lactation Room - Schlage ND40-SOS-OCC. No substitutions.

8. Normal Panic Room (See Security Section) - Schlage ND53JD-IS-OCC– No substitutions

9. Clinical Panic Room (See Security Section) - Schlage ND53JD-IS-OCC –No substitutions.

C. Electrified locks:

1. Electrified Lockset – Schlage ND80EUJD – No Substitutions.

2. For electric strikes use 24v DC powered electric strikes. HES 1600 or Von Duprin (field reversible type) at all bored lock sets. (Typical installation: Fail Secure, but verify per situation)

08.88.53 – Security Glazing:

PART 1 GENERAL

- 1.1 Labeled, typically square wire mesh "Baroque" pattern, but verify if diagonal wire is in same area.

- 1.2 Window Kits – Wire Glass with steel frames. If window glass is rated, the frame must also carry the appropriate rating and label.

DIVISION 09: FINISHES

Please See Master Finish Schedule

09.21.00 – Plaster and Gypsum Board Assemblies:

PART 1 GENERAL

- 1.1 Provide Gypsum Panel systems in lieu of plaster. If Plaster is necessary, ensure that surface alkalinity is compatible with paints/finishes and discuss with Project Manager if proposed.
- 1.2 Sound insulation – Typically installed in all stud walls - fiberglass batts, full depth & height of studs. Acoustical blankets on top of office ceilings if directed by NCH project manager.
- 1.4 Special boards (DensGlass, Shaftwall, etc.) as required for high traffic areas, abuse areas, fire ratings, etc. Discuss locations with NCH Project Manager...

PART 2 PRODUCTS

2.1 Gypsum Board

- A. USG (United States Gypsum) Type X branded gypsum board is preferred. However, National Gypsum and other brands are approved alternates. . No other brand Substitutions without approval by NCH project manager. Moisture resistant in wet or moist areas as appropriate. Impact resistant board only on for Behavioral Health Spaces if directed by NCH Project Manager.
- B. 5/8" thickness Type 'X' for interior walls; 1/4" (or other thicknesses) allowable for lamination to cover old walls, plaster walls, etc.
- C. All drywall is to be held a minimum ¼" and a maximum of 5/8" above the rough floor. No caulks or filler to be used in gap unless specifically required by the AHJ as part of a fire rated assembly; or in wet areas where an integral (flash cove) base is to be installed, or in areas where sound transmission might be a concern, as directed by the PM. In this case the flooring installer will fill the 5/8" gap if required to properly install his product.
- D. Where sound transmission is a concern (offices, exam rooms, etc.), install gypsum board to deck above. May not be necessary at closets and other non-occupied spaces.
- E. No Metal Corner Bead, No Coat compound applied to corner bead please.
- F. No "reveal" type details without approval from NCH Project Manager
- G. USG gypsum joint compound compatible with previous and successive coats as recommended by manufacturer.
- H. Gypsum finish – Level 4 finish in all locations.
- I. Design Professional shall reference control Joints in drawings and specifications and should follow ASTM C840-24.

2.2 Gypsum Board Fireproofing

A. Shaft walls - As required, typical CH studs

B. See section 09.90.00 regarding rated partition labeling system

09.22.16 – Non-Structural Metal Framing:

PART 1 GENERAL

1.1 Non-Structural Metal Framing (Metal Stud Systems)

A. Base track: 20 gauge, with 2" leg at all metal stud walls. Track to meet SSMA-T200 requirements. Use of Dietrich (or other manufacturer) 20 gage "equivalent" studs (at 16" on center) is acceptable.

1.2 Metal studs / framed openings

A. Walls to be minimum 20 gage studs at 16"oc, slab to slab at typical wall.

B. Framed openings to be minimum (2) 16 gage studs.

C. Framed opening headers to be a minimum (2) 16 gage studs. No base track headers.

D. Non 90 Degree corners to receive full height 16 gage reinforcing to nearest studs.

1.3 Blocking

A. 16 gage galvanized steel strips 8-12" wide. Design professional should add notes in drawings where blocking is required. Where steel is not adequate support, use Fire Treated wood blocking.

09.30.13 – Ceramic Tile:

PART 1 GENERAL

1.1 In wet areas - "UltraSet" required (trowel applied waterproofing membrane) or similar

1.2 Grout - Epoxy type required in all locations. Grout lines between tiles should be as thin as possible; 1/16" is preferable, even for large tiles. See Master Finish schedule for additional information.

1.3 See Master Finish schedule for additional information.

09.50.00 – Ceilings:

PART 1 GENERAL

1.1 Acoustical Ceilings – See Master Finish schedule for additional information.

1.2 Suspension Assemblies – Armstrong, Prelude XL, intermediate duty, 15/16" exposure, Aluminum, Steel or Plastic as required per installation location. See Master Finish schedule for additional information.

1.3 Specialty Ceilings – verify w/ Engineering PM

1.4 Technology Rooms – refer to Division 27 requirements for special requirements

09.65.00 – Resilient Flooring:

PART 1 GENERAL

1.1 Resilient Base and Accessories

- A. All Base to be Cove Style Base - See Master Finish Schedule for additional Information.
- B. Base to be installed at all exposed areas inclusive of toe kicks of cabinetry and along finished ends. - See Master Finish Schedule for additional Information.
- C. See Master Finish Schedule for specific Behavioral Health Areas – NCH Project Manager to Verify.

1.2 Resilient Sheet Flooring

- A. All Base to be Cove Style Base - See Master Finish Schedule for additional Information.
- B. Integral SV (flash) cove only in wet areas or required by code as approved by NCH Project Manager.
- C. Where possible, sheet flooring to be adhered using spray adhesive and follow manufactures recommendations. If sprayed adhesive is applied, floor needs to be back rolled following manufactures installation instructions.

1.3 Resilient Tile Flooring

- A. Waxing/polishing is not required as this work is typically performed by owner supplied outside vendor.
- B. Wet equipment rooms are to positively flow toward drains and resist the passage of water.

PART 2 PRODUCTS

2.1 Resilient Tile Flooring

- A. VCT – See Master Finish Schedule – All should be stack bond pattern, all "grain" the same direction. Product to be finished per manufactures recommendation inclusive of owner supplied waxing.

PART 3 EXEUCUTION

3.1 Resilient Sheet Flooring

- A. Where possible, sheet flooring is to be adhered utilizing spray adhesive. If sprayed adhesive is applied, floor needs to be back rolled following manufactures installation instructions.

3.2 Resilient Tile Flooring

- A. Resilient flooring is to extend UNDER all casework except where sheet vinyl flash cove is used

09.68.00 – Carpet:

PART 1 GENERAL

- 1.1 Where possible, Carpeting is to be adhered utilizing spray adhesive. If sprayed adhesive is applied, floor needs to be back rolled following manufactures installation instructions.

09.72.00 – Wall Coverings:

PART 1 GENERAL

1.1 Vinyl Coated Fabric Wall Covering

- A. Very limited use. Discuss potential locations, specification, with NCH Project Manager.

09.90.00 – Painting and Coating:

PART 2 General

- 2.1 See Master Finish Schedule for specific product information. All non-metal substrates receive Prime + 2 top coats. Prime + 1st topcoat goes on before ceiling grid is installed. 2nd topcoat at finish. DW contractor patches all nicks, blemishes, etc. after prime or 1st topcoat. Patches are to be primed before 2nd topcoat. (PPG primer). All Metal substrates provide Prime + 3 top coats. Verify with NCH Project Manager.
- 2.2 Paint Sheens should be assigned based on use and area. See Master Finish Schedule and verify with NCH Project Manager.
 - A. Walls: Semi-Gloss in all areas with the exception of the following:
 - 1. Interior of private administrative staff offices shall be Eggshell.
 - 2. Wet wall behind restroom plumbing fixtures to be Semi-Gloss Epoxy Paint.
 - B. Hard Ceilings: Semi-Gloss in all areas.
 - C. Painted Mechanical Room Concrete Floors: 1 Coat Primer – Two coats Water Borne Epoxy Paint. Gloss Finish. Ensure that concrete curing/sealing compounds are compatible with this finish requirement. See Master Finish Schedule.
 - D. Painted Metal: 1 Coat Primer - Three Coats Urethane Modified Low VOC Alkyd Gloss Enamel. See Master Finish Schedule.
 - E. Stair Rails/ Guardrails/ Handrails: 1 Coat Primer -Three Coats Water Borne Acrylic Gloss Paint. See Master Finish Schedule.
 - F. Stained Wood: Satin Polyurethane Finish. 2 topcoats minimum.
- 2.8 Special paints as required and as approved for the use – verify with Project Manager.
- 2.9 Stencil all fire rated and smoke partitions with 6” high Semi- Gloss Red letters above the ceiling line indicating the fire rating for the wall. Stenciling is required within 3’ of every assembly termination and placed no greater than 10’ Apart. The stencil is to be located on each side of the wall, should be fire engine red, and should indicate “1-HR. Fire Partition”. “2-HR. Fire Partition”. “3- HR. Fire Partition”, “1 HR. Smoke Barrier”, or “Smoke Tight Partition (NR)”. The installation of the stencil must occur within (24) hours of the completion of drywall finishing above the ceiling line.
- 2.10 Storage rooms in sprinklered buildings to have an accent stripe painted 20” below finished ceiling. See Master Finish Schedule and verify with NCH Project Manager.
- 2.11 Contractors involved with painting are responsible for disposing of their own material, including, but not limited to unused paint and thinner.

DIVISION 10: SPECIALTIES

10.06.20 – Schedule for Interior Specialties:

PART 1 GENERAL

- 1.1 Wall Hung Accessories and Equipment – SEE FFE Schedule

- A. Verify with NCH Project Manager which items are OFCI or CFCI.
- B. Verify size and location of all FFE items with NCH Project Manager
- C. Design Professional should reach out and obtain cut sheets from CP PM for all owners supplied items and incorporate them into the documents.
- D. A/E team to coordinate and indicate items on Bid Documents (OFCI or CFCI), including any required blocking.
- E. All power cords related to wall-hung contractor installed items shall be securely tacked to the walls.
- F. All corners of wall-hung items to be securely attached to wall, following manufacturer recommendations. Coordinate with CM/CP for specific Details

10.14.00 – Signage:

PART 1 GENERAL

- 1.1 Obtain current version of Interior & Exterior Signage manuals from NCH Project Manager.
- 1.2 A/E team to coordinate and indicate signage types and locations on Documents, following the NCH signage standards documents.
- 1.3 Ensure that 12” minimum clear is adjacent to strike side of jamb (“entry” side) of ALL doors to allow placement of signage.
- 1.4 Interior, exterior, donor, and digital signs are to be consider for placement and required power and data.

10.21.00 – Compartments and Cubicles:

PART 2 PRODUCTS

2.1 Toilet Compartments

- A. Toilet compartments: Floor supported, head rail braced, stainless steel, satin color. Stainless with Steel Castings: ASTM A 743/A 743M
- B. Urinal Screens: Floor supported, stainless steel, stainless steel hardware.
- C. Hardware and Accessories: Manufacturer's heavy-duty operating hardware and accessories.
- D. Hinges: Manufacturer's minimum 0.062-inch-thick stainless steel paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door. Mount with through-bolts.
- E. Latch and Keeper: Manufacturer's heavy-duty surface-mounted cast-stainless-steel latch unit designed to resist damage due to slamming, with combination rubber-faced door strike and keeper, and with provision for emergency access. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible. Mount with through-bolts.
- F. Door Bumper: Manufacturer's heavy-duty rubber-tipped cast-stainless-steel bumper at out-swinging doors. Mount with through-bolts.
- G. Door Pull: Manufacturer's heavy-duty cast-stainless-steel pull at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible. Mount with through-bolts.

H. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel anchors compatible with related materials.

I. Basis of Design Manufacturer: Subject to compliance with requirements, provide products by Accurate Partitions Corporation; Ultimate Privacy or by one of the following:

1. Accurate Partitions Corporation
2. Ultimate Privacy
3. Hadrian Inc.
4. Metpar Corporation

J. Miscellaneous

1. 4" stainless steel shoe
2. Bracket: stainless steel, continuous
3. No plastic anchors
4. Coat/robe hooks inside of each stall

2.2 Cubicle Curtains & Track -

A. Track is CFCI - Imperial IFC track #98 White supported from ceiling grid utilizing Imperial IFC #98 White swivel click suspension system.

2.3 Curtain is OFOI by NCH vendor.

10.26.00 – Wall and Door Protection:

PART 1 GENERAL

1.1 Wall Corner Guards (CFCI)

- A. White color with 3" exposed edge on each side with Integrally colored plastic type .080 thick
- B. Concealed Aluminum Retainer.
- C. Start guard above wall base and extend 6' minimum height.
- D. InPro or Acroyn only approved manufactures
 - a. InPro - IPC #150BN
 - b. Acrovyn - SM-20AN

1.2 Crash Rails (CFCI)

- A. White Color, 8" Wide Surface Mount with matching endcaps
- B. Concealed Aluminum Retainer
- C. Bottom of Crash rail to be 6" AFF unless otherwise indicated by NCH Project Manager.
- D. InPro or Acroyn only approved manufactures
 - a. Acrovyn – SCR-64 (cont. Alumn. Retainer)Shadow grain texture.
- E. 6" and 5" Also used as alternates if indicated by NCH Project Manager.

1.3 FRP - Protective Wall Covering – (CFCI)

- A. White Color- Include note to provide appropriate Seam, Corner and Cap Moldings as Required.

- B. Embossed Texture, .060 Thick sheet plastic glued to walls.
 - C. IPC, Acrovyn or FIRE X brand glass board preferred or approved equal by NCH Project Manager.
 - D. ¼" Thick Glacier White Corian could be used as an alternate. See NCH Project Manager.
- 1.4 FRP – Impact Resistant Protective Wall Covering- (CFCI)
 - A. Acrovyn High Impact Rigid Wallcovering Sheet. .060 Thick, Velvet Texture #949 White
 - B. Include note to provide appropriate Seam, Corner and Cap Moldings as Required.
- 1.5 Splash Guards FRP - Protective Wall Covering – (CFCI)
 - A. IPC or Acrovyn preferred, typically .060 sheet plastic glued over DW (class A fire rated)
- 1.6 Chair Rail Rub Guards - (CFCI)
 - A. Cut to specified Height 4" -24"
 - B. White .060 Thick
 - C. InPro or Acroyn only approved manufactures
 - 1. Acrovyn – RS-60
 - 2. Ipro #0238
 - D. 12 mm Thick Glacier White Corian could be used as an alternate. See NCH Project Manager.
- 1.7 Door and Frame Protection – (CFCI)
 - A. Door Guards – Height 48" wrap around door and to be fitted with guard to prevent binding.
 - B. InPro or Acroyn only approved manufactures
 - 1. Acrovyn
 - 2. Ipro #1748

10.28.13 – Toilet Accessories:

PART 1 GENERAL

- 1.1 Items that are contractor furnished – contractor installed.
- 1.2 Grab rails – CFCI
 - A. Satin finish stainless steel, 1-1/4" max outside diameter, standard configurations (ada) typical. No peened grip rails to be specified. Indicate lengths and heights in drawings.
 - B. Bobrick b-5806 or American Specialties 3700 series or approved equal.
- 1.3 Restroom cell phone shelf – CFCI
 - A. Bobrick - b-295x16 stainless steel shelf. (4"d x 16"l)
- 1.4 Toilet paper holders – CFCI
 - A. NCH standard - compact quad vertical roll coreless tissue dispenser, (Georgia Pacific #56747a), surface wall/stall mounted, show and tag on elevation /plans. Faux stainless steel
- 1.5 Approved alternates - discuss with NCH Project Manager
 - A. Compact Side-By-Side Double Roll Bathroom Tissue Dispenser, (Georgia Pacific #56797), surface wall/stall mounted, show and tag on elevation /plans.

- B. Compact Vertical Double Roll Bathroom Tissue Dispenser, (Georgia Pacific #56767), surface wall/stall mounted, show and tag on elevation /plans.
- 1.6 Toilet Seat Covers – CFCI
 - A. Public restrooms only. Health Guards Toilet Seat Cover Dispenser, #HG-1-2, White plastic, half- fold dispenser. Typical installation with double-sided tape. Quantity as determined; show and tag on elevations/plans.
- 1.7 Hygiene Disposal Receptacle – (CFCI)
 - A. Rubbermaid Commercial Products Sanitary Napkin Receptacle: Wall-Mounted, 10 3/4 in Wd, 12 1/2 in Ht Model FG614000WHT -(Granger #3U933)
- 1.8 Mirrors – (CFCI) Individual Units (i.e. No full wall mirrors) – Satin SS edged, metal backed, no shelf, concealed fastener/clip system.
 - A. Restroom Sink Mirror (Non Lighted) 24 “x 42” - Stainless steel Satin finish frame, CHAN LOK - #6020-2442 or approved equal
 - B. Restroom Sink Mirror (Backlighted) Bradley 7B1 Elvari Mirror - 7B1-5024360 24”Wx 36”X 1.6”D - 120-277V , 50/60Hz
 - C. Restroom Sink Mirror (With Shelf) 24 “x 42” - Stainless steel Satin finish frame, Bobrick B166 or similar.
 - D. Full Length Wall Mirror (Lactation Room and Others) – 24 “x 60” - Stainless steel Satin finish frame, CHAN LOK -#6020-2460 or approved equal
 - E. Full Length Wall Mirror (Gowning and Others) – 18 “x 60” - Stainless steel Satin finish frame, CHAN LOK -#6020-1860 or approved equal
- 1.9 Baby Changing Station – CFCI
 - A. Horizontal Surface-Mount Installation – Koala Kare Products #KB200-05 – White Granite Finish
 - B. Locations and quantities are to be confirmed with NCH Project Manager as typically more frequent than code driven.
- 1.10 Adult Changing Table – CFCI (Please Note: Restrooms that have adult changing tables shall have automatic door openers installed)
 - A. Surface-Mount Installation – (GC to provide power and blocking)
 - B. Koala (KB3000-AHL)
 - C. (Approved Alternate) Pressalit Care Nursing Bench 3000 #R853902
 - D. Verify with NCH Project Manager for locations and quantities.
- 1.11 Environmental Services Mop Holder (CFCI) – Must have holders and Shelf. (36min Length)
 - A. Bradly # 9934
- 1.12 Bench (CFCI)
 - A. Scranton Products, Tufftec Benches 42”W X 20”D X 18”H - Color Sandcastle.
- 1.13 Sanitary Napkin Dispensers (CFCI) – Verify with PM on per-project basis
- 1.14 Single Robe Hook (CFCI) - Bobrick Classic Series Surface mounted Robe Hook B-6717 Satin Finish

- 1.15 Single Towel Hook (CFCI) - Bobrick Surface Mounted Towel Pin -B-6777 Satin Finish.
- 1.16 Items that are owner furnished – contractor installed. See FFE schedule
- 1.17 Soap Dispensers – OFCI
 - A. "Ecolab - Disposacare 540ml" typically an 800 ml surface mounted type, approximately 10" high and 4.5" wide, projects approx. 3.5" from wall. Typical mounting with plastic drywall anchors; typically one dispenser per lavatory or sink; show and tag on elevations/plans.
- 1.18 Paper Towel Dispensers – OFCI
 - A. Multi-Stall Restrooms – "enMotion 8" 1-Roll Automated Roll Towel Dispenser" (Georgia-Pacific #59437A) 1-roll type, battery operated, surface wall mounted (13.063"W x 9.063"D x 14.875"H).
 - B. Single stall and single lav. /sink locations – Multifold Paper Towel Dispenser" (Georgia Pacific 54701) Multi-Fold painted steel; quantity as determined; surface wall mounted, show and tag on elevations/plans.
 - C. Single stall and single lav./sink locations – Combination C-Fold/Multifold Paper Towel Dispenser" (Georgia Pacific 56601) C-Fold/Multi-Fold, painted steel; quantity as determined; surface wall mounted, show and tag on elevations/plans.
 - D. Patient Rooms and D-Building in general – enMotion Automated Touchless Paper Towel Dispenser, Semi Recessed Stainless Steel finish.

10.43.13 – Defibrillator Cabinets:

PART 1 GENERAL

- 1.1 AED are OFCI. Verify with Project Manager location. AED Cabinets are Semi Recessed in new build locations and surface mounted in retrofit locations. See master device elevation sheet for AED and Sign Mounting Height
- 1.2 Provide AED defibrillator cabinets in on-stage public areas. Final locations to be verified by NCH Project manager and Biomedical Engineering in conjunction with established NCH standards and with input from CCE. Employee Health & NCH Code Blue Committee, with input from NCH QIS. AED do not need to be placed where a defibrillator is accessible within a 3-minute response time.
- 1.3 AED are to be provided and installed throughout NCH owned facilities including main campus and offsite locations. For non-NCH owned offsite facilities; the facility owner is responsible for providing and maintaining and AED.
- 1.4 AED to be located by elevators with standard signage. If elevators are not present in the building, AED to be installed in lobby or entry of stairwell. Placement strategy noted below.

AED Standard Placement: Installed by the elevators. If elevators do not exist, AED installed in lobby or by stairwell. Signage to accompany AED.		
Floors	AED Floor Placement	# of AED
LL	1 on LL	1
1	1 on 1	1
2	1 on 1	1
3	1 on 1	1
4	1 on 1, 1 on 4	2
5	1 on 1, 1 on 4	2
6	1 on 1, 1 on 4	2
7	1 on 1, 1 on 4, 1 on 7	3
8	1 on 1, 1 on 4, 1 on 7	3
9	1 on 1, 1 on 4, 1 on 7,	3
10	1 on 1, 1 on 4, 1 on 7, 1 on 10	4

1.5 One AED defibrillator location covers +/- 2 floors

1.6 All AED requests must be requested through Construction Purchasing. Ongoing lifecycle management of the devices and supplies will be funded by Biomedical Engineering Services. No Extra batteries, cases etc. are to be ordered with the AED by CP.

PART 2 PRODUCTS

2.1 Defibrillator Cabinets: OFCI

A. New Build (Semi – Recessed) - Model #8000-001257

B. Retrofit (Surface Mounted) - Model #8000-001256

2.2 Defibrillator Signs: OFCI (both new build and retrofit)

A. AED Wall Sign Kit, One Flush and One 3-D Sign – Model # 8000-0825

2.3 Defibrillator Unit: OFCI (both new build and retrofit)

A. ZOLL AED BLS Model # - 8503-001103-01

10.44.00 – Fire Protection Specialties:

PART 1 GENERAL

1.1 Fire extinguishers and cabinets are contractor furnished and contractor installed.

1.2 Fire Extinguisher Cabinets and ABC Fire Extinguishers (CFCI) – Larsens or Equivalent (White Steel)

A. Steel Semi Recessed Cabinet with 2 ½” Rolled Edge.

B. Vertical Duo Door with Clear Tempered Safety Glass (No Lock) (Vertical Skinny Door Half-light window)

C. Plain Metal Door (No Lettering)

D. (2) Red Lettering Decals (One applied each side of cabinet, perpendicular to the wall. Decals shipped loose and applied by contractor.)

E. Provide Applicable directional Signage on wall above cabinet that is installed by contractor.

See master mounting height sheet for applicable location.

F. If cabinet is hidden and not easily visible, Contractor shall provide applicable tent signage to increase visibility.



PART 2 PRODUCTS

- 2.1 Larson 2409-6R Semi Rec. 2.5" (RO Dimensions 25" x 10 ½" X 4") or appropriate size cabinet based on code.

A. Furnish with ABC type Fire Extinguisher (unless different type is required due to specific project needs) with date/approval card, and certified at building turnover for the following (12) month period. Amerex Aluminum Valve or approved equal.

- 2.2 Exterior Lock Box

A. Electronic access, exterior lock boxes (aka Knox Box) shall be provided at all new builds, in compliance with local AHJ requirements.

10.51.00 – Lockers:

PART 1 GENERAL

- 1.1 Lockers are contractor furnished and contractor installed.
- 1.2 12"x18"x36" Double Stack Steel lockers with Ventilated/Louvered Doors (Small Louver at Top of Door/ Not Full Door Louver). 16 Ga Cold Rolled Steel Door and Body, Continuous "Piano" Style Hinge, Recessed Handle meets ADA requirements. Will accept padlock.

A. Finish End Cover Panels and infill strips to be provided by locker manufacturer to close off gaps. 4" tall Z base is provided by locker manufacturer. This should allow a recessed toe kick. Laminate vinyl wall base on top of metal locker base. Locker numbering starts at 100 for the ground floor and 200 on second floor.

- B. Design professional should indicate on documents that the adjacent floor finish and base continues under the lockers. If lockers are removed the integrity of the floor is maintained.
- C. Sloped top must be provided by locker manufacturer. Unless GWB soffit is provided.
- D. Color to match LYON COLOR AA ASH – No Other colors allowed unless approved by NCH PM.
- E. Single Tier Lockers are allowed with Laminate top. Discuss with NCH Project Manager

- 1.3 PDQ Qwik-Ship Lockers by Republic Storage Systems, LLC. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- A. Penco Products, Inc.; Guardian Lockers.
- B. Lyon Workspace Products, LLC; Standard Lockers.
- C. DeBourgh Mfg. Co.; Worley Lockers
- D. Art Metal Products; maintenance-Free Quiet KD Lockers.
- E. Hadrian Manufacturing Inc.; Emperor Lockers.
- F. List Industries Inc.; Standard Quiet KD Lockers.

10.57.00 – Wardrobe and Closet Specialties:

PART 1 GENERAL

- 1.1 A/E to coordinate and indicate items on documents. Include dashed drawing and general note indicating blocking for all accessories.
- 1.2 See FFE schedule for additional information

10.82.00 – Grilles and Screens:

PART 1 GENERAL

- 1.1 All – typically anodized or powder paint finished – verify based upon exterior aesthetic.
- 1.2 Exterior Applications – All Intake and Exhaust Grilles, Louvers and Screens to have nylon insect netting on the inside face, and metallic bird screen on the interior face.

10.82.01 – Wall Mounted Shelving (CFCL):

- 1.1 All wall mounted shelving is ¾" thick white melamine with all ends finished. Depth to be determined by project manager.
- 1.2 Shelf track and brackets to be white heavy duty dual slot track. Single slot track and bracket not acceptable due to durability.

DIVISION 11: EQUIPMENT

11.05.00 – Common Work Results for Equipment:

PART 1 GENERAL

- 1.1 Where applicable – Refer to and utilize current AEP Gridsmart Business Energy Efficiency requirements and strategies (Prescriptive, New Construction, Custom or Whole Building) to meet rebate incentives and to reduce long term energy costs and consumption.

11.30.13 – Residential Appliances:

PART 2 PRODUCTS

- 2.1 Refrigerators are OFCI. All refrigerators should NOT have ice and water dispensers in the door or within the unit. All Staff should use the separate Ice and water dispensers located on counters and not within appliance units.
- 2.2 Dishwashers utilized for toy / equipment cleaning to be NSF Certified / ANSI 184. Kenmore Ultra Wash Smart is one example that meets this specification, when Sanitize Rinse Option is utilized. Verify casework fitment. Reference NCH policy 160F required.
- 2.3 Dishwashers for clinical areas only. Not intended for staff convenience.

11.46.83 – Ice Machines:

PART 2 PRODUCTS

Follet Brand Ice/Water machine only brand allowed. NO EXCEPTIONS.

- 2.1 No internal filters to be ordered with the machine. External filter outlined below.
- 2.2 Breakroom – staff consumption ice machines (OFCl) – NCH PM chooses size based on project.
- 2.3 (Most typical for breakrooms of all sizes) Medium Size (12 LB Capacity 150 servings per day – 35 People) Symphony Plus Ice and Water Dispenser by Follet Corporation 12CI425A-S Sensor safe with Chewblet Ice. (Nominal size; 16” W x 24” D x 33” H) Required Accessories : Base stand with 4” leg kit. No Internal Filters.
- 2.4 Large Size (15 LB Capacity – 160 servings per day – 50 People) 15 Series Chewblet ice machine countertop ice and water dispenser. 15CI100A-IW-NF-ST-00
- 2.5 Small Size (7 LB Capacity – 140 servings per day – 25 People) 7 Series Chewblet ice machine countertop ice and water dispenser- 7CI00A-IW-NF-ST-00
- 2.6 All ice machines must indicate the following in the documents.
 - A. All ice/water dispensers to have separate filter system attached to water line prior to connection to ice/water dispenser. This is (CFCl). Please see specification section 22.32.00 for filter requirements. This needs to be in the construction documents and located below the sink for access.
 - B. Ice Machine must be hard piped with PVC with separate supply line shut off.
 - C. **Backflow preventer required – ASSE 1024 - This is (CFCl).** Please see specification section 22.05.23 for backflow preventer requirements.
 - D. Drain pipe to be minimum ½ inch PVC. Airgap and Hub Drain to be above the counter set above countertop.
- 2.7 Lab/PT/OT – bulk ice machines. Not for human consumption (OFCl)
 - A. Follet Maestro Plus UFD414A80 Flake Ice maker on Legs (Chewblet Version also available UFD414A80)
 - B. Drain line Hard Piped PVC to Floor Drain with Air Gap
 - C. Ice Machine must be hard piped with PVC with separate supply line shut off.
 - D. Backflow preventer required – This is (CFCl). Please see specification section 22.05.23 for backflow preventer requirements.

11.71.00 – Medical Sterilizing Equipment:

PART 2 PRODUCTS

- 2.1 Sterilizers / Autoclaves – Use direct steam injection machines utilizing NCH central plant steam. Primus or Consolidated brands. Do not use Getinge or Amsco/Steris. Discuss offsite locations with NCH PM.

11.72.00 – Examination and Treatment Equipment:

PART 1 GENERAL

- 1.1 Code “Blue” Crash Carts – Size = (As you look at the front of the cart): 47”w x 26”d x 74” h, cart requires an adjacent wall receptacle for charging on board equipment

DIVISION 12: FURNISHINGS

12.20.00 – Window Treatments:

PART 1 GENERAL

- 1.1 (OFOI) under a separate contract.

12.46.00 – Furnishing Accessories:

PART 1 GENERAL

- 1.1 Sharps containers, glove box holders, etc (OFCI) SEE FFE SCHEDULE -See master mounting height sheet for additional information.
- 1.2 Hand Foam Sanitizers (OFCI) SEE FFE SCHEDULE- See master mounting height sheet for additional information.

A. Verify locations with NCH Project Manager.

DIVISION 13: SPECIAL CONSTRUCTION

13.20.00 – Special Purpose Rooms:

PART 1 GENERAL

- 1.1 Verify – typical Architect’s specifications
- 1.2 A.I.I. Room (Airborne Infection Isolation) – Requires adequate enclosure detailing to allow for proper “delta P”.
- 1.3 PE Room (Protective Environment) – Requires adequate enclosure detailing to allow for proper “delta P”.

DIVISION 14: CONVEYING EQUIPMENT

14.20.00 – Elevators:

PART 1 GENERAL

- 1.1 Verify - typical Architect’s specifications
- 1.2 Elevator pits to be poured concrete (no exceptions). Exterior bentonite waterproof membrane (5-sided); submittals are required. Provide exterior perimeter foundation drain pipe set in granular bed.
- 1.3 Elevator Equipment and Controls

- A. Elevator Doors: Brushed Stainless Steel hoistway entrance framing & doors typical.
- B. Elevator In-Cab Control Panel: NCH to review/approve shop drawing for controls layout and all button tags. All keyed switches (ex. fans, access panels, fireman override, phase 1 & 2, etc.) should be standardized and reviewed by NCH prior to releasing the vendor for production.
- C. Elevator Communication: Elevator manufacturer/contractor shall provide code required two way video/ voice communication device. Device should be concealed with an engraved cover in the elevator cab. The elevator contractor should provide, mount and terminate within the elevator equipment room network jack(s) for connection to a 24/7 manned communication station.
- D. Travel cable conductors: Confirm with NCH project manager the quantity and type of copper and fiber conductors for both Day 1 use as well as future capacity/spares. Coordinate conductor travel cable conductors with owner.
- E. Interior walls: stainless steel or plastic laminate, confirm material and finish selection with NCH.

14.92.00 – Pneumatic Tube Systems:

PART 1 GENERAL

- 1.1 Pneumatic Tube Systems should be on the Nexus platform
- 1.2 Swisslog – TransLogic 6" diameter, multi-zone system – Contact Swisslog at 303-576-8906, Larry Bray for system details, verify with NCH all proposed components. Recessed Stations typical.
- 1.3 Equipment and start-up – Owner furnished, vendor installed (OFVI). NCH contract direct with Swisslog. New and reworked stations and devices are to be equipped with latest RFID modules from Swisslog.
- 1.4 Coordination is required during design between A/E team and Swisslog to assure location and utilities are planned appropriately.

DIVISION 17: SUSTAINABILITY STANDARDS AND GUIDELINES

17.00.00 – Vision:

PART 1 GENERAL

- 1.1 NCH is dedicated to enhancing sustainability across all our facilities. Our goals include maintaining an Energy Star Score of 75 or higher and reducing greenhouse gas emissions. To achieve this, we will integrate the Sustainability Standards and Guidelines into all building projects, to be used in conjunction with our standard design guidelines. Design professionals are expected to define the approach and incorporate sustainable design as part of their service.

17.00.10 – Guiding Principles:

PART 1 GENERAL

- 1.1 Provide a healthier environment for all occupants while lowering life cycle costs and reducing the environmental impact during design, construction and operation.
- 1.2 Design intelligent, economically prudent projects that reduce energy consumption while increasing the comfort, health, and safety for patients, families, and associates.
- 1.3 Decisions will be driven by:

- A. Balancing initial and long-term operating costs.
- B. Reducing energy consumption.
- C. Maximizing efficiency through energy management strategies.
- D. Incorporating environmentally friendly design principles

17.00.20 – Definitions:

PART 1 GENERAL

- 1.1 Energy Management: Energy managers, also known as energy modelers or energy engineers, design, develop, or evaluate energy-related projects or programs to reduce energy costs or improve energy efficiency at all stages of a building’s life, including the design/build, remodeling, and operation stages. NCH has an energy manager on staff that the NCH project manager can consult with and connect with the design team as needed to help advise on energy and sustainability aspects of the project.
- 1.2 Life Cycle Cost Analysis (LCCA): LCCA is a process of evaluating the economic performance of a building over its entire life. Sometimes known as “whole cost accounting” or “total cost of ownership,” LCCA balances initial monetary investment with the long-term expense of owning and operating the building.
- 1.3 Budget Alignment: Process of ensuring that the project’s allocated budget is closely matched and consistent with project’s scope goals, and deliverables.

17.30.00 – General Requirements:

PART 1 GENERAL

- 1.1 This section is applicable to all project categories.
- 1.2 All NCH projects must have a defined sustainability approach. However, not all projects will be expected to achieve the same results and applications will be based on project details and project types (see Guidelines vs. Standards chart at the end of this Division).
- 1.3 Project categories at the end of this division outline Standards (Required) and Guidelines (Optional) for sustainability measures to be utilized in each type of project.
 - A. New Construction – NCH Owned Properties
 - B. Renovation – NCH Owned Properties
 - C. NCH Leased Facilities
 - D. Infrastructure – Critical infrastructure, replacement of infrastructure needs both on main campus and off-sites.
- 1.4 All projects that affect significant centralized building energy using equipment, shall hold review meetings with the NCH project manager, energy manager, architect, engineers, owner’s representative, facility maintenance personnel, and commissioning agent (if applicable) to review these design standards and guidelines to set project goals and outcomes. Review meetings should occur at each of these stages of the project: (a) During Schematic Design (SD) phase, (b) prior to bidding when construction documents are nearly finished, (c) at the conclusion of construction with close out documents.

A. Projects that are exempt from this are: cosmetic update only projects (finishes only, not moving wall or modifying any MEP systems), parking lots, medical equipment replacements, or planning projects prior to schematic design.

- 1.5 Cost benefit/Life cycle analysis: There are multiple areas in this document where a cost benefit or life cycle cost analysis is recommended before a decision is made. This analysis should be documented, in a memo, even if it is done through simple calculations. This is especially important when eliminating energy efficient equipment for “budget alignment”. The analysis documentation, completed by the A/E/C team, should at minimum consist of the following:

A. Key assumptions that impact economics

B. Impact on site energy consumption of the site – increase or decrease in the energy cost. Use energy costs of \$0.07/kWh and \$5.00/MMBtu – contact the energy manager for better energy cost estimates.

C. Results – payback and/or life cycle costs impact, recommended decision.

- 1.6 A life cycle cost assessment should be issued before implementing “Budget Alignment” that impacts energy and water efficiency.

A. Controls features should not be removed during budget alignment because this significantly limits the ability of the new equipment to operate efficiently and achieve the intended results.

B. The impact of removing an efficiency feature should be calculated with a holistic approach.

- 1.7 NCH has outlined sustainable building operations and maintenance practices for implementation into projects.

A. Building Energy Management

1. Building envelope related energy efficiency features considered by the design team or suggested by the energy manager should be incorporated based on a life cycle cost analysis. Key cost benefit analysis assumption, methodologies, and results should be documented by the design team. Any buildings envelope features that can pay for themselves with energy efficiency in less than a 10-year period should be considered into the building design after discussion with the design and construction, and the designated NCH project’s sustainability team.
2. Energy modeling is required to maximize energy performance and support an integrated design process for new construction projects. For major renovation projects, energy modeling will be required if there will be a significant impact on building envelope, energy plant equipment, or large HVAC systems. Energy modeling activities shall be performed by a professional engineer.
3. Mechanical and electrical energy efficiency features, including equipment and controls, should be incorporated into the building after a cost-benefit assessment of the features. Key assumptions, methodology, and results should be documented by the design team.

- a. Any energy efficiency features that can pay for themselves with energy efficiency in less than a 5-year period should be considered into the building design after discussion with the design and construction, and the designated NCH project's sustainability team.
- 4. Building Energy Efficiency Features: Within the sustainability implementation plan, the design team should provide a bullet-point list summarizing all intended energy efficiency features that exceed current code requirements. This list should be provided to the owner prior to finalizing the schematic design
- 5. Building Automation Systems (BAS) shall monitor the following:
 - a. Electricity usage
 - b. Steam usage (if applicable)
 - c. Hot water usage (if applicable)
 - d. Chilled water usage (if applicable)
 - e. Water usage (building level)
- 6. All new construction should be designed to at least meet NCH's energy goals and should aim for an Energy Star Score of 75 or above.

17.50.00 – Architectural Design:

PART 1 GENERAL

- 1.1 New building designs shall take advantage of passive solar design features when determining layout and envelope.
 - A. Consider orienting the building on an elongated east-west axis to maximize daylight availability and minimize summer solar heat gains.
 - B. Site selection shall result in increased greenspace and plant materials post development.
 - C. During due diligence of site selection, discussions shall be had around potential orientation of building to be able to utilize passive solar design as much as possible.
- 1.2 Entryway Vestibules:
 - A. All public entries should have vestibules to reduce infiltration rates.
 - B. Doors in the vestibules should aim to minimize the hot/cold draft in the entrance areas. This can be accomplished by two sets of doors with air sealing and by off-setting doors or utilizing air curtains. Designs should consider wind patterns in relation to seasonal prevailing winds and the orientation of the building.
- 1.3 Establish daylight design criteria before schematic design is complete so that public and staff spaces have maximum potential for daylight availability. Utilizing daylight is not only energy efficient but also results in increased productivity and "feels healthier" to occupants.
 - A. Wherever feasible consider incorporating shading elements that also function as light shelves, on windows located on south-facing facades to maximize daylight penetration.
 - B. Maximize window widths and window header heights to maximize daylight penetration depth into spaces.

- C. Account for benefits of shading in the design, including impacts on reduced HVAC system sizes and benefits to occupant comfort.
 - D. Coordinate with HVAC and Electrical Engineers to provide life cycle cost analysis to determine best options for daylighting.
 - E. Consider and evaluate the use of programmable occupancy sensors (for both intensity and duration) where feasible for lighting. Suggested locations include private offices, stairwells, supply closets, break areas and mechanical spaces. Ensure that there is adequate coverage and spacing for each area.
- 1.4 Insulation: Consider using a higher R-value than required by code. Perform an energy cost analysis using a higher R-value to determine what the savings and Return on Investment (ROI) would be over 10 years to help make decisions.

17.60.00 – Plumbing Design:

PART 1 GENERAL

- 1.1 Landscape irrigation: aim to reduce water used for landscaping
- A. Landscape design shall use plants that are in balance with local climate and require minimal irrigation.
 - B. Water that does not go to the sanitary sewer (i.e. irrigation, cooling tower supply) must have deduct meters installed to obtain sewer credit from the water supplier and easily accessible exterior controllers.
 - C. Use drip, micro misters or sub-surface irrigation systems with smart controllers throughout. Rainbird IQ system is preferred.
 - D. All landscape areas shall be mulched to conserve moisture at the soil surface to reduce need for irrigation during limited rainfall periods.
- 1.2 Water metering and sub-metering: Provide sub-meters by building or addition. All meters shall be integrated with the building automation system. Register all new sub-meters that have been installed with appropriate water jurisdiction to ensure water is deducted based on what it is feeding.
- 1.3 Total building water usage monitoring shall be integrated into the building automation system for new construction.
- 1.4 Refer to sections 22.42.13, 22.42.16, 22.42.23, and 22.42.39 for plumbing fixture guidance. Provide high efficiency plumbing fixtures to reduce water usage where possible.

17.70.00 – HVAC Design:

PART 1 GENERAL

- 1.1 Controls and Sequence of Operations - Special attention should be paid to the control sequences to utilize all the efficiency features of the equipment that has been specified. Ensure that all applicable energy code sequences are included and planned for in the documents.
- A. Controls contractor to verify with NCH project manager, building and space level HVAC occupancy setback schedules. These schedules shall be implemented before go-live. In cases

where entire air handlers cannot be scheduled off during unoccupied times, each VAV box which serves a variable occupancy zone shall have unoccupied schedules implemented.

- B. The building automation system (BAS) shall control all major equipment in the building including baseboard heaters, cabinet unit heaters, exhaust fans, etc., with possible exceptions granted for cases of small equipment
- C. VAV Reheat control shall be programmed with “dual-maximum” control strategy which is more efficient.
- D. Economizer sequence and setpoints should be clearly defined and at minimum should be outside-air dry-bulb temperature based. Enthalpy based economizer sequence can be used in conjunction with outside-air dry-bulb temperature if desired.
 - 1. Single fixed enthalpy based economizing sequence should not be used.
- E. Cooling tower control sequence shall at a minimum utilize wet-bulb based control strategy instead of a fixed setpoint. In this approach, the condenser water setpoint is controlled to be equal to the outside air wet bulb temperature plus an adjustable approach temperature. (CT-setpoint°F = Outside air wet bulb°F + Approach°F).
 - 1. We have found Twb + 7°F to typically be the optimum strategy for central Ohio.
 - 2. The condenser water temperature setpoint low limit should match the low limit specified by the chiller manufacturer.
 - 3. More advanced condenser water control strategies may be considered.
- F. Variable speed supply fans controlled with duct static pressure sensors shall have setpoints determined by testing and balancing contractor and coordinated with controls contractor to verify airflow meets design.
- G. BAS analytic/fault detection software shall be installed for all centralized HVAC equipment (air handler's, pumps, chillers, boilers, exhaust fans) and owner specified building locations.
- H. Supply air temperature setpoint reset sequences shall be implemented unless a critical process requires a fixed setpoint. This reset sequence can be either outside air temperature based or based on damper positions of the connected VAV boxes.
- I. For renovation projects, the design team and controls contractor shall review all existing occupancy schedules, setpoints, and sequences with facility staff for any equipment being replaced or modified to ensure proper function of new equipment.
- J. The design documents shall include a list of data points to be trended within the building automation system (BAS). This list shall include all major HVAC and lighting equipment including stand-alone equipment such as fans, unit heaters and computer-room units. The list should also include any specific requests made by the owner.
- K. Large HVAC zones with multiple VAV boxes utilize one DDC sensor or average multiple sensors to minimize simultaneous heating/cooling

1.2 Cooling Systems:

- A. For data center or telecom rooms, the design team shall assess the following approaches for economic feasibility:

1. Dedicated HVAC systems that won't impact unoccupied schedules elsewhere in the facility or require chilled water from the central plant (typically disabled below 50°F outdoor air temperature).
 2. Selecting high efficiency CRAC units (if applicable)
 3. The design team should also provide a recommended setpoint table that shows cooling setpoints based on the type of computer equipment in the space. Depending on the equipment, server/telecom rooms may be kept as warm as 80°F without any issues.
- B. Central chilled water systems shall be considered through life cycle cost analysis for all facilities with process cooling loads.
- C. Chilled water plants should be designed with life cycle costs in mind. Elements that should be considered include:
1. Higher efficiency chillers (water, air cooled or ground-coupled). Magnetic bearing chillers are preferred.
 2. Variable speed chilled water pumps.
 3. Variable speed cooling towers with higher rated GPM per HP. These towers will have lower hp for the same capacity requirements but may result in a larger size/surface area. Fixed set-point cooling tower control is not acceptable for new systems.
 4. Size chilled water piping to maintain best practice fluid velocities. This could result in larger pipes with smaller pump power requirements and could provide room for future expansion.
 5. Chilled Water (CHW) distribution systems should be designed with two-way valves (air handlers and similar coils) with limited and controlled by-pass. This will avoid low delta T issues at the chiller while reducing pumping energy use. Recommend at least 12 degree delta T and 42°F baseline for chilled water supply.
 6. Chilled Water Supply Temperature Setpoint (CHWST STPT) reset should be considered (example: 42°F at OAWB of 70°F and 48°F at OAWB of 50°F.)

1.3 Heating systems

- A. Minimize use of electric resistance heating systems as much as possible. When required, these heaters shall be controlled through a BAS and control sequences should be specified to minimize the use of electric resistance heaters.
1. Outdoor air dry bulb shall be ≤ 40 degrees to enable heaters.
 2. Set as back up to primary heating.
 3. Example - electric baseboard heaters should be controlled with an offset to the primary heating source in a zone. Sequence should have these units as being "OFF" unless certain outside air dry bulb (OADB) threshold is met.
 4. If a VAV box serves the same space, ensure they cannot operate in dissimilar modes (simultaneous heat and cool).
- B. Hot water heating plants should be designed with life cycle costs in mind. Elements that should be considered include:

1. Condensing boilers to provide the required heating capacity with appropriately designed end use system. It is imperative that condensing boilers designed with return hot water temperature below 130°F, and ideally reset down as low as 100°F. New construction only: If these setpoints cannot be met, condensing boilers should not be used.
 2. Heating coils and zone terminal heating systems shall be designed to operate with lower hot water temperatures (130°F or lower is ideal) that could be achieved through heat pumps, heat recovery or with fully condensing boiler operations. Ensure that the added cost of deeper / larger coils is included in LCCA.
 3. Design hot water systems with a minimum of 30°F dT across all coils.
 4. Select boiler controls capable of automatic O₂ trim to optimize combustion efficiency across the boiler's firing range. Fixed linkage controls are not acceptable.
- 1.4 Ventilation: Review the latest ventilation guidelines specific to the facility type and provide detailed ventilation calculations for each zone of the building showing ventilation effectiveness multipliers used, including the basis of design reference. Ventilation calculations should be issued on the drawing set prior to the completion of design development drawings.
- 1.5 Humidification
- A. Humidification is very energy intensive and should be limited where possible
 1. Avoid grouping zones with and without humidification requirements on the same air handler.
- 1.6 Air Systems
- A. Constant volume air handling systems serving multiple zones should not be acceptable unless the unit is a dedicated outside air unit, or the areas being served are required to be constant volume to maintain air changes or space pressure relationships.
 - B. For systems served by traditional air handling unit systems (including VAV), combine thermal zones that have similar ventilation requirements, loads, and schedules into groups served by the same air handling unit (AHU) or roof top unit (RTU) system.
 1. Utilize for operating rooms and spaces with high air changes per hour (ACH) requirements.
 2. Group spaces that have a high occupant diversity factor. The HVAC systems shall be designed to set back or shut off when these zones are unoccupied.
 3. Consider stand-alone/single zone systems for sensitive areas that require 24/7 operation (example: pharmacy). These spaces should not be grouped with zones that are not 24/7 if possible.
 4. Ensure that spaces that have similar temperature / humidity and air change requirements or similar units are grouped together.
 - C. The design teams should take the following into consideration when designing any systems with air handling unit (AHU) and/or roof top unit (RTU):
 1. Economizers: design all units with economizers per Energy Code.

2. Demand Control Ventilation (DCV): consider for systems serving large zones or groups of zones with high ventilation requirements and variable occupancy patterns (conference rooms, gymnasiums, auditoriums, etc.).
 3. Energy Recovery: Teams should provide added cost for energy recovery if unit is greater than 5,500 cfm and greater than or equal to 30% outside air. An AHU should not have both DCV and energy recovery.
 4. High efficiency cooling: provide the incremental cost of selecting units with high-efficiency DX cooling beyond Energy Code.
 5. Natural gas turn-down ratio: provide the incremental cost of selecting units with higher natural gas furnace turn-down ratio.
- D. For the design of replacement AHUs and/or RTUs, the design team should use current operations information of the spaces served to inform cooling loads, heating loads, air flow and ventilation requirements and capacity of the unit(s). It is highly recommended to use seasonal factors and/or year-round data, if available, or at minimum a few weeks of existing trend data (power or operational) to improve the design sizing assumptions, load calculations, and specified operations.
1. Pre-tabulation work shall be completed prior to completion of schematic design phase if current reports are not available.
 2. Current space information and space type should be used to confirm required outside air requirements for the space. Old design specifications should not be used to set outside air requirements of new air handlers. Teams are required to document outside air calculations for new AHU-RTU on the drawings. NCH facilities to provide documentation needed, if available.
- E. The design teams should take the following into consideration when designing any major exhaust systems such as fume hoods in labs:
1. Utilize pressure-sensing flow control VAV valves in zones. VAV valves should report airflow measurements to the central BAS.
 2. Utilize low-face velocity fume hoods whenever possible.
 3. Utilize demand or occupancy-based controls, along with movable sashes, for fume hoods that decrease exhaust airflow when the sashes are closed.
 4. The zone VAV system should modulate airflow in response to changing airflow needs of the fume hoods to maintain required pressure balance in the zone in reference to a relative pressure sensor.
 5. Exhaust fan system shall have the following features: VFDs, verified operating characteristics that are documented on the drawings regarding maximum flow and minimum flow, redundancy, enough static pressure to utilize a HEPA filter in the exhaust airstream, if project requires.
- F. Refrigerant management program for refrigeration and air conditioning shall be established for new building construction. HVAC systems shall contain CFC free refrigerant and be low global warming potential (GWP) where possible.

- G. All fans smaller than 0.5 hp in nominal motor size shall use electronically commutated (EC) motors instead of a permanent split capacitor (PSC) motors. EC motors are significantly more efficient than PSC motors and incremental cost difference is small.
- H. Consider air filtration options for AHUs that minimize static pressure drop across the filter while providing appropriate filter efficiencies, service life, and cost. Guidelines should be provided on when the air filters should be replaced.
 - 1. When considering newer technologies for filters, discuss options with the owner before finalizing.
- I. Dedicated outside air systems (DOAS) shall be furnished with energy recovery devices in all cases.
 - 1. When possible, DOAS units shall include bypass dampers that allow for 100% return air recirculation, bypassing the energy recovery device, and allow outdoor air dampers to be closed during the morning warm-up / cool-down mode.
- J. For units with DX cooling that require reheat, consider hot gas reheat. The unit would have a hot gas reheat coil that uses the hot refrigerant gasses to reheat the air flow which improves overall operating efficiency of the unit.

17.80.00 - Electrical Design:

PART 1 GENERAL

- 1.1 The design team should complete photometric drawings showing the designed lighting levels for each interior and exterior zone of the building prior to the completion of design development documents. This is to verify that lighting levels have been designed for a healthy indoor environment without under or over lighting.
 - A. Provide a table for each space type with the average lighting level from the photometrics and the recommended lighting level based on IESNA lighting standards. Any large variations should be discussed with the energy manager or commissioning agent (if applicable) and the Owner.
 - B. Provide a completed COMcheck form indicating lighting wattage compliance to the energy manager for review prior to the construction bidding process.
- 1.2 Specify both required lighting output (lumens) and lighting efficacy (lumens per watt) for every LED fixture type on the drawings. Fixtures need to meet or exceed these metrics to be accepted for the project.
- 1.3 LED lighting shall be used throughout all projects to reduce electricity usage.
 - A. All LED fixtures should have dimming capability when available.
- 1.4 Design teams should consult with the owner before specifying/installing any third-party central lighting control system as it may not be desirable.
- 1.5 Light pollution reduction: Parking lighting shall be fully shielded, with zero up-light and minimal backlight, to minimize light trespass to adjacent properties.
- 1.6 Building energy sub-metering: Design team shall consult with the project manager to determine if any sub-metering below the building level is required for individual tenant billing or Energy Star purposes.

1.7 Backup Generators:

A. For projects where backup generators are being installed, design teams shall consider EPA tier 4 generators which can participate in demand response and other load curtailment programs to generate revenue for NCH. A life cycle cost analysis should be performed to determine payback compared to less efficient generators (Tier 1 – 3) which cannot participate.

1.8 Electric Vehicle Charging

A. Design team shall discuss EV charging requirements (if any) for the project with the NCH project manager. Feasibility and cost of future EV charging installations should be evaluated when sizing new switchgear or installing other new electrical distribution infrastructure. Costs of upsizing infrastructure to allow for future EV charging installations should be presented to the NCH project manager as an alternate option.

17.90.00 – Standards and Guidelines Application:

Standards (Required) (S) vs Guidelines (Optional) (G)						
Line No	Sustainable Action	New Construction NCH Owned Properties	Renovation NCH Owned Properties	NCH Leased Facilities	Critical Infrastructure	Comments
1	Life Cycle Cost Analysis	S	S	G	S	See specifications for details
2	Energy Modeling	S	G	G	G	Must do for renovation if energy using systems/envelope are modified
3	Passive solar design features	S	S	G	G	Life cycle cost analysis needed to determine best options
4	Day light design criteria	S	S	G	G	Life cycle cost analysis needed to determine best options
5	Insulation – above code minimum	S	S	G	N/A	Architect and contractor to report actual R-value selected/installed
6	Landscape design – use plants from local climate and require minimal irrigation	S	S	G	S	
7	Landscape irrigation – deduct meters for water not going to sanitary sewer	S	S	G	S	
8	Landscape irrigation – water limiting irrigation systems	S	S	G	N/A	
9	Chilled water plant LCCA	S	S	G	S	See section 17 70 00 2d (water-cooled vs. air-cooled, magnetic bearing, variable speed pumping)
10	Hot water heating plant LCCA	S	S	G	S	See section 17 70 00 3 (hot water condensing boilers, hot water supply temperature at 130°F, and O2 trim)
11	Ventilation calculations	S	S	G	S	
12	Air handling unit designs	S	S	G	S	See section 17 70 00 6
13	Refrigerant management program	S	S	G	G	
14	Controls and Sequence of Operations Best Practices	S	S	G	S	See 17 70 00 1
15	Lighting design photometric review	S	S	G	G	
16	BAS analytic/fault detection	S	S	G	G	
17	Electric, Steam, CHW, Water/Sewer sub-metering	S	S	G	S	Design team to consult with NCH project manager to determine if metering below building level is needed
18	Light pollution reduction	S	S	G	N/A	
19	High efficiency plumbing fixtures	S	S	G	N/A	
20	LED lighting throughout building	S	S	G	S	
21	Entryway vestibule design	S	S	G	N/A	See 17 50 00 2
22	Backup Generators - evaluate EPA Tier 4, cost vs. revenue	S	S	G	S	
23	Electric Vehicle Charging	G	G	G	G	
24	Anesthetic Gas Disposal Management	S	S	G	G	

DIVISION 21: FIRE SUPPRESSION

21.05.00 – Common Work Results for Fire Suppression:

See Above Ceiling System Identification Matrix for additional information

PART 1 GENERAL

- 1.1 Recessed, QR and Flexible Fire Suppression heads required for all renovation and new build construction projects. This is to help with above ceiling maintenance access.
- 1.2 Non-Water Based Systems – Verify use with PM - (verify - typical Architect's specifications)
- 1.3 No building feeders, Electrical panels, or Electrical equipment allowed in the same room as Fire Pumps. The room may contain the control panels for the pump and jokey. They must be located away from the pump, opposite walls.
- 1.4 No building feeders, Electrical panels, or Electrical equipment allowed in the water service room

PART 2 PRODUCTS

- 2.1 Heads - semi recessed chrome escutcheon type; QUICK RESPONSE
- 2.2 Heads in Telcom (TR + MER) rooms – Prefer 286 degree Quick Response heads in lieu of 155 degree. Head to be upturned with cage if no ceiling.
- 2.3 MER and TR fire suppression – Dry pipe or dry type fire suppression is not required in TR's, but may be required in certain MER locations. Discuss options with NCH project manager prior to proceeding with design.
- 2.4 Piping - steel, Schedule 40 125# steam rated, 175# WOG, Class 125, screwed joints for 1-1/2" and smaller pipe; Fire Suppression systems 1-1/2" and larger to be grooved pipe and fittings, based on Victaulic schedule 40. No Equal.
- 2.5 Tampers, flows, etc., provided and installed by FPTC, wired by ETC.
- 2.6 Facility Fire-Suppression Water-Service Piping - Fire Department Connections - Siamese Connection to be Chrome Plated Brass.
- 2.7 Gate valve for Fire systems shall be by Kennedy.
- 2.8 Fire Pump Controls by Firetrol.
- 2.9 Fire Pumps – Based on Peerless. Equals by Aurora.

21.09.00 – Fire Alarm Instrument, Detection and Control Systems:

PART 1 GENERAL

- 1.1 Control and Detection System based on Gamewell FCI.
 - 1.2 Control and Detection System to be a separate system from the building fire alarm system, but shall be by the same manufacturer and integrated to allow alarm and points to be visible on the remote operator interface computer.
- 1.3 Control and Detection System shall be fully address type including detectors, actuation, and alarm devices.

- 1.4 Detectors and Notification devices shall be speaker strobes.

21.10.00 – Water-Based Fire-Suppression Systems:

PART 1 GENERAL

1.1 Related Documents

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section
- B. Building Code Referenced Edition of NFPA Pamphlet No. 13 - Installation of Sprinkler System
- C. Building Code Referenced Edition of NFPA Pamphlet No. 14 - STANDPIPE AND HOSE SYSTEMS

1.2 Summary

- A. This section includes the following fire suppression systems:
 - 1. Wet pipe sprinkler systems
 - 2. Dry pipe sprinkler systems
 - 3. Standpipe systems

1.3 Scope

- A. Furnish and install a complete and approved wet sprinkler system. System to be complete with all pipe supports and offsets necessary to clear structure, equipment, ducts and piping.
 - 1. Sprinkler system shall be installed complete with all necessary accessories for proper operation, and in strict accordance with the requirements of NFPA Pamphlet No. 13 and all regulatory agencies involved.
- B. Furnish and install a complete and approved dry pipe pre-action sprinkler systems. Systems to be complete with all pipe supports and offsets necessary to clear structure, equipment, ducts and piping.
 - 1. Sprinkler system shall be installed complete with all necessary accessories for proper operation, and in strict accordance with the requirements of NFPA Pamphlet No. 13 and all regulatory agencies involved.
 - 2. Dry and Pre-action systems shall use tank type air compressors with regulation valves for pressures. NCH will not except Nitrogen Generator systems in conditioned spaces.
 - 3. Garages using Nitrogen Generators to be discussed with NCH Project Manager.
- C. Furnish and install a complete and approved standpipe system. System to be complete with all pipe supports and offsets necessary to clear structure, equipment, ducts and piping.
 - 1. Standpipe system shall be installed complete with all necessary accessories for proper operation, and in strict accordance with NFPA 14 and with the requirements of all regulatory agencies involved.
- D. Furnish and install a complete and approved foam system for the helipad system. System to be complete with all pipe and equipment supports and offsets necessary to clear structure, equipment, ducts and piping.
- E. Fire Pump Room is for Fire Pump and Fire Pump Controller only. No other electric panels are to be installed in the room
- F. Fire Pump floor drain shall be located away from any electrical equipment. All piping to be run to drain

1.4 Submittals

- A. Provide the following:
 - 1. Product data for fire suppression equipment.
 - 2. Piping layout.
 - 3. Hydraulic calculations.
 - 4. Foam System.
 - 5. Fire-hydrant flow test report.
 - 6. Operation and maintenance data.
 - 7. Test Results

1.5 Quality Assurance

- A. The Fire Protection Contractor shall not submit or bid the sprinkler system as a gridded type system.
- B. Sprinkler systems shall be designed and sized hydraulically and according to NFPA Pamphlet No. 13, and the rules and regulations of the Insuring Company and the Local Building Code. (Required for approvals.) See Plans for specific design information, including zoning, flow and density, allowances and head spacing.
- C. Standpipes and fire department hose connection system to be sized and designed according to NFPA Pamphlet No. 14, the rules and regulations of the Insuring Company, and the Local Building Code. Provide minimum pipe sizes when shown on drawings.
- D. Prepare plans and calculations for review by the Construction Manager, the Insuring Agency and the Inspection/Approval Authorities. Documentation to be as specified in NFPA Pamphlet No. 13.
- E. Submit four (4) sets of plans and calculations to the Construction Manager for "Preliminary" review. The Fire Protection Contractor shall address all comments generated by this review to the satisfaction of the Construction Manager, prior to submittal to the inspection/approval authorities previously specified.
- F. Submit four (4) sets of plans and calculations to the Insuring Agency for "Preliminary" review. The Fire Protection Contractor shall address all comments generated by this review to the satisfaction of the Insuring Agency, prior to submittal to the inspection/approval authorities.
- G. After plans and calculations have been reviewed and approved for construction by the code enforcement authorities, provide four (4) sets of the completion documentation with all required stamps and approvals to the Construction Manager for final review and record.
- H. If applicable, wiring diagrams for all items included in the fire protection system shall be submitted for review, along with plans and calculations. This includes manufacturer's standard diagrams for pre-wired elements such as tamper and flow switches.

1.6 Coordination

- A. All work shall be done in a neat and workmanlike manner and this Contractor shall coordinate with all other Contractors on the project and make certain that the installation of this work does not interfere with the proper installation of the other trades.
- B. Unless indicated otherwise at specific areas and/or locations, location of all sprinkler heads shall be determined by the Fire Protection Contractor, as required for protection specified, and final approval.³

- C. All sprinkler heads to be aligned in respect to each other and building structural elements to present a uniform, even appearance.
- D. The Fire Protection Contractor is responsible for locating all sprinkler heads in one of the optional ceiling tile installation points as detailed on drawings for gridded lay-in ceilings.
- E. Location of sprinkler heads by the Fire Protection Contractor is subject to approval by the Architect in review of the "Preliminary" Plans Submittal specified herein. The Architect reserves the right to relocate heads during this review, providing sprinkler protection is not compromised, and no conflicts occur with NFPA or inspection/approval authorities' requirements, as a result of these relocations.

1.7 Extra Materials

- A. Sprinkler head cabinet - provide cabinet, (coordinate location with Construction Manager) with appropriate sprinkler heads and head wrench for emergency use. Sprinkler types supplied to be proportioned to correspond with quantities in Building but have minimum of two (2) sprinklers of each type. Quantities per NFPA No. 13.

PART 2 PRODUCTS

2.1 Above Ground – Pipe and Fittings – Wet Pipe Sprinkler Systems and Wet Standpipe Systems

- A. Pipe shall be Schedule 40 ASTM A53 black steel pipe with extra heavy pattern fittings except as noted below.
 - 1. Standard weight pattern cast-iron screwed fittings 1-1/2 inches in size and smaller shall be permitted where pressures do not exceed 300 psi.
- B. Rolled or cut grooved mechanical fittings by Victaulic Corp. No Equal and shall be used for piping 1-1/4" and over in size. Where applicable.

2.2 Above Ground – Pipe and Fittings – Dry Pipe Sprinkler Systems and Dry Standpipe Systems

- A. Pipe and fittings shall be UL listed meeting NFPA 13 standards, rated for 300 psig service.
- B. Pipe and fittings shall be Schedule 40 ASTM A53 hot dipped zinc coated (galvanized) steel pipe with galvanized cast iron or malleable iron fittings per NFPA Standards.
- C. Compressed air piping shall be standard weight galvanized steel pipe with Victaulic Corp. fittings or threaded galvanized malleable iron fittings. No Equal.

2.3 Valves

- A. Post Indicator Valves provided by Kennedy Valve Corp. Valves to be flanged ends with indicator reading "Open" or "Closed", extension section as required for mounting height of 30" aboveground, angle wrench, counterclockwise opening, painted fire protection red. (Approved type valve.)
 - 1. Valves to be factory tapped for supervisory switch. Fire Protection Contractor shall provide and install supervisory switches on all valves (switches to be approved type).
- B. Gate valves provided by Kennedy Valve Corp. Outside screw and yoke, bronze, wedge disc, screwed gate valves for size 2" and smaller. Flanged for sizes 2-1/2" and larger with iron body and bronze mounted. Counterclockwise opening and not less than 250psi WWP. (Approved type). Use N.R.S. type for P.I.V. assemblies.
- C. Check valves in fire line - approved type, iron body, flanged with brass seal ring, disc, and hinge, 500 psi WWP.

2.4 Specialty Valves

- A. Specialty valves Dry and Pre-action by Victaulic Valve Mfg. No equals.
- B. Double interlocked pre-action system assembly, electrically controlled and operated, shall be complete including, but not limited to, the following items:
 - 1. Rubber seat main check valve
 - 2. Deluge valve which shall be solenoid operated
 - 3. OS&Y control valve (with supervisory switch)
 - 4. Pneumatic actuator for double interlock
 - 5. Testing and operation control and check valves
 - 6. Mechanical emergency release - located near riser
 - 7. Main drain valve - run discharge to floor drain or elsewhere as indicated on drawings
 - 8. Pressure switch for alarm if water enters supply piping in protection area
 - 9. Pressure switch for alarm if supervisory air pressure in dry-pipe system drops 10 psig below maintenance level.
 - 10. Contractor to provide all other pipe, fittings and accessories required for installation approval, testing and operation
 - 11. All pre-action controls as specified in Section 21 09 00, "Instrumentation and Control for Fire-Suppression Systems"
- C. Deluge water spray suppression system, electrically controlled and operated, shall be complete including but not limited to, the following items:
 - 1. Deluge valve which shall be solenoid operated
 - 2. OS&Y control valve (with supervisory switch)
 - 3. Testing and operation control and check valves
 - 4. Mechanical emergency release - located near riser
 - 5. Main drain valve - run discharge to floor drain or elsewhere as indicated on Plans
 - 6. Pressure switch for alarm when water enters supply piping and discharges at protection point.
 - 7. Contractor to provide all other pipe, fittings and accessories required for installation, approval, testing and operation.

2.5 Sprinklers – Wet Systems

- A. Sprinklers heads: Based on Victaulic, NCH approved alternates Tyco, Reliable, Viking, All models shall follow manufacturers size, type, capacity and meeting other requirements.
- B. Upright sprinkler: Based on Victaulic, NCH approved alternate Tyco, Reliable, Viking – Quick Response standard orifice, 1/2" NPT inlet connection, spray type outlet/deflector, and natural bronze finish. "K" factor of 5.6. To be used for protection in areas without concealing structure for supply piping.
- C. Semi-Recessed Pendant Sprinkler: Based on Victaulic, NCH approved alternate Tyco Reliable, Viking - 1/2" quick response orifice, 1/2" NPT inlet connection, spray type outlet/deflector, and adjustable two-piece escutcheon assembly. Sprinkler head and escutcheon to have a polished chrome finish. "K" factor of 5.6. To be used for protection in areas with dropped ceilings where supply piping is concealed.
- D. Tamper Resistant Institutional Sprinkler: Based on Victaulic, No Alternates - Model VK410 with 1/2" NPT inlet connection, tamper resistant construction, and escutcheon assembly. Sprinkler

head and escutcheon to have polished chrome finish. “K” factor of 5.6. To be used for protection in areas where noted on drawings.

- E. Concealed Pendant Sprinkler – Based on Victaulic, NCH approved alternate Tyco Reliable, Viking. All should be Quick Response with ½” standard orifice, ½” NPT inlet connection, drop down deflector assembly, two-piece adjustable escutcheon and cover plate for flush ceiling installation. “K” factor of 5.6. Provide cover plate with Teflon coated manufacturer applied finish, color to match ceiling finish at location installed. To be used for protection in areas with dropped ceilings and concealed supply piping.
- F. In all areas having ceilings with surface mounted light fixtures the Fire Protection Contractor shall install sprinkler heads with two-piece deep escutcheon plates.
- G. Flexible sprinkler connection assemblies: Based on Victaulic, No Alternates Flexible sprinkler connection assemblies shall be Flex Head Model #20XX, Victaulic VicFlex, no equals. Shall be fully welded, non-mechanical fitting type, with minimum 1 inch internal diameter corrugated type 304 stainless steel hose, type 304 stainless steel braided outer cover and collar, 1 inch NPT male inlet and stainless steel or carbon steel 1 inch x 0.5 inches or 1 inch x 0.75 inches NPT female reducer outlet. Seals, when utilized shall be EPDM.,
- H. Ceiling brackets: Based on Victaulic, NCH approved alternate Tyco Reliable, Viking. These shall be direct attachment type having integrated snap-on clip ends positively attached to the ceiling using tamper-resistant screws and a removable attachment hub with a set screw. Ceiling attachment shall incorporate a tamper-resistant label for visual verification of inappropriate removal and relocation. The flexible sprinkler connection assembly shall be UL listed and FM Global approved for fire protection service, and seismically qualified pursuant to ICCESAC-156.
- I. All backflow preventers shall be reduced pressure zone device manufactured by Watts model 957 RPZDA, Equals by Wilkens.
- J. All Fire System pressure gauges shall have ball valve style shut offs before the UL listed pressure gauge. Pet cocks will not be allowed. Valves shall be Apollo series threaded connection.
- K. Sprinkler gauges shall have ball valve shut offs; no Pet cocks allowed.

2.6 Sprinklers – Dry Systems

- A. Sprinklers Heads: Based on Victaulic, NCH approved alternate Tyco Reliable, Viking. The following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor’s option:
 - 1. Reliable, Viking
- A. Upright sprinkler: Based on Victaulic, NCH approved alternate Tyco Reliable, Viking. All Should be Quick Response with 1/2” standard orifice, 1/2” NPT inlet connection, spray type outlet/deflector, and natural bronze finish. “K” factor of 5.6. To be used for protection in areas without concealing structure where supply piping is exposed.
- B. Semi-Recessed Pendant Sprinkler: Based on Victaulic, NCH approved alternate Tyco Reliable, Viking - Quick Response with E-1 escutcheon, 1/2” quick response orifice, 1/2” NPT inlet connection, spray type outlet/deflector, and adjustable two-piece escutcheon assembly. Sprinkler head and escutcheon to have a polished chrome finish. “K” factor of 5.6. To be used for protection in areas with dropped ceilings where supply piping is concealed.

- C. In all areas having ceilings with surface mounted light fixtures, the Sprinkler Contractor shall install sprinkler heads with two-piece deep escutcheon plates in lieu of recessed escutcheon previously specified.
- D. All drum drop valves shall be Apollo Valve, model 77C. No gate valves allowed

2.11 Hose Valves

- A. Hose connections and hose stations based on manufacturer as indicated. Hose connections and hose stations by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Elkhart Brass Mfg. Co., Inc.
 - 2. Fire-End and Croker Corp.
 - 3. Potter-Roemer; Fire-Protection Div.
- B. Field Adjustable Pressure Regulating Fire Hose Valve - Potter Roemer No. 4033-MSA-1 2-1/2" cast brass field adjustable pressure regulating angle valve, furnished with threaded female inlet/male outlet, wheel handle operator, 400 psig pressure rating, monitor switch adaptor, tamper-proof, and polished chrome finish. Provide with No. 4625-D brass cap and chain with polished chrome finish. Outlet threads to be as specified by the Local Fire Department, verified in advance by the Fire Protection Contractor.
- C. Recessed Mounted Fire Hose Valve Cabinets - Larsen Occult Series, Model SSO-3216 valve cabinet with fully recessed steel box, flush mounted stainless steel door and frame with concealed hinge, and matte black finish on steel box surface. Provide door with solid #4 finish stainless steel front, pull handle and die-cut identification lettering. Cabinet size to be coordinated with hose valve size

2.12 Fire Department Connections

- A. Fire department connections based on manufacturer as indicated. Fire department connections by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 - 1. Elkhart Brass Mfg. Co., Inc.
 - 2. Fire-End and Croker Corp.
 - 3. Potter-Roemer; Fire-Protection Div.
- B. Fire Department Connection - Furnish and install sidewalk type polished chrome plated straightway Siamese fire department connections consisting of the following:
 - 1. Double Clapper 2-1/2" x 2-1/2" x 4" Siamese body, 2- 1/2" threads (specifications to be local Fire Department threads) and 4" to be standard pipe thread. Equivalent to Potter Roemer 5845.
 - 2. Sleeve.
 - 3. Sidewalk plate labeled "Automatic Sprinklers".
 - 4. Two - 5" Storz (Model 5795-02) with chains (Model 5799-02).
 - 5. Necessary 4" pipe and fittings to connect as shown on the Drawings.
 - 6. All exposed surfaces to be polished chrome plated.

2.13 Alarm Devices

- A. All alarm devices and Preaction / dry panels must report back to the Operations Command Center, whether the Command Center is First Responder or not. Alarm Devices based on

manufacturer as indicated. Alarm devices by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:

1. Tyco, or Potter
- B. Gate valve supervisory switches, based on Potter - Sprinkler Contractor to furnish and install gate valve and post indicator valve supervisory switches on all shut-off valves and gate valves in the Sprinkler System. All supervisory switches must report to operations panel for monitoring.
- C. Flow switch – Based on Potter Similar to Reliable Model A vane-type Waterflow Detector with pipe saddle, U-bolt, adjustable pneumatic retard to prevent false alarms and two (2) sets of form "C" contacts. All Flow switches must report to operations panel for monitoring.
- D. Pressure switch - Reliable Model J, micro-switch, adjustable range 2-20 psi-proof pressure 300 psi, suitable for open or closed circuits or both and pilot duty, self-setting after each operation. Equal by Potter

2.14 Pressure Gauges

- A. Pressure Gauges based on manufacturer as indicated. Pressure gauges by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option:
 1. Tyco
 2. Grinnell Fire Protection.
 3. Reliable Automatic Sprinkler Co.
 4. Victaulic Co. of America
 5. Viking
- B. Water pressure gauges - 3-1/2" brass pressure gauges similar to Reliable Model UA, Range 0 to 300 lbs. NPT male pipe connection. Install at each Inspector's test connection, alarm valve and elsewhere as required.

2.15 Air Compressors

- A. The Fire Protection Contractor shall provide individual automatic air compressor assemblies required for each air supervised dry-pipe system. The compressor shall be sized for specific installation requirements as determined by the Fire Protection Contractor. Manufacture by Jenny or General Air excepted. The compressor assembly shall be complete as required for system operation, including, but not limited to, the following:
 1. Receiver tank, floor mounted, belt driven compressor unit
 2. Integral pressure switch for compressor control
 3. Pre-piped and wired package assembly for single point connections
 4. Adjustable pressure regulation
 5. Mounting hardware
 6. Fractional HP, 120V-1Ø motor operation
 7. All low air alarms must report to Operations for monitoring of alarms.
- B. The Fire Protection Contractor shall locate and install the compressor assembly at or near the dry pipe riser. Coordinate with structure and work of other trades as required for clearance and access.

2.16 Exterior Drain Downspout Nozzle

- A. Zurn ZANB-199-55 nickel bronze body, threaded inlet, stainless steel screen and decorative face of wall flange and outlet nozzle. Manufacturer and model to match secondary drain downspout nozzle provided by Plumbing Contractor.

DIVISION 22: PLUMBING

22.05.00 – Common Work Results for Plumbing:

PART 1 GENERAL

- 1.1 General notes regarding the plumbing line/fixture flush to be incorporated into the A+E drawings and/or specifications. This process is to occur whether new construction or renovation:
 - A. Contractor shall flush all affected plumbing lines and fixtures (excluding toilets) for (10) minutes within 72-hours of final turn-over to NCH. This includes all showers, sinks, faucets, mop sinks, hose bibs, food service equipment connections, med rooms, etc. – all faucets. See NCH Operations for assistance in setting electronic faucets for this procedure.
 - B. The contractor shall clean-up all showers, sinks, countertops, etc. made dirty as a result of the flushing process.
 - C. Contractor shall ensure all Laminar Flow or Moderators are free of debris prior to being turned over to NCH.
 - D. As per NCH Epidemiology standards, the Contractor is to maintain a log (by room number) documenting the flushing process. The log is to be turned over the Engineering Project Manager when the work is complete.
- 1.2 NCH Campus – Follow Design Guidelines
- 1.3 Owned Offsite – Follow Design Guidelines
- 1.4 Leased Offsite – Follow Design Guidelines
- 1.5 Common Piping and Ball Valve Notes:
 - A. Common water line installation for DCW and DHW ½" thru 4". Domestic Plumbing systems installed for NCH must utilize Viega ProPress fittings and Press Ball valves. The use of threaded ball valves and solder joints will not be permitted. No union ball valves will be allowed. No unions after the ball valve will be accepted. In limited instances, the use of solder joints will be permitted where there is not sufficient access to use the press tool. Prefabbed sections will be allowed as required, providing the tool will fit in the area of work.
- 1.6 Demolition of plumbing – All piping must be returned to the main line and capped. No "dead-legs" are to be left in the system.
 - A. Demolition in construction areas will include removal of all sink and closet carriers not being used. No carriers to be left in walls.
 - B. All unused sanitary lines removed back to stack.
- 1.7 See NCH Water Management Plan. All plumbing system design, installation & start up procedures to align with current NCH Water Management Plan. Design & contracting teams to validate current standards with NCH Plumbing Trades
- 1.8 Pipe hangers and anchors etc. Basis of design should be Gruvlok with alternates approved by NCH Project Manager.

22.05.23 – General-Duty Valves for Plumbing Piping:

PART 2 PRODUCTS

2.1 General duty for Plumbing Piping: Valves

- A. Ball Valves – Threaded and sweat: (2" dia. or less, Used only on heating systems or equipment utilizing steel pipe – all sweat ball valve locations to be approved by NCH prior to specification and/or installation) – Based on Apollo 77C-100/ 77C-200. Equals by Milwaukee BA-400/400S. Two Piece body, full port, chrome plated ball, blowout proof stem. No union connection ball valves are to be specified or installed.
- B. Pro Press Ball Valves – ½"-2" dia. based on Apollo, no equal. 2-1/2" dia. and larger use CTS press flanges and Keystone 222 butterfly valves. No other equals. Valves must have "Leak before Press Technology". Follow manufacturer's installation guidelines.
- C. Butterfly Steam Valves –Vanessa Triple Offset Basis of Design and Preferred. Approved Alternate would be Adams and JamesBury Triple Offset. All steam valve applications and pressures must be discussed with the NCH Project Manager and Operations to verify appropriate use/application.
- D. Butterfly Valves – Domestic water; 2.5" >; Keystone Figure #222. No Domestic Water Equals
- E. Butterfly Valves – Domestic systems, For Domestic 12" and larger shall be Keystone GRL series.
- F. Butterfly Valves – Heating Systems below 180 degree;; 2.5" >; Keystone figure 222 Basis of Design. Approved equals by Victaulic.
- G. Butterfly Valves Condensate – Feedwater, Keystone "K" loc, series 36 Lug style. Equals by Jamesbury and Adams.
- H. Gate Valves – Heating systems or Chilled water; based on Velan. Equals by Crane. No Nibco valves.
- I. Gate, Globes and Ball Valves for Steam – Gate valves to be WSP150/300, based on Velan. Equals by Crane. Ball valves ½"-2" dia. shall be Apollo carbon steel 72A-140-64 series with 250# steam trim. 2 ½" dia. and larger shall be flanged. Flanges on the pipe may be welded at contractor's option. Welding the valve to the pipe in the system is permitted with prior approval by NCH Project Manager and Operations. No Nibco valves. All Steam valve applications and pressures must be discussed with NCH Project Manager and Operations.
- J. Steam and Condensate Ball Valves - Ball valves ½"-2" dia. shall be Apollo carbon steel 72A-140-64 series with 250# steam trim. 2 ½" dia. and larger shall be flanged.
- K. Check Valves – Domestic and Heating – 2-1/2" dia. and larger, Flanged. Must be stainless steel. Based on Velan. Equals by Keckley.
- L. Check Valves – Lift Stations – Base of Design; Crispin Series SWL with air cushion.
- M. Check Valves Steam & Condensate – 2" and smaller threaded Class 250, Milwaukee #507 and Apollo 168T
- N. Check valves "Wafer Style" – Domestic & HVAC systems along with pump discharge applications. Stainless steel construction. Condensate and LP steam to be discussed with Operations and Project Manager. Size 2" and larger to be manufactured by DFT Mfg. Equals by Crane Mfg. and Titan Mfg.

- O. Gaskets - All steam/condensate valves using flanged connections must use spiral wound Flexatatic gaskets, Garloc gaskets for steam/condensate applications are NOT accepted
- P. Strainers – Domestic water, 2-1/2" dia. and above to be stainless steel. Cast iron not allowed in potable water. Preferred Mfg. by Keckley Style SSA-7 class 150. Equals by Mueller Model 781-SS class 150, and Stayflow YSF series. Review all specified occurrences with NCH PM. 2" dia. and below to be brass, Mfg. by Apollo, Watts, Hoffman, Sarco, Crane.
- Q. Strainers – HVAC systems, 2-1/2" dia. and above, Cast iron. Mfg. by Keckley, equals by Mueller. 2" dia. and below Mfg. by Apollo, Watts, Hoffman, Sarco, Crane.
- R. Strainers – Steam systems, 2-1/2" dia. and larger Mfg. by Keckley, equals by Mueller. 2" dia. and below Mfg. by Apollo, Watts, Hoffman, Sarco, Crane.
- S. Condensate Check Valves – Based on Velan piston, bolted top, spring check. 2"-5" >; Velan swing check. Equals by Crane.
- T. Check Valves – 2" dia. and smaller - Domestic Hot & Cold – Based on Apollo #161T threaded swing check. Equals by Crane threaded swing check. To be used with Propress adapters, or use Viega Press checks. No Nibco Valves.
- U. Check Valves – 2" dia. and smaller - Heating System – Based on Apollo #161T threaded swing check. Equals by Crane threaded swing check. To be used with Propress adapters. No Nibco Valves.
- V. Gas Cocks – ITT, Grinnell, Homestead, McDonald
- W. Boiler Drain Stops – Based on Legend Equals by or Apollo, Watts
- X. Solenoid Valves – Based on ASCO, Equals by Parker.
- Y. Wall and Roof Hydrants – by Zurn.
- Z. Balance valves for domestic hot water – Bronzed body design. Not to be used as shut off valve, you must use ball valves for isolation. Based on Bell & Gosset. Equals by Victaulic/Tour Anderson.
- AA. Backflow Preventers – Verify compliance with all Columbus city codes. All backflow installations shall be provided with strainers, 1/2"-2" dia. shall be brass, 2-1/2" dia. and above shall be stainless steel. All backflow installations to be accessible, all isolation backflows to be mounted along equipment room wall at 4' height when applicable. No backflows can be installed in ceilings. Devices cannot be installed behind other piping. If alternate locations are required, review with owner. All containment devices must follow the City Of Columbus codes.
 - 1. All new backflow installations must be tested and submitted to the City of Columbus with the location on the record sheet. Also the Location and room number of each new device must be given to NCH Engineering Operations Plumbing Supervisor or MEP Manager from installing contractor
 - 2. All backflow installations will be mounted in a serviceable and convenient location. Ceiling applications to be reviewed by NCH Operations
 - 3. All ice machines shall be equipped with ASSE 1024 double check valve prior to filter arrangement
 - 4. Soda and coffee machines shall be installed with ASSE 1022 backflow per plumbing code. Manufacture based on Watts SE-3. Equals by Wilkins.
- BB. Reduced Pressure Assembly
 - 1. 1/2" -2" Wilkins Reduced Pressure 975XL2. We will not Accept 975XL3 valves. No exceptions. Equal by Watts 919QT
 - 2. 2-1/2" - 8" Watts 957 RPZ NRS/OSY Stainless Steel device. No Equal

3. No Watts 009 devices allowed
4. All reduced pressure backflows must be equipped with a manufactured air gap provided by the same manufacture as the backflow and piped to floor drain.

CC. Double check Assembly

1. 1/2" - 2" Wilkins 950XL Double Check Assembly Equal by Watts 719QT
2. 2-1/2" - 8" Watts 757NRS/OSY No Equal

DD. Double Check Detector Assembly (Fire Systems)

1. 2-1/2" - 10" Watts 757 OSY No Equals

EE. Vacuum Breakers – Based on Wilkins, Equals by Apollo Valve and Watts.

FF. Irrigation Backflows – Based on Wilkins, Equals by Apollo Valve and Watts.

- 2.2 Deduct meters – All meters must meet the City Of Columbus codes and regulations. (Refer to specific meter model based on current city standards)

22.05.48 – Vibration and Seismic Controls for Plumbing Piping and Equipment:

PART 2 PRODUCTS

- 2.1 Vibration Dampers – by Metraflex.

22.05.53 – Identification of Plumbing Piping & Equipment:

PART 1 GENERAL

- 1.1 See Maintainable Asset List (MAL)

- 1.2 SCOPE

A. Provide brass tags on all valves. Tags shall state type of line in which the valve is installed (heating water supply, steam, etc.) and number of valve. Furnish a schedule or schedules of all valves tagged with number, location and purpose of each valve and mount schedules under glass on Equipment Room wall, or elsewhere as required. Schedules shall be located near and convenient to the valves on the schedule.

B. After piping and insulation is painted, this Contractor shall apply adhesive labels for all piping systems, lettered with the name of contents of piping. Flow direction arrow of the same colors is to be located on each end of the label and wrapped around the entire pipe.

Contractor shall verify with Engineer the colors for any piping systems not listed here.

C. This Contractor shall label all disconnects, motor starters, switches and equipment furnished under this Contract.

D. All steam “systems piping” will identify the pressure of each line in the equipment room. All “steam stations” will identify the inlet and outlet steam pressure. The reduced pressure must be identified numerically along with the low pressure label. This will be labeled with the same material as the naming label.

E. Provide 1/4” to 3/8” ceiling markers on ceiling grid tees to identify location of valves, boxes, and devices above ceiling.

PART 2 PRODUCTS

- 2.1 Valve tags shall be brass minimum 16 gauge.
- 2.2 Pipe labels and flow arrow tape shall be similar to Brady B-946 indoor/outdoor marking film with high gloss, durable, flexible, pressure-sensitive adhesive product. Flow arrow tape background color shall match label background color. Furnish a minimum of 12 additional labels for each service and a minimum additional roll of arrow tape for each service. Size of labels and letters shall be per ASME A13.1 as follows: Pipe labels have the pipe contents spelled out, NO abbreviations

SIZE OF LEGEND LETTERS (PER ASME A13.1)

PIPE COVER O.D. (INCH)	LENGTH OF COLOR FIELD	SIZE OF LETTER
¾ to 1 ¼	8"	½"
1 ½ to 2	8"	¾"
2 ½ to 6	12"	1 ¼"
8 to 10	24"	2 ½"
Over 10	32"	3 ½"

- 2.3 Equipment labels shall be 1/16" thick laminated plastic nameplates or 0.020" thick aluminum nameplates. Background shall be black with 3/8" letters engraved on the face. Letters shall be white or natural aluminum.

PART 3 EXECUTION

- 3.1 No Stencils Allowed, Labels only. Secure equipment labels with screws. Do not attach to covers where covers can be easily mixed up.
- 3.2 Tape shall be wrapped completely around pipe on end of the label in a fashion to help hold the label onto the pipe.
- 3.3 Preparation
 - A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.
- 3.4 Pipe Label Installation
 - A. Locate pipe labels where piping is exposed and above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units.
Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

7. All labels must have systems called out exactly, no abbreviations allowed, Refer to list in 3.4 B

B. Pipe Label Color Schedule:

SERVICE	BACKGROUND COLOR	LETTER COLOR
Storm Piping	White	Black
Secondary (SEC) Storm Piping	White	Black
Sanitary Piping	White	Black
Sanitary Vent Piping	White	Black
Domestic Cold Water	White	Dark Blue
Domestic Hot Water	White	Dark Red
Domestic Hot Water Return	White	Dark Red
LZ Domestic Cold Water	White	Blue
LZ Domestic Hot Water	White	Dark Red
LZ Domestic Hot Water Return	White	Dark Red
HZ Domestic Cold Water	White	Blue
HZ Domestic Hot Water	White	Dark Red
HZ Domestic Hot Water Return	White	Dark Red
140°F Hot Water	White	Dark Red
Tempered Water	White	Dark Red
Tepid Water	White	Dark Red
Softened Water	Light Blue	Black
Reverse Osmosis Supply	Light Blue	Black
Reverse Osmosis Return	Light Blue	Black
Make-Up Water	White	Blue
Natural Gas	Red	White
Instrument Air	White	Black
Compressed Air	Blue	White
Oxygen	Green/Yellow Diagonal	White
Med Vac	White/Black Diagonal	Black
Dental Air	Yellow/White Diagonal	Black
Dental Vacuum	White /Black Diagonal	Black
Evac	Purple	White
NO ₂	Blue	White
Chilled Water Supply	Blue	White
Chilled Water Return	Blue	White
Condenser Water Supply	Green	White
Condenser Water Return	Green	White
Condenser Freeze Protection Supply	Green	White
Condenser Freeze Protection Return	Green	White
High Pressure Steam 125#	Orange	Black
High Pressure Steam 65#	Orange	Black
Steam Condensate	Brown	White
Condensate Pump Discharge	Brown	White
High Pressure Condensate	Brown	White
Heating Water Supply	Orange	White
Heating Water Return	Orange	White
Fuel Oil Supply	Yellow	Black
Fuel Oil Return	Yellow	Black
Sprinkler Piping	Red	White

C. Medical gas piping color scheme to match NFPA 99 requirements.

D. Pipe and insulation to be cleaned prior to installing pipe labels to ensure adhesion.

- E. Provide an additional 24 of each label and 48 of each arrow label as attic stock.
- F. Medical gas and laboratory cylinder gas piping to be labeled at intervals of no less than every 20 feet, at least in or above every room, on both sides of walls or partitions penetrated by piping, and at least once in every story height traversed by a riser.

22.07.19 – Plumbing Piping Insulation:

PART 2 PRODUCTS

- 2.1 Plumbing Piping Insulation – All Valves 2 ½” and larger to have removable wraps equal to Fit Tight Covers Manufacturer.

22.11.16 – Domestic Water Piping:

PART 1 GENERAL

- 1.1 Domestic Water Piping – Type “L” Copper with Viega ProPress ½” thru 4” on all systems, including Heating Systems, DCW, DHW, and Air lines. No solder joints on domestic systems, unless specifically required due to confines of space – instances to be reviewed in field with NCH Project Manager.
 - A. All domestic hot and cold water loops, systems or branch lines will have low point flush ports with ball valve connections for flushing the lines in accordance with NCH Water Management Plan.
 - B. All patient room domestic hot and cold feed lines shall have isolation ball valves serving the room located in the corridor. They can feed up to two rooms per set of valves for DHW, DCW. Exam rooms and non-patient rooms will follow the same rule.
 - C. All new domestic feeds for DCW, DHW, and DHWR shall have tee’s installed after main feed ball valves serving an area for chlorination tap point of the area being served.
 - 1. The tap shall be supplied with ball valve and draining plugs.
 - 2. Adequate drain location and receptacles shall handle the required flow.
 - 3. Follow line size of the designed system for flush port size.
 - 4. Requirement shall be applied to all floors and areas of new construction, and in renovations & remodels where piping is affected.
 - D. All fixture locations must not be further than 50’ from a DHW return line.
 - E. All air lines must use proper o-ring rated for oil participants
 - F. Steel pipe allowed on Heating systems with Victaulic fittings 2-1/2” and larger. Viega Mega Press acceptable alternate if installed per manufactures instructions.
 - G. During Construction **contractor** shall be responsible to ensure that water is not stagnant in any pipes. Filled areas will need to be flushed routinely and logged with location and date. Testing **MUST** be performed by the contractor per NCH-Water Management Plan & local requirements. Results must be and logged on the flushing report & submitted to city as per current regulations. ***New construction areas large or small shall be chlorinated for 24 hours per WMP (Water Management Plan) guidelines provided by the contractor performing work.***

H. Options for flushing can be auto flush faucets approved by NCH. (as manufactured by Sloan Bluetooth) Until the systems are filled the DCW and DHW will remain at the main with no dead legs in closed position. No returns can be capped for any measure of time, no dead legs. **Return lines MUST be in service at all times. PLEASE NOTE: When Construction Activities impact circulation, routine flushing must occur. See WMP (Water Management Plan) for further guidance.**

1. New Builds - Contractors shall install a flush point on all DHW return lines in the equipment room prior to the tie in back to heater.
2. Remodel Projects – contractors shall install, or connect the DHW return to the system return lines during each phase of the project.

I. Supply Piping – Copper, Type “L”, no solder joints, and no threaded ball valves. Viega ProPress systems only.

J. Brazing – Any brazed joint in a plumbing system must be done by a brazing certified installer. Certifications to be submitted to CM before brazing the joint.

K. Allow Victaulic grooved fittings on piping 2 ½” and above. Fire Systems, Domestic water systems, Heating systems, Chilled water systems, Condenser water systems and other approved applications (including copper, steel or galvanized) for piping 2-1/2” and above, as listed in the Victaulic manufacturer’s literature. No equals.

1. Dielectric Fittings: Use Victaulic Style 47 Dielectric Waterway when connecting dissimilar metals in liquid systems. ½" through 8" size range available with grooved or threaded ends.
2. Execution: Grooved Joints: Grooved joints shall be installed in accordance with the manufacturer’s latest published installation instructions. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. Gaskets shall be of an elastomer grade suitable for the intended service, and shall be molded and produced by the coupling manufacturer. The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor’s representative is not considered qualified to conduct the training or jobsite visit(s).)

L. Allow **Viega ProPress** - The use of the Viega ProPress system should be limited to the approved applications as listed in the Viega ProPress literature and system data sheets. Use of the Viega ProPress system is only approved by NCH for pipe sizes up to and including 4”. Note: Follow manufacturer’s installation guidelines.

1. Note: On fittings 2-1/2” and larger, as indicated by the manufacturer, additional care should be given to clean the pipe and inspect for scratches prior to pressing.

M. ProPress by Viega:

1. Copper Press Fittings: Viega North America, 301 N. Main, Suite 900, Wichita, KS 67202 (800) 976-9819

2. Pressing Tools: Ridge Tool Company, 400 Clark Street, Elyria, OH 44035, (800) 519-3456

N. Piping Materials:

1. Hard Copper Tube: ASTM B 88, Type K, or L (ASTM B 88M, Type B), water tube, drawn temper
2. Copper Fittings: ASME B16.22, wrought copper
3. ProPress Fitting: Copper press fittings (1/2" to 4" hard copper tubing) shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM and have SC (Smart Connect) feature design (leakage path)

O. Soft Copper Tube: ASTM B 88, Type K, or L (ASTM B 88M, Type B), water tube, annealed temper.

1. Copper Fittings: ASME B16.22, wrought copper.
2. ProPress Fitting: Copper press fittings (1/2" to 1-1/4" soft copper tubing) shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM and have SC (Smart Connect) feature design (leakage path).

P. Joint Construction:

1. ProPress Connections: Copper press fittings shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

Q. Pro Press ball valves: By Viega Corp.

R. Trap Primer Piping – Install Pex under slab trap primer tubing as recommended by manufacturer. Tubing system to be initially charged and maintained with 50 psig air until concrete is cured. Installer shall be available during concrete pour and repair any damaged tubing during concrete pour.

S. Thermometer wells shall be stainless steel, no brass allowed

22.11.19 – Domestic Water Piping Specialties:

PART 1 GENERAL

1.1 Thermostatic Mixing Valves.

- A. Hose Stations Steam / Water – Based on Leonard. Equal based on the same size, type, capacity and meeting other requirements may be provided at the Contractor's option.
- B. Master Mixing Stations – Should be electrical design. Master mixing valve stations will be Powers Intellistation and recirculation system with manual override, allows valves to be set to

a tempered water position in the event of power failure. Unit to have BAS integration. Thermostatic Bi-metal coil not accepted. All master mixing stations must be supplied with a “test tee” and ball valve on the discharge water supply for testing and set up of the master mixer station. This allows set up and temperature settings to be performed at the mixing station in the equipment room making fine tuning much easier when coming on line. No Leonard Master Mixing Valves Allowed.

C. Hand Sink Mixing Valves- ALL “PUBLIC” OFFERED HAND SINKS under sinks shall be ASSE 1070 manufactured by Leonard Valve Model 170A-LF with 3/8” compression connections and internal check valves. All “public only” faucets shall have its own mixing valve piped with flex connectors. No multiple faucets to be used on one mixing valve. Equals by Apollo, or Watts. With the following base-line specifications:

1. Minimum flow: 0.25 GPM (0.95 l/Min) Certified to ASSE
2. Maximum flow: 4 GPM
3. Maximum pressure: 125 PSI (8.6 BAR)
4. Maximum hot water temperature: 180°F (82°C)
5. Hot water inlet temperature range: 120-180°F (49-82°C)
6. Cold water inlet temperature range: 33-80°F (1-27°C)
7. Temperature adjustment range: 95-120°F (35-49°C)

1.2 Emergency safety showers- Thermostatic mixers for emergency showers shall be Leonard. Provide with internal cold water bypass (20 GPM), hot water shutdown on failure of cold supply, locked temperature regulator set at 85 F, high temperature limit stop set for 900 F, combination check stops on inlets, outlet dial thermometer, color-coded, integral wall support, and factory installed.

1.3 Water Meters for Deduct and Irrigation

A. Must read Cubic feet and be manufactured by Master Meter. All meters must have RF remote reader:

1. 1” Meter to be MB16A11B050102A1
2. 2” Meter to be MM23A00B050102A1
3. Radio (RF transmitter) E2972Q0155.

B. All installation must follow all City and municipality code and regulations.

22.11.23 – Domestic Water Pumps:

PART 1 GENERAL

- 1.1 Domestic Water Booster Pumps - Based on Peerless Syncroflow, equal by Grundfos pumps. All systems to have ABB drives. No PRV’s
- 1.2 All booster package factory piping and manifold shall be stainless steel with associated fitting in stainless
- 1.3 Parking Garage booster pumps to be Grundfos CMBE series.

22.13.13 – Facility Sanitary Sewers:

PART 1 GENERAL

- 1.1 PVC Schedule 40 required (non-plenum areas only), cast iron use must be verified by Engineering; Note: fire assembly penetrations are responsibility of PC. Steel Sleeves required at NEW masonry and concrete wall & floor assemblies. Based on Charlotte.
- 1.2 No designed drainage systems shall incorporate “double Tee Wye” fittings.
- 1.3 In multi-story High rise applications the use of cast iron pipe should be used in vertical risers only.

22.13.16 – Building Sanitary Waste and Vent Piping:

PART 1 GENERAL

- 1.1 All unused sanitary lines removed back to stack.
- 1.2 Soil, waste, and vent lines shall be solid wall PVC piping – ASTM D2665 drain waste and vent. Fittings shall be PVC socket type fittings – ASTM D2665, made to ASTM D3311, drain, waste and vent patterns.
- 1.3 Soil and waste lines and fittings in return air plenums, shafts, chases, and from floor drains in boiler room and at sterilizers shall be cast iron soil pipe. Balance of system shall be PVC piping. Hub Joint cast iron shall be used for boiler room and sterilizer drains below slab.
- 1.4 Vent lines in return air plenum, shafts and chases shall be standard cast iron soil pipe. Copper DWV fittings and pipe at the Contractor’s option.
- 1.5 All cast iron soil pipe above grade shall be service weight or “No-Hub”.
- 1.6 Cleaning:
 - A. Clean interior of piping. Remove dirt and debris as work progresses.
 - B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
 - C. Place plugs in ends of uncompleted piping at the end of day and when work stop.

22.13.19 – Sanitary Waste Piping Specialties:

PART 1 GENERAL

- 1.1 NO Watts drainage products
- 1.2 All Sanitary and Storm pumps to utilize float ball systems, not transducers.
- 1.3 All Sanitary and Storm pump piping to be galvanized material, no screwed joints, allow Victaulic fittings.
- 1.4 Floor Drains – Based on Zurn, with round grilles. No equals. All floor drains to be 3” or larger. NCH will not except 2” emergency drains as floor drains.
 - A. NOTE that floor drains are to be set 1/8” minimum below the adjacent floor area and the concrete “dished” out with a grinder for 18” diameter around center of drain.
- 1.5 Floor sinks – Based on Zurn.
- 1.6 Chemical Waste Lines – Labline Enfield mechanical or fuseal; Orion mechanical, Chemdrain by Charlotte (as approved by application).

1.7 Grease Interceptors

A. Grease interceptors above grade for kitchen use to be plastic. No steel grease traps. Manufactured by Endura Grease Interceptors, (Canplas)

B. Grease traps underground can be Plastic or fiberglass. Equals by concrete.

1.8 Overflow Spout – Zurn # Z199-SS

1.9 Plaster Traps – Based on Zurn Z1180. Typically, above floor level for ease of maintenance. Unit to be installed utilizing no-hub band connections for service.

1.10 Trap Primers – Based on Precision Plumbing Products “Oregon.” All trap primers to be of brass body design. Trap primers located in non-public, non-patient areas

1.11 Trap Primers: Electronic – Manufactured by Precision Plumbing Products “Oregon.” All trap primers to be of brass body design.

1.12 All closet waste lines shall be minimum 4” in diameter

22.13.29 – Sanitary Sewage Pumps:

PART 1 GENERAL

1.1 Based on Vaughan chopper pumps.

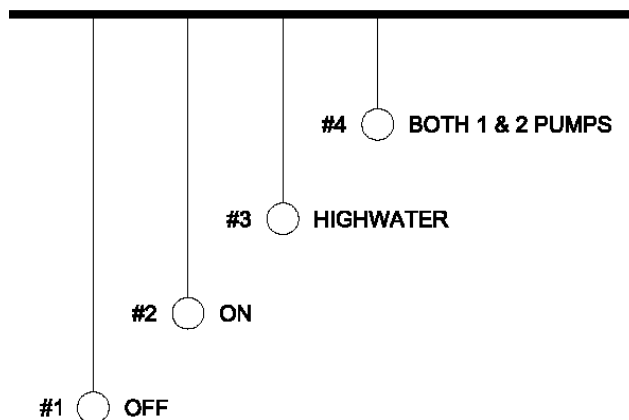
1.2 NCH operation to review applications NOT using Chopper pumps

1.3 Check valves base of design by Valmatic Surgebuster. Options to be discussed with operations plumbing supervisor per job.

1.4 All waste piping shall be galvanized with galvanized grooved Victaulic fittings. No screw joints

1.5 Refer to following graphic:

SUMP FLOATS DIAGRAM

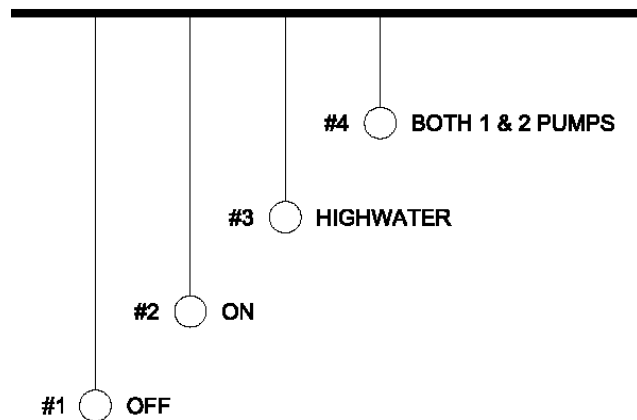


22.14.29 – Sump Pumps:

PART 1 GENERAL

- 1.1 All Storm System sump pumps to be of the submersible type. Provide lifting wire or guide rail for removal. Pumps to be of a continuous duty run. Based on Zoeller or Peerless. All discharge piping to shall be galvanized with galvanized grooved Victaulic fittings. No screw joints Options can be discussed with operations per Job
- 1.2 Check valves base of design by Valmatic Surgebuster
- 1.3 Options can be discussed with operations per job.
- 1.4 Refer to following graphic:

SUMP FLOATS DIAGRAM



22.31.13 – Domestic Water Softeners by Chem Aqua:

PART 1 GENERAL

- 1.1 Water treatment shall be High Purity Water System built by Chem Aqua. Coordinate with NCH Project Manager

22.31.16 – Commercial Water Softeners By Marlo:

PART 1 GENERAL

- 1.1 Water treatment shall be High Purity Water System built by Chem Aqua. Coordinate with NCH Project Manager

22.32.00 – Domestic Water Filtration Equipment:

PART 2 PRODUCTS

- 2.1 Water Filters – Verify, based on use, location, etc. Discuss with owner for manufacture.
- 2.2 For ice/water machines:
 - A. Watts Flow Max
- 2.3 1 each Cartridge Housing FH4200BL1PR 10-1/2"
- 2.4 1 each 1 micron Melt blown 2.5 X 9-7/8" FPMB1-978

A. Equals approved by operations. Size and equipment may vary by manufacture. Listed option for ½" water lines. No Carbon filters excepted for installation.

22.33.00 – Electric Domestic Water Heaters:

PART 1 GENERAL

- 1.1 50 gallon or less, electric. Based on AO Smith. Equals by State, Bradford White or Lochinvar. All domestic hot water tank drains shall be piped to drain for flushing
- 1.2 Thermometer wells shall be stainless steel, no brass allowed

22.34.00 – Fire-Fueled Domestic Water Heaters:

PART 1 GENERAL

- 1.1 50 gallon or less, gas fired. Based on AO Smith. Equals by State, Bradford White or Lochinvar. All domestic hot water tank drains shall be piped to drain for flushing
- 1.2 Thermometer wells shall be stainless steel, no brass allowed

22.35.00 – Domestic Water Heat Exchangers:

PART 1 GENERAL

- 1.1 Hot Water shall be generated by instantaneous hot water converter powered typically by steam from the central plant. Typically, Patterson-Kelly (or approved equivalent). Condensate from heater MUST drain by gravity to a vented condensate receiver tank. Hot water return/circulation loop typical.
- 1.2 Equals by Cemline.
- 1.3 Thermometer wells shall be stainless steel, no brass allowed

22.42.13 – Commercial Water Closets, Urinals and Bidets:

PART 1 GENERAL

- 1.1 Water Closet (Wall Hung-Preferred) – Kohler Kingston #K4325ADA or 4325-L (for bed pan lip). Equals by Sloan; ST-2059-A (universal) or 2059-A-BPL for bed pan washer lugs and American Standard.
 - A. Feet bolted to floor using min. 1/2 [13mm] dia. anchors.
 - B. Rear anchor assembly required for secure installation.
 - C. Floor anchors must each be able to withstand a pull-out force of 820 lbs. [372 kg]
 - D. Utilize 4" piping to main
- 1.2 Water Closet - Gravity Fed (limited locations, verify with NCH PM) – Kohler Highline Class Five Model K3939-ADA. Equals by American Standard and Sloan
- 1.3 Water Closet: Stainless (limited locations, verify with NCH PM) – Based on Willoughby Mfg.
- 1.4 Water Closet carriers, Urinal Carriers and Water Cooler Carriers – Based on Zurn. All closet carriers to be 750# rating. Urinal Carriers on PVC sanitary stub out to be brass, no plastic carrier brackets.
- 1.5 Water Closet Seats – Based on Bemis. Equal by Centaco.
- 1.6 Urinals:

- A. New install applications – One pint urinals based Kohler Bardon #K-4991-ET . Equals by Sloan #SU-1009 and American Standard, manual or hardwired hands-free.
 - B. Urinals - Existing – Based on Kohler (Bardon #K 4960 ET). When upgrading existing bathroom, where applicable, use the one pint urinals.
- 1.7 Bedpan Washers –Based on Sloan Slimline Regal BPW 1100-1.6 XL. Equal by Delaney. Bedpan washers are located only as directed by NCH Engineering Project Manager and may require revisions to toilet spec to receive bedpan washer components.

22.42.16 – Commercial Lavatories and Sinks:

PART 2 PRODUCTS

- 2.1 Wall Mounted Sinks: (CFCI)
 - A. Lavatory: (Wall Mounted Porcelain Sink) Single hole, 4” center set, or 8” center set.
 - 1. Kohler Kingston K2005, K2006 or K2007 (Preferred.)
 - 2. Equals by Sloan Fixtures, American Standard.
 - 3. Lavatory Carriers – All wall hung lavatories to have Zurn in-wall carrier.
- 2.2 Lavatory (Integrated Corian Sink – Research)
 - A. Corian – ½” Glacier White Corian countertops, Corian sink Model 810P integral overflow drains; wall mounted with no hose attachment. Placement of support brackets need to clear area for trash can below.
- 2.3 Lavatory (Wall Mounted Stainless Steel): Based on Willoughby Mfg. (discuss with Owner Group)
- 2.4 Hopper Sinks (Wall Mounted Porcelain) – Kohler Bannon K-6718-0. Equals by American Standard.
 - A. All hopper sinks to have check valves on supplies above ceiling
- 2.5 Floor Mounted Sinks: (CFCI)
 - A. Floor Mounted Mop Sink – Only Stainless-Steel Mop basins allowed. 36x 36” Minimum size. IMC Teddy Model FS- ADA 36x 36 x16” Stainless steel mop sink. Contractor shall provide all necessary drains, traps and strainers based on selected model.
- 2.6 Drop-in Sinks: (CFCI)
 - A. Stainless Steel Drop In (All Areas) - Elkay Lustertone Series 18 GA (ELUH) – Preferred. Sizes to be determined by Design Professional based on application
 - 1. Equals by Just DL-AGR Series, 18 GA.
- 2.7 Kitchen pre-rinse units – Based on T&S, equal by Chicago
- 2.8 Sinks Accessories / Traps/ Valves/Connectors: (CFCI)
 - A. P-Traps – Based on McGuire 17 gauge, chrome plated with cleanout and Zurn Corp. No PVC traps.

B. Supply Stops – Based on McGuire 5/8" x 3/8" Quarter turn compression angle stop. Equal by Dearborn Brass Company and Zurn Corp. For use with Stainless steel flex connectors. No loose key must have handles.

1. ADA-Compliant Trap Wrap Insulation – based on Tru-bro, Equal by McGuire Pro-Wrap.
 - 1.No Lav. Shields, except as approved by owner.

C. Flex Connectors – By Eastman, Watts, Jones, Stephens, ProFlow.

D. Basket Strainers – Based on McGuire #151. Equal by Dearborn Brass, and Zurn Corp.

E. Open Grid strainers – Based on McGuire #155A. Equal by Dearborn Brass Company and Zurn Corp.

F. Pop up PO plug – Based on McGuire #155MP. Equal by Dearborn Brass Company and Zurn Corp.

22.42.23 – Commercial Showers:

PART 2 PRODUCTS

2.1 Showers – Based on Aquarius, equals by Best Bath.

2.2 Shower valves

A. NCH Campus – Based on Leonard Aquatrol 4500. No Leonard LVC shower valves are to be used.

B. Owned Offsite – By Powers or Zurn.

C. Leased Offsite – By Powers or Zurn.

22.42.26 – Commercial Disposals:

PART 2 PRODUCTS

2.1 Garbage Disposal (Patient care and Break Room): ISE 1/2hp Badger 5 disposal (No Alternates), Provided with cord and plug. Design Professional should coordinate with Engineer.

22.42.39 – Commercial Faucets, Supplies and Trim:

PART 1 GENERAL

1.1 General Faucet Specifications:

A. All faucets subject to Epidemiology splash zone guidelines and have moderator or laminar flow outlet. No aerators are allowed per NCH Epidemiology Guidelines.

B. All faucets shall be installed with flex connections

C. Minimum flow: 0.25 GPM (0.95 l/Min) Certified to ASS

D. Maximum flow: 4 GPM

E. Maximum pressure: 125 PSI (8.6 BAR)

- F. Maximum hot water temperature: 180°F (82°C)
- G. Hot water inlet temperature range: 120-180°F (49-82°C)
- H. Cold water inlet temperature range: 33-80°F (1-27°C)
- I. Temperature adjustment range: 95-120°F (35-49°C)

- 1.2 Mixing Valve Requirements: Mixing Valves are only required if faucet is in a "Public Use Area."
- 1.3 Mixing valves under sinks shall be ASSE 1070 manufactured by Leonard Valve Model 170A-LF with 3/8" compression connections and internal check valves. No multiple faucets to be used on one mixing valve and be piped with flex connectors.
- 1.4 Chemical dispenser water connection for EVS rooms: (CFCI) Provide 3/4 "wall mounted cold water connection with manual shut off valve. No backflow preventor required. Provide braided connection hose at appropriate length to connect the OFOI chemical dispenser.

PART 2 PRODUCTS

- 2.1 NCH Main Campus – Based on Sloan.
- 2.2 Owned Offsite – Based on Zurn.
- 2.3 Leased Offsite – Based on Zurn.
- 2.4 Faucets: - "Hands-Free" AC Electric and Battery : Typical for lavatory and SS sink applications. All electronic faucets to be installed with flex connectors. Do not hard pipe. Do not use pipe dope. No Chicago Electronic Faucets to be specified. Base of design Sloan Valve Company – Preferred. Equals by American Standard. Grid drains shall be used, discuss pop-ups with owners' group. Below are basic options offered by Sloan. Discuss with Plumbing supervisor if you have different applications.
 - A. Option #1 – HANDS FREE BATTERY - PATIENT / EXAM ROOM (Non Adjustable temperature) - Sloan EAF-150-ISM Hands Free battery powered faucet with Laminar flow. Cover plate ETF 607-A: 4" or ETF 608-A: 8" as required for Sloan options. Basic hands free battery faucet for exam rooms.
 - B. Option #2 – HANDS FREE AC/BATTERY BACKUP – NON PATIENT/ STAFF/ PUBLIC HANDSINKS / RESTROOMS (Adjustable Temperature) - Sloan ETF-660-4-BOX-ADM-2.2-LAM also available in 4" trim plate spread -- ETF= AC From the Factory / BOX Mounted Transformer under sink. Hardwired or Plug in Transformer. 2.2 GPM LAMINAR OUTLET
 - C. Option #3 - HANDS FREE AC/BATTERY BACKUP- 10 3/4" TALL GOOSE NECK FAUCET FOR SERVICE SINKS (Adjustable Temperature) -Sloan ETF-770-4-BOX-ADM-2.2-LAM also available in 4" trim plate spread -- ETF= AC From the Factory / BOX Mounted Transformer under sink. Hardwired or Plug in Transformer. 2.2 GPM LAMINAR OUTLET
- 2.5 Faucets – Manual: "Hands On": Single handle - Based on Chicago, Equals by Speakman, Moen Commercial and Powers ASSE 1070 Temp Tap and American Standard. Two Handle - 4" On Center: Based on Chicago, Equal by American Standard. All Faucets must have spouts sized to fit the sink bowl. Size variations are determined by the Engineer. Standard factory offerings may not be applicable.

- A. Low-profile Faucet --4" OC Chicago 802-317XKCP with E32 laminar flow outlet. Ceramic disc cartridge
- B. Gooseneck Faucet --4" OC (5-1/4" Gooseneck Spout) Chicago 786-E3XKCP with E29 laminar flow outlet. ceramic disc cartridge.

NOTE: Above with grid drains unless pop-up is specified.

- 2.6 Two Handle - 8" On Center": Based on Chicago, Equal by American Standard. All Faucets must have spouts sized to fit the sink bowl. Size variations are determined by the Engineer. Standard factory offerings may not be applicable.

- A. Gooseneck Faucet (2.2 GPM) --8" OC (5-1/4" Goosneck Spout) 8" Chicago 786-GN2FCXKABCP: widespread faucet and 4" wrist blade handles, Control Pressure compensating laminar flow non-aerating outlet, 2.2 GPM, ceramic disc cartridge.

NOTE: Above with grid drains unless pop-up is specified.

- 2.7 Faucets - "Foot Pedal Valve":

- A. NCH campus – Chicago #834-EPCP or 625-CP with single spout 626-CP. Equal by American Standard
- B. Owned Offsite – Based on Chicago, Equal by Zurn
- C. Leased Offsite – Based on Chicago, Equal by Zurn

NOTE: Above with grid drains unless pop-up is specified.

- 2.8 Faucets – Manual: "BREAKROOM WITH PULL DOWN SPRAY":

- A. American Standard "Beal" Model # 4931300.002 with no trim plate. Polished Stainless Steel.

- 2.9 Faucets – Manual: "RESEARCH LAB SINK": (Gooseneck Faucet 13" tall Neck - single hole)

- A. Watersaver Color Tech Low Flow Vacuum Breaker Gooseneck Faucet with Adjustable flow. Model # CTA414VB – 10VB-SCC

- 2.10 Faucets – Manual: "Floor Mounted Sink/Mop Sink/ Hopper Sink": Chicago, #897-CP. Equals by American Standard. All faucets must be piped with check valves on the hot and cold supply.

22.42.43 – Flushometers:

PART 1 GENERAL

- 1.1 **Patient Bathrooms** - Manual Flush Valve
- 1.2 **Public/Staff Bathrooms** - Automatic Infrared Valve.

All Based on Sloan Regal –Options for equals by Delaney Flush valve. Discuss Power Requirements with NCH Project Manager

22.45.13 – Emergency Shower:

PART 1 GENERAL

- 1.1 General note: All safety showers new or retrofit should have a floor drain. No exceptions

PART 2 PRODUCTS

- 2.1 Safety Showers by Haws. Equals by Guardian, Chicago.
- 2.2 Safety Shower Mixing Valves by based on Leonard.
- 2.3 NCH Campus – Safety Showers Based on Haws Corporation. Equals by Chicago, Guardian.
- 2.4 Owned Offsite – By Haws, Guardian or Chicago
- 2.5 Leased Offsite – By Haws, Guardian or Chicago

22.45.26 – Eye/Face Wash Equipment:

PART 1 GENERAL

- 1.1 Eyewash units listed below meet ANSI Z358. Decision for which to use may be discussed with user group.
- 1.2 Requirements for eyewash and shower equipment for the emergency treatment of the eyes or body of a person who has been exposed to hazardous materials. If the med. rooms and solid utilities contain hazardous and/or corrosive materials, eye wash stations should be present
- 1.3 Emergency eyewash and shower equipment should be available for immediate use, but in no instance should it take an individual longer than 10 seconds to reach the nearest facility.
- 1.4 It is recognized that the average person covers approximately 55 ft. (16.8 m) in 10 seconds when walking at a normal pace.
- 1.5 A single step up into an enclosure where the equipment can be accessed is not considered to be an obstruction. Additionally, installers should allow for adequate overhead clearance to accommodate the presence of cabinets over counter- or faucet- mounted emergency eyewashes, so as not to create an additional hazard that could be encountered when using the device.
- 1.6 A door is an obstruction. Where the hazard is not corrosive, one intervening door can be present so long as it opens in the same direction of travel as the person attempting to reach the emergency eyewash and shower equipment and the door is equipped with a closing mechanism that cannot be locked to impede access to the equipment.
- 1.7 Equipment should be located adjacent to the hazard but situated in such a manner such that exposure to the splash hazard or other hazards (e.g., exposed electrical conductors) does not occur while using the eyewash.
- 1.8 To meet code, temperature ranges are 60-100 degrees F.

PART 2 PRODUCTS

- 2.1 Hand-held sink eyewash (Counter type hose): Haws 8904 or approved alternate Watersaver Black Color Tech CTEW1022BP-SCC. All hose type eye/face wash units to have non-testable backflow and mixing valves with thermometer. Mixing valve temperature to be set per ANSI Z358 (v2014 is between 60 and 100 degrees F).
- 2.2 Sink Faucet Mounted Eyewash (No Hose): Chicago Faucet Company series 8452 two handle 8" center with ADA -317 blade handles preferred.

- A. All options meeting ANSI Z358.
 - 1. Provide with Leonard TA300 mixing valve with stops and thermometer for OSHA guidelines testing.
 - 2. Verify the model with the user groups.
 - 3. No Equals.
- 2.3 Eyewash tempering valves based on Leonard Valve model TA-300-LF.
 - A. DURA-trol® solid bi-metal thermostatic control
 - B. Locked temperature regulator set for 85°F (29°C)
 - C. High temperature limit stop set for 90°F (32°C)
 - D. Internal cold water bypass on failure of hot water supply standard on all models
 - E. ANSI/ISEA Z358.1-2014 requires water to emergency equipment to be “tepid”
 - F. Optional systems with temperature override protection available
 - G. All systems factory tested before shipment
 - H. ASSE Standard 1071 listed
 - I. All mixing valves provided with thermometer
 - J. Mixing valves installations to be located for nursing or staff to read. Under counter preferred.
- 2.4 NCH Campus – Eyewash Based on Haws Corporation. Equals by Speakman
- 2.5 Owned Offsite – By Haws, Speakman
- 2.6 Leased Offsite – By Haws, Speakman

22.47.00 – Drinking Fountains and Water Coolers:

PART 1 GENERAL

- 1.1 Drinking Fountains / Water Coolers and standalone bottle filler should not have internal or external filtration. (CFCI)
- 1.2 Verify with NCH if Water Cooler is single or two-level. Review all locations with NCH PM.

PART 2 PRODUCTS

- 2.1 Elkay Models (Preferred Manufacturer)
 - A. Basis of Design - (Dual Height Drinking fountain with Bottle Filler) - DF-1 – Elkay Bottle Filling Station & Versatile Bi-Level ADA Cooler, Model EZSTL8WSVRLK
 - B. Oasis Models (Alternate Manufacturer.) - No internal and external filters
 - C. M8CREBQ 507650 (Dual Fountain with Bottle Filler)
 - D. M8CR 504592 (Dual Fountain)
 - E. M8WR 504607 (Single Fountain)
 - F. M8WREBF 507179 (Single Fountain with Bottle Filler)
- 2.2 Standalone Bottle Filler (CFCI) - Verify Mounting height with master elevation sheet. Review all locations with NCH PM. No internal or external filtration are to be installed with these units.

- A. BF-1 – Elkay Bottle Filling Station Model EZWSM8K with Mounting Frame accessory. See Master mounting height page for mounting height. Do not use product cut sheet for mounting heights.

22.60.00 – Gas and Vacuum Systems for Laboratory and Healthcare Facilities:

PART 1 GENERAL

- 1.1 All alarm wiring: All low voltage wiring shall be supported independently by bridal rings or j-hooks (if structured cabling is used), at distances no greater than 5' apart, utilize approved manufacture raceways (ex. EZ-Path) or electrical conduit with bushed ends when penetrating walls and/or floors, is labeled on both ends of cable and/or at every termination point. Attaching low voltage cabling to all thread or ceiling grid support wires is prohibited. Independent ceiling wires can be used if a unique identifier is used to distinguish low voltage supports from ceiling system support wires.
- 1.2 Liquid Nitrogen Storage: Audio/Visual Oxygen depletion monitors are required for all locations where bulk liquid nitrogen is stored or dispensed. This would be either through a bulk tank or Dewer system. Monitors should be internal to the space where the nitrogen is dispensed and stored. Monitors are also required at all point of entry into to the space to alert occupant not to enter the space if there is an oxygen event. Basis of Design is PURE AIR with approved alternates.
- 1.3 Med gas piping
 - B. Medical Gas Piping - Rigid copper type “L” unless specifically approved by Engineering.
 - C. All brazing on Medical Gas Piping must be completed in compliance with NFPA 99.
 - D. Medical Gas Outlets – Amico Preferred, Equal by Beacon Medeas – All should be able to accept Ohmeda Style connection for medical equipment devices. Connect II Universal Quick Connect Preferred. *NOTE: J4, J5 floors use a Puritan-Bennett brand/style, so on these floors match the existing outlets to maintain consistency*
 - E. Medical Gas Zone Valves - Amico Preferred, Equal by Beacon Medeas
 - F. Medical Gas Alarms - Amico Preferred, Equal by Beacon Medeas
 - G. All valves & panels installed in any system must be tagged according to NCH’s valve tagging guidelines.
 - H. The cutting and capping of medical gas systems; including O2, Vac and Med Air systems to eliminate medical gas shutdowns is situationally approved by NCH
 - A. Contractor to obtain approval from NCH PM/CM prior to work on the System.

DIVISION 23: HEATING, VENTILATING, AIR-CONDITIONING HVAC

23.05.00 – Common Work Results for HVAC:

PART 1 GENERAL

- 1.1 Technology Rooms – refer to Division 27 requirements for special requirements
- 1.2 Rooftop Hose Bibb(s) to be installed in close proximity of rooftop HVAC equipment as required for coil cleaning.
- 1.3 Pipe hangers and anchors etc. Basis of design should be Gruvlok with alternates approved by NCH Project Manager.
- 1.4 All low voltage wiring shall be supported independently by bridal rings or j-hooks (if structured cabling is used), at distances no greater than 5' apart, utilize approved manufacture raceways (ex. EZ-Path) or electrical conduit with bushed ends when penetrating walls and/or floors, is labeled on both ends of cable and/or at every termination point. Attaching low voltage cabling to all thread or ceiling grid support wires is prohibited. Independent ceiling wires can be used if a unique identifier is used to distinguish low voltage supports from ceiling system support wires.

See Above Ceiling System Identification Matrix for additional information

23.05.23 – General-Duty Valves for HVAC Piping:

PART 2 PRODUCTS

- 2.1 VALVESGate, Ball, Butterfly, Globe and Gas Cock Valves: Valves by the following manufacturers meeting requirements of these specifications may be furnished at the contractor's option and shall all be by the same manufacturer.
 - A. Ball Valves – Apollo 77c-100/200 equal to be Viega Press Valve
 - B. Butterfly Valves (Heating)– Victaulic - Equal By Keystone
 - C. Butterfly Valves Condensate, Feed water – Victaulic - Equal By Keystone
 - D. Drain Valves – Apollo, Milwaukee
 - E. Gas Cocks – ITT, Grinnell, Homestead
 - F. Steam Butterfly Valves – Vanessa - Equal By Adams and Jamesbury

PART 3 EXECUTION

- 3.1 Check Valves < 2" bronze 2-1/2" and larger – Provide Stainless Steel. Review with NCH PM and Plumbing General-Duty Valves, Section 22.05.23
- 3.2 Combination Balance and Stop Valves – Combination Balance and Stop Valves shall be based on Tour and Anderson/Victaulic. Combination Balance and Stop Valves by the following manufacturers of the same size, type, capacity and meeting other requirements may be furnished at the contractor's option and shall all be by the same manufacturer.
 - A. Bell+Gossett

- 3.3 Combination Balance and Stop Valves – Tour and Anderson/Victaulic Series 786/787/788/789 bronze body, globe style, positive shut-off and memory stop, differential pressure readout ports, drain port. Valves on piping systems operating below 1000 F shall be furnished with pre-formed insulation cover.

23.05.53 – Identification for HVAC Piping & Equipment:

PART 1 GENERAL

- 1.1 See Maintainable Asset List (MAL)

23.09.00 – Instrumentation and Control For HVAC:

PART 1 GENERAL

- 1.1 Related Documents

- Verify -

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

- 1.2 Summary

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. Related Sections include the following:

- Designer to Populate -

- 1.
- 2.
- 3.
- 4.
- 5.

- 1.3 General BAS Scope

- A. Furnish and install a complete native BACnet DDC Building Automation System (BAS) to automatically control the operation of the new HVAC system and other systems as defined herein. The new Building Automation System shall fully integrate into the existing facility wide native BACnet network.
- B. The required integration shall include the creation of custom graphics, historical trending creation and set-up, alarm and event management and the compilation and display of all devices and objects on the existing BACnet Webserver. All graphic historical trends and alarm/event management displays will reside on the existing BACnet. This scope of work for the BACnet Webserver will be part of the NCHs BACnet integrator.
- C. The system shall perform the integration through the use of BACnet/IP communications. BACnet over Ethernet will not be supported for facility-wide communications. Failure to mention any specific item or device does not relieve the Contractor of the responsibility for installing or integrating such device/peripheral in order to comply with the intent of the Drawings or this Specification.

- Verify Contractors and if Alternate Pricing is needed –

D. The Contractor shall provide alternate pricing for BAS systems as manufactured by:

1. Delta Controls
2. Johnson Controls

1.4 General BAS division of work

A. Building Automation System (BAS) Contractor shall provide:

1. A fully integrated and fully programmable BACnet building automation system (BAS), UL listed (UL916 and UL864), incorporating direct digital control (DDC) for energy management, equipment monitoring and control. Contractor shall provide applicable UL listed device for stair pressurization (UL 864). The use of algorithmic or canned programming controllers will not be permitted. A UL864 listing shall be required for all controllers that are utilized in a smoke control sequence and as necessary to meet or exceed all national and local codes. In addition, UL864 devices and non UL864 shall not be permitted on the same network segment unless the devices are separated with a UL864 Ethernet switch. All MS/TP network segments shall be consistent with its UL864 or non UL864 implementation. There shall not be UL864 product and non UL864 product on the same MS/TP network segment. Coordinate closely with the Construction Manager and Engineer the portions of the BAS system that will require UL864 listing.
2. The BAS Contractor will provide all required devices, sensors, wiring, programming, setup and alarms for all inputs identified in the specification. For complete refrigerator, freezer and critical room temperature and/or humidity monitor the system will be installed as part of the BAS controls system.
 - a. Provide Phoenix Controls Advanced Pressure Monitor II (BACnet) as the standard for required for local monitors of AIIR/PE/OR's locations (model number: Phoenix Controls Advanced Pressure Monitor II)
3. Necessary conduit, wiring, enclosures, and panels, for all DDC temperature control equipment and devices. Installation shall comply with Division 26 Electrical Specifications and applicable local and national codes.
4. All components and control devices necessary to provide a complete and operable DDC system as specified herein.
5. All final electrical connections to each stand-alone DDC Controller. Connect to 120VAC power as provided by the Division 26 contractor, to be terminated near the DDC Controller, as shown on the Electrical Drawings.
6. BAS Contractor shall be responsible for all electrical work associated with the BAS control system and as called for on the Drawings. This BAS control wiring shall be furnished and installed in accordance with the Electrical requirements as specified in Division 26, the National Electric Code, and all applicable local codes.
7. Surge transient protection shall be incorporated in design of system to protect electrical components in all Building Controllers, Advanced Application Controllers and operator's workstations. Provide an external protection device listed under UL 1449 with minimum clamping voltage of 130 VRMS and surge current capability of 22,500

- Amps for all custom fabricated control panels and all main system components (i.e., AHUs, Chillers, Boilers, etc.).
8. All 120V and low voltage electrical control wiring exposed throughout the building and within walls shall be run in conduit in accordance with the Electrical requirements as specified in Division 26, the National Electric Code, and all applicable local codes. All low voltage wiring that is concealed in accessible ceilings may be run in plenum rated cable per the National and Local Electrical codes. All conduit used for BAS wiring shall be blue.
 9. All exposed plenum rated 24VAC power required for operation of the BAS shall be by the BAS Contractor and shall be limited to 100 VA per the national and local codes. Any 24VAC power link that exceeds the 100 VA rating must be installed in conduit per Division 26 and all applicable codes, regardless of the nature of the installation.
 10. BAS Contractor shall provide programming modifications necessary to fine tune sequences during commissioning and through the warranty period of system and for an additional 12 months, at no extra cost to NCH.
 11. All 120V devices not specifically called for on the Electrical Drawings required for a complete and operating BAS system, shall be the responsibility of the BAS Contractor.

- Coordinate how BACnet integrator will be contracted with -

A. BACnet Integrator provides:

1. The following scope of work will be provided by the Nationwide Children's Hospital (NCH) BACnet Integrator. All products and services will be furnished by the NCH BACnet Integrator directly to the hospital - or - as a separate prime Contractor under the supervision of NCH and the Project Engineer. This work is outside the scope of the BAS contractor except for the coordination between the BAS system and the work included in this scope. The work is to include:
2. Complete BACnet/IP and Ethernet network management for the entire hospital.
 - a. The Integration Partner has provided one main BACnet routers on each floor of the hospital. The devices will be capable of routing BACnet/IP and BACnet Ethernet (Clause 7) traffic. The intent is to eliminate any confusion in network configurations and/or management. The devices and related accessories have been installed by the BACnet Integrator and is separate of the BAS controls contractor. The devices will function as BACnet Broadcast Management Devices (BBMD) for every subnet. The Building Automation Network will be comprised of multiple subnets, one per building (typically) operating as one single virtual LAN. The preferred communications within a given subnet will be BACnet over Ethernet, while the necessary communications across subnets will be BACnet/IP. The objective is to facilitate a user-friendly network that permits expansion using standard Ethernet networking. The successful BAS controls contractor will still provide a complete and functioning system but will not be responsible for routing any network traffic between subnets. That said, the successful BAS control's contractor will be solely responsible for installing all necessary components and wiring in full compliance of the specifications. NCH will

provide all required device instances, network numbers and other related data to ensure proper network design. The BAS Controls Contractor shall be responsible for obtaining all necessary information from NCH to provide their complete and operational system.

3. Custom graphic displays, complete alarm and event management, and centralized trending through the existing BACnet Server.

a. The Integration Partner will provide all custom graphic displays, event and alarm management and centralized trending as required in the related specifications. The successful BAS controls contractor will be responsible for providing all pertinent information to the BACnet Integrator. Pertinent information shall include the BACnet object listings per panel, all intrinsic or algorithmic alarm settings, and all trend log information. The work performed by the BACnet Integrator does not alleviate the BAS control contractor's responsibility to provide BACnet alarming or trending functionality. The successful BAS contractor must support all facets of interoperability as identified in the BACnet conformance section. The BACnet Integrator will compile, manage, and present the data in the standard NCH format as coordinated with the operations department.

b. Graphic display, alarm management and reporting and trending reports shall be created by the BACnet Integrator in the standard NCH format established as part of the existing refrigeration monitoring system. The BACnet integrator shall coordinate these requirements with the operations department.

C. HVAC Contractor provides:

1. All wells and openings for water and air monitoring devices Temperature sensors, flow switches and alarms furnished by BAS Contractor.
2. Installation of all control valves as per the contract drawings.
3. Installation of all dampers and adjacent access doors for smoke; outdoor air, return air, exhaust air, and ventilation dampers.
4. All package unit control panels including but not limited to, factory boiler panels, factory chiller panels, refrigerant monitors and specialty interface modules, for these control panels, required for BACnet compliance.

D. Electrical Contractor provides:

- Coordinate -

1. Electrical Contractor shall provide dedicated 120 volt, 20 amp circuits and circuit breakers from emergency power panel for each DDC Controller. Run power circuit to junction box near controllers installed and/or as final connection to controllers shown on Electrical Drawings by BAS Contractor.
2. Electrical contractor will also provide smoke detector and smoke damper interlock and power wiring for all life safety applications.

1.5 General Product Description:

- A. The building automation system (BAS) shall integrate multiple building functions including mechanical and electrical equipment supervision and control, alarm management, energy management and historical data collection utilizing the BACnet protocol.
- B. The building automation system shall consist of the following:
 - 1. Stand-alone peer-to-peer Building Controllers with 32 bit processors, a minimum of 2 MB of flash memory and 10 bit A/D converters. Ethernet connectivity is required for all Building Controllers.
 - 2. Stand-alone peer-to-peer Advanced Application Controllers with 32 bit processors, a minimum of 1 MB flash memory and 10-bit A/D converters. Ethernet or MS/TP connectivity will be permitted for all AACs.
 - 3. Software and licensing agreements for portable operator's terminal
 - 4. Provide seamless interconnection to the existing NCH BACnet central graphic workstation. The BAS Contractor shall coordinate with the Hospital's BACnet integrator who will build NCH standard and customized graphic displays in accordance with the existing formats.
 - 5. There is no requirement to interface with the Building Access Control System or the Fire Alarm System except as specifically outlined in Section 23 09 93 "Sequence of Operation for HVAC Controls".
- C. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, Building Controllers, Advanced Application Controllers, expansion modules and operator devices.
- D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each DDC Controller shall operate independently by performing its own specified control, alarm management, operator I/O and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices. Alarm management and data collection that requires a single mechanism for user notification or viewing is strictly prohibited.
- E. All Controllers shall be able to access any data from, or send control commands and alarm reports directly to, any other DDC Controller or combination of controllers on the network without dependence upon a central processing device (peer-to-peer). All Controllers shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

1.6 Related Work

- A. Materials furnished by the BAS contractor, but installed by others:
 - 1. BAS Contractor to furnish the following to the Heating, Ventilation and Air Conditioning Contractor for installation by the HVAC contractor:
 - a. Control valves and temperature sensor wells for wet systems
 - b. Location of all wells and openings for temperature, pressure, and flow sensors for pipe systems
 - c. Automatic control dampers for air systems

- d. Location of all ducts and openings for temperature, pressure, flow, and humidity sensors for air systems.

1.7 Submittals

- Confirm Quantity and Extent of Submittals -

- A. Submit sets of drawings showing the kind of control equipment for each of the various systems and their functions, along with indications on the drawing of all original set points and calibration values, and setup parameters, and sequence of operation of the automation system. These drawings shall be submitted for approval to the Owner/Engineer, together with a complete brochure describing the equipment and their functions and operation. Include all application software documentation (actual programs or their job-specific flow charts) with DDC system and schedule a review meeting with NCH and the Engineer at least two weeks before installation and before startup.
- B. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated
1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
 2. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection
1. Bill of materials of equipment indicating quantity, manufacturer, and model number.
 2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 3. Wiring Diagrams: Power, signal, and control wiring.
 4. Details of control panel faces, including controls, instruments, and labeling.
 5. Written description of sequence of operation.
 6. Schedule of valves including flow characteristics.
 7. DDC System Hardware:
 - a. Wiring diagrams for control units with termination numbers.
 - b. Schematic diagrams and floor plans for field sensors and control hardware.
 - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
 8. Controlled Systems:
 - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.

- b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
 - c. Written description of sequence of operation including schematic diagram.
 - d. Points list.
- D. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.
- E. Software and Firmware Operational Documentation: Include the following:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.
 - 5. Software license required by and installed for DDC workstations and control systems.
- F. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
- G. Qualification Data: For Installer.
- H. Field quality-control test reports.
- I. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Maintenance instructions and lists of spare parts for each type of control device and compressed- air station.
 - 2. Interconnection wiring diagrams with identified and numbered system components and devices.
 - 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
 - 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
 - 5. Calibration records and list of set points.

1.8 Quality Assurance

- A. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- B. Single source responsibility of supplier shall be the complete installation and proper operation of the BAS and control system and shall include debugging and proper calibration of each component in the entire system. The BAS must be supplied and installed by the same Control Contractor. Only Factory Authorized Distributors will be considered for installation. The letting of separate contracts by the prime HVAC Contractor for the Control System and a separate contract for its installation by a third party installer is strictly prohibited.

C. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.

D. Supplier shall have an in-place support facility within 50 miles of the site with technical staff, spare parts inventory and all necessary test and diagnostic equipment.

E. All electronic equipment shall conform to the requirements of FCC Regulations, Part 15, Subpart B, Class A, governing radio frequency electromagnetic interference, and be so labeled.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. BAS shall comply with, and be listed at time of bid for the following Underwriters Laboratories Standards:

1. UL 916 for Energy Management Equipment, per category PAZX for Energy Management Equipment.
2. UL 864 for Control Units for Fire-Protective Signaling Systems, per category UUKL for Smoke Control System Equipment.

H. Comply with ASHRAE 135 for DDC system components.

I. Product shall be ISO 9001 Registered at the time of bid.

J. Design and build all system components to be fault tolerant.

1. Satisfactory operation without damage at 110% and 85% of rated voltage and at plus 3-Hertz variation in line frequency.
2. Static, transient and short-circuit protection on all inputs and outputs.
3. Protect communication lines against incorrect wiring, static transients and induced magnetic interference.
4. Network-connected devices to be AC-coupled or equivalent so that any single device failure will not disrupt or halt network communication.
5. All Building / System Controllers shall have real time clocks and data file RAM with battery and SRAM backup.
6. All controllers shall be EEPROM, flash driven.
7. The BAS Installer shall have a competent and factory certified Project Manager who is able to answer field questions, is aware of all schedules and schedule changes, and is responsible for the BAS Installer's work and the coordination of their work with all other trades. This Project Manager shall be available for on-site and shall respond to design, programming, and equipment related questions. Failure to provide the above services shall be considered a breach of Contract Documents.

1.9 Delivery, Storage, And Handling

A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.

B. System Software: Update to latest version of software at Project completion.

PART 2 PRODUCTS

2.1 Manufacturers

- Verify Manufacturers for Each Project with NCH Operations –

- A. NCH will accept pricing and qualifications for BAS systems as manufactured by Delta; and installed by BCI, as manufactured by Siemens Building Technologies; and installed by the local branch, and as manufactured by Johnson Controls; and installed by the local branch.
- B. Energy monitoring manufactures should be Onicon, Rosemont or Spirax. No know alternates without prior Project Manager approval. Badger is not an acceptable alternate.
- C. Steam flow meters to be Rosemont Flow sensors. No know alternates without prior Project Manager approval. Badger Vortec is not an acceptable alternate.

- Verify if Presentation is Necessary -

- D. Presentation will be setup for each manufacturer submitting pricing to present their qualifications to the Nationwide Children's Hospital. As part of the presentation, a project staffing plan to address how the project will be designed, installed, started-up, checked-out and commissioned will be required.

2.2 BACnet Conformance

- A. The Building Automation System (BAS) contractor shall supply a BACnet (ANSI/ASHRAE 135-2004) compliant system. Each device category and its required compliance are listed below. BACnet compatible systems that employ the use of proprietary 'gateways' will not be accepted unless otherwise noted.
- B. The BACnet system shall be capable of Internet Protocol (IP) communications. BACnet/IP or Annex J will be considered the basis of design.
- C. The primary Local Area Network (LAN) shall be based upon the ISO 8802-3 Ethernet standard and will be required for all Building Controllers, System Controllers and Operator Workstations. The use of MS/TP communications for interconnecting the said devices is strictly prohibited. The installation of all Ethernet wiring, accessories, and connectors shall conform to the ISO standard and/or guidelines identified herein. The connection media shall be Category 6A, Unshielded Twisted Pair (UTP) wire. The maximum single network run shall not exceed more than 90 meters. The BAS system may utilize the customer's Local Area Network (LAN) provided the bandwidth consumption is less than 10% of the total network bandwidth. Under no circumstances, shall the customer's LAN be subject to failure and/or abuse. In efforts to decrease liability, all BACnet devices that reside on the LAN must support the BACnet Broadcast Management Device (BBMD) scheme. Multi-casting or Global broadcasting will not be permitted without the use of a BBMD. NCH's BACnet integrator has provided the BBMD device for every building. The BAS Contractor shall coordinate with the Hospital and the BACnet integrator for their controllers to reside on the building level network supported by the BBMD. The Hospital network has been segmented so that each building will be a separate subnet from all others.
- D. The secondary or sub-network shall utilize the Master-Slave/Token-Passing protocol, as acknowledged by the ANSI/ASHRAE 135 standard. Proprietary RS-485 or equivalent links will

not be considered unless otherwise noted. The MS/TP link shall operate at a 76.8 Kbps minimum and utilize no more than 2 repeaters in any instance. Multi-channel repeaters will not be permitted.

- E. The use of proprietary gateways to transmit input/output data, and/or related information, must reside on the Ethernet LAN and be approved, in writing, prior to the bid.

- Verify if OWS is needed –

- F. Workstation conformance (OWS): The new Replacement Hospital workstation must be scheduled or submitted to the BTL for future testing, under Device Profile B-OWS (Annex L of the BACnet standard) with support of the following BIBBs:

Alarm and Event Management BIBBs

AE-ACK-A, AE-ACK-B, AE-ASUM-A, AE-ASUM-B, AE-ESUB-A, AE-ESUM-B, AE-INFO-A, AE-INFO-B, AE-N-A, AE-N-E-B, AE-N-I-B

Device Management BIBBs

DM-BR-A, DN-DCC-A, DM-DCC-B, DM-DDB-A, DM-DDB-B, DM-DOB-A, DM-DOB-B, DM-LM-A, DM-LM-B, DM-OCD-A, DM-OCD-B, DM-RD-A, DM-RD-B, DM-TM-B, DM-TS-A, DM-UTC-A

Data Sharing BIBBs

DS-COV-A, DS-COV-B, DS-COVU-A, DS-COVU-B, DS-RP-A, DS-RP-B, DS-RPM-A, DS-RPM-B, DS-WP-A, DS-WP-B, DS-WPM-A, DS-WPM-B

Network Management BIBBs

NM-CE-A, NM-CE-B

Scheduling BIBBs

SCHED-A, SCHED-E-B, SCHED-I-B

Trending

T-ATR-A, T-ATR-B, T-VMT-A, T-VMT-E-B, T-VMT-I-B

- G. Building Controller Conformance (BC): The new Replacement Hospital building controllers must be certified and listed by BTL (BACnet Testing Laboratory) under Device Profile B-BC (Annex L of the BACnet standard) with support of the following BIBBs:

Alarm and Event Management BIBBs

AE-ACK-B, AE-ASUM-B, AE-ESUM-B, AE-INFO-B, AE-N-A, AE-N-E-B, AE-N-I-B

Device Management BIBBs

DM-BR-B, DM-DCC-B, DM-DDB-A, DM-DDB-B, DM-DOB-A, DM-DOB-B, DM-OCD-B, DM-RD-B, DM-TM-A, DM-TS-A, DM-TS-B, DM-UTC-A, DM-UTC-B

Data Sharing BIBBs

DS-COV-A, DS-COV-B, DS-COVU-A, DS-COVU-B, DS-RP-A, DS-RP-B, DS-RPM-A, DS-RPM-B, DS- WP-A, DS- WP-B, DS-WPM-B

Network Management BIBBS

NM-CE-A, NM-CE-B

Scheduling BIBBs

SCHED-A, SCHED-E-B, SCHED-I-B

Trending

T-ATR-B, T-VMT-E-B, T-VMT-I-B

- H. Advanced Application Controller Conformance (AAC): The new Replacement Hospital AAC's must be certified and listed by BTL (BACnet Testing Laboratory) under Device Profile B-AAC (Annex L of the BACnet standard) with support of the following BIBBs:

Alarm and Event Management BIBBs

AE-ACK-B, AE-ASUM-B, AE-ESUM-B, AE-INFO-B, AE-N-E-B, AE-N-I-B

Device Management BIBBs

DM-BR-B, DM-DCC-B, DM-DDB-A, DM-DDB-B, DM-DOB-A, DM-DOB-B, DM-LM-B, DM-OCD-B, DM- RD-B, DM-TM-A, DM-TS-B, DM-UTC-B

Data Sharing BIBBS

DS-COV-A, DS-COV-B, DS-COVU-A, DS-RP-A, DS-RP-B, DS-RPM-A, DS-RPM-B, DS-WP-A, DS- WP-B, DS- WPM-B

Network Management BIBBS

NM-CE-A

Scheduling BIBBs

SCHED-E-B, SCHED-I-B

Trending

T-ATR-B, T-VMT-E-B, T-VMT-I-B

- I. Application Specific Controllers (ASC): ASCs will not be permitted on this project. The minimum level BACnet Controller that will be accepted by NCH shall be listed as a B-AAC device under the BTL certification process.
- J. Read / Write Properties: The entire BACnet BAS system (all OWS, BC, AAC and ASC devices) shall support the following Read/Write properties within the given BACnet objects and shall permit dynamic creation and deletion thereof.

Analog Input Object

Read and Write Properties: Description, Name, Value, COV Increment, Out of Service, Reliability
Read Only Properties: Type, Units, Status Flags, Event State

Analog Output Object

Read and Write Properties: Description, Name, Value, Out of Service, Reliability

Read Only Properties: Type, Units, COV Increment, Status Flags, Event State, Priority Array

Analog Variable Object

Read and Write Properties: Description, Name, Value, Units, COV Increment, Out of Service, Reliability

Read Only Properties: Type, Status Flags, Event State

Binary Input Object

Read and Write Properties: Description, Name, Value, Out of Service, Reliability

Read Only Properties: Type, Status Flags, Event State

Binary Output Object

Read and Write Properties: Description, Name, Value, Out of Service, Reliability, Minimum On/Off time

Read Only Properties: Type, Status Flags, Event State, Priority Array

Binary Variable Object

Read and Write Properties: Description, Name, Value, Out of Service, Reliability
Read Only Properties: Type, Status Flags, Event State

Event Enrollment Object

Read and Write Properties: Description, Name, Notification Class, Event Enable, Event Parameter, Event Type, Object Reference

Read Only Properties: Type, Event State, Event Time Stamps, Notification Type, Acknowledged Transactions

Notification Class Object

Read and Write Properties: Description, Name, Priority, Recipient List
Read Only Properties: Type, Notification Class

Calendar Object

Read and Write Properties: Description, Name
Read Only Properties: Type, Value Schedule Object

Read and Write Properties: Description, Name, Object Reference, Weekly Schedule, Effective Period, Schedule Exceptions

Read Only Properties: Type, Value

Trendlog Object

Read and Write Properties: None

Read Only Properties: Description, Name, Type, Notification Class, Event Enable, Event State, Event Time Stamps, Notification Type, Acknowledge Transactions, Log Enabled, Start/Stop Time, Log Interval

Program Object

Read and Write Properties: Description, Name, Out of Service, Reliability, Program Change Read Only Properties: Type, Status Flags

Loop Object

Read and Write Properties: Description, Name, Value, COV Increment, Out of Service, Reliability, Tuning Parameters, Action, Controlled Variable

Read Only Properties: Event State, Status Flag, Type

File Object

Read and Write Properties: Description, Name Read Only Properties: Type

2.3 Networking Communications

- A. The design of the BAS network shall integrate operator workstations and stand-alone DDC Controllers on a peer-to-peer communications network, and other devices on other networks. The network architecture shall consist of the following four levels:
 - 1. A facility-wide Ethernet communications network based on the BACnet/IP protocol (Annex J.)
 - 2. An auto-dial/auto-answer BACnet PTP telecommunications network
 - 3. A building-wide peer-to-peer communications network between Building Controllers utilizing the BACnet protocol over Ethernet. If this specification requirement cannot be met, the alternate manufacturer must identify how building-wide peer-to-peer communication will occur and how it will affect the Hospital's IT infrastructure.
 - 4. BACnet MS/TP secondary networks extended from appropriate Building Controllers to associated Advanced Application Controllers.
 - 5. Any use of a proprietary network within a building operation must be identified at the time of bid as an exception to the specification.
- B. Access to system data shall not be restricted by the hardware configuration of the building automation system. The hardware configuration of the BAS network shall be totally transparent to the user when accessing data or developing control programs.
- C. Facility-wide Ethernet Communications Network (Primary Connection)
 - 1. Local within each building, an Ethernet link has been provided for the facility wide BACnet/IP virtual network. Provide a new or extend from an existing Ethernet link for the building-wide peer-to-peer network (Building Controller network). Only one peer-to-peer Building Controller per floor or area shall provide the interface to the BACnet/IP virtual network for remote monitor, remote manual control, remote alarm, and remote programming of sequences of all building-wide points (BBMD device).

- Confirm -

2. The BAS manufacturer has an existing OWS in the operations office for monitor, control, alarm, displaying graphics, and simultaneous programming of sequences. This workstation may be utilized for this function but must be upgraded to meet the requirements in Paragraphs 2.08 and 2.09.
3. All Ethernet communications shall include software management and control for both access and privilege. This shall manage all rights for access and privilege per each remote location, for remote monitor, remote manual control, remote alarm, and remote programming of sequences of all building-wide points.

D. Building-wide Peer-to-Peer Communications Network:

1. Local building operator workstations and Building Controllers shall directly reside on an Ethernet network such that communications may be executed directly between Building Controllers and workstations on a peer-to-peer basis, without requirement for any device to operate or manage the network. A portion of the network management is built into each of the 'peer-to-peer members. 'Peer-to-peer' refers to controllers that (when interconnected) will act independently as equals, without a network manager and will communicate in a token passing protocol with each other to pass data packet information for the purpose of building-wide monitoring and control. A special data packet called the 'token' is constantly and continually 'passed' to every member of the peer-to-peer communications network. Any peer-to-peer device on the network can send a packet of data only when it has the 'token'. Any peer-to-peer device on this network can request data from, or send data to, any other device on the network. With this procedure, token ensures that data collisions do not occur, and assures that all members of the network get equal opportunity for all data on the network.
2. Systems that operate via polled response or other types of protocols that rely on a network manager, file server, or similar device to manage panel-to-panel communications will not be considered.
3. All operator devices either resident on the peer-to-peer network or connected via dial-up modems shall have the ability to access all point status and application report data or execute control functions for all other devices via the peer-to-peer network. Access to data shall be based upon logical identification of building equipment. No hardware or software limits shall be imposed on the number of devices with global access to the peer-to-peer network data
4. Network design shall include the following provisions:
 - a. Provide high-speed data transfer rates for alarm reporting, quick report generation from multiple controllers and upload/download efficiency between network devices. System performance shall ensure that an alarm occurring at any DDC Controller is displayed at workstations and/or alarm printers within 5 seconds.
 - b. Support of any combination of DDC Controllers and operator workstations directly connected to the peer-to-peer network. A minimum of 50 devices shall be supported on a single network (including MS/TP).
 - c. Message and alarm buffering to prevent information from being lost.

- d. Error detection, correction and retransmission shall be included to guarantee data integrity.
 - e. Synchronization of real-time clocks, to include automatic daylight savings time updating between all controllers shall be provided. Universal Time Coordinate based upon Greenwich Mean Time must be supported. (All BC devices must have Real Time Clocks with battery and SRAM backup, see section 1.03 H). It is preferred that the system clock utilizes the NCH-IS NTP (Network Time Protocol) server, so devices are synchronized with the Hospital's standard time server.
- 5. Acceptable protocols for intercommunications between building-wide peer-to-peer Building Controllers:
 - a. BACnet over Ethernet. If this protocol is not available, then the BAS manufacturer shall identify how building-wide peer-to-peer intercommunication will occur.
- E. Local Area (communications) Network (LAN):
 - 1. This communications network shall be limited to Building Controllers and Advanced Application Controllers and shall communicate bi-directionally with the BACnet peer-to-peer network.
 - 2. Advanced Application Controllers shall be arranged on the LANs in a functional relationship to the corresponding Building Controllers. For example, a VAV Advanced Application Controller serving a VAV terminal box shall be connected on a MS/TP network from the Building Controller that is controlling the corresponding air handling unit.
 - 3. A maximum of 64 Advanced Application Controllers may be configured on any individual LAN from any Building Controller to insure adequate global data and alarm response times.
 - 4. Acceptable protocols for intercommunications between Advanced Application Controllers and Building Controllers, are as follows:
 - a. BACnet (MS/TP) or BACnet over Ethernet
 - 5. The BAS manufacturer's control components shall not communicate on a proprietary communication network at any level. Any proprietary communication network required for third party control component shall submit to the Engineer and Owner for approval prior to purchase of the component.
 - 6. The Hospital-wide BACnet networking plan shall conform to the spreadsheet on the following page.

2.4 Building Controller

- A. DDC (stand-alone) Controllers shall have a 32 bit processor with EEPROM, flash driven operating system (OS). They shall also be multi-tasking, multi-user, real-time digital control processors and permit I/O expansion for control / monitoring of up to 48 I/O. Controller size shall be sufficient to fully meet the requirements of this specification.
- B. Each Building Controller shall have sufficient flash memory (EEPROM), a minimum of 2 megabyte, to support its own operating system. In addition, there shall be additional SRAM

memory for database handling: Both the EEPROM and SRAM shall permit full implementation and support of all B-BC requirements of this specification, including:

1. Control processes
2. Energy management applications
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
4. Historical/trend data for points specified
5. Maintenance support applications
6. Custom processes
7. Operator I/O
8. Dial-up communications
9. Manual override monitoring

C. Each Building Controller shall support:

1. Monitoring of the following types of inputs, without the addition of equipment outside of the Building Controller cabinet:

a. Analog inputs:

- 4-20 mA
- 0-10 Vdc
- Thermistors

b. Digital inputs:

- Dry contact closure
- Pulse Accumulator
- Voltage Sensing

2. Each Building Controller shall be capable of providing the following control outputs without the addition of equipment outside the Building Controller cabinet:

a. Digital outputs (contact closure):

- Contact closure (motor starters, up to size 4)

b. Analog outputs:

- 4-20 mA
- 0-10 Vdc
- 0-135 Ohm (with external Transducer)

- D. Each Building Controller shall have a minimum of 10 percent spare capacity for future point connection and be supplied with all necessary expansion modules to utilize the spare capacity. The controller shall support up to 48 (minimum) I/O with modular expansion modules. The type of spares shall be in the same proportion as the implemented I/O functions of the panel, but in no case shall there be less than two spares of each implemented I/O type. Provide all processors, power supplies, database memory, program sequence memory, and communication controllers complete so that the implementation of any added point (within the above 10% spare) only requires the addition of the point sensor, and wiring.

1. Provide sufficient internal memory for the specified control sequences and have at least 25% of the memory available for future use.

2. Each Building Controller shall provide at least one RS-232C serial data communication ports (BACnet PTP compatible) for operation of operator I/O devices such as industry standard printers, operator terminals, modems, and laptop portable operator's terminals. Building Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers, or terminals. System-wide access must be provided at each mechanical equipment room through the local Building Controller. Panel mounted terminals are not required. Furthermore, all Building Controllers shall include a hardwired, concealed and secured, RJ-11 or RJ-45 jack for use by the Portable Operators Workstation. The local operator, using the Portable Operators Workstation, shall plug into this jack, and shall perform all monitoring, control, and programming of sequences for all facility-wide points and sequences while standing at any Advanced Application Controller.
- E. The operator shall have the ability to manually override automatic or centrally executed commands at the Building Controller via local, point discrete, on-board supervised hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points. These override switches shall be operable whether the panel processor is operational or not.
1. Switches shall be supervised and mounted either within the Building Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
 2. Building Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. Building Controllers shall also collect override activity information for reports.
- F. Building Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LED's or analog indication of value shall also be provided for each analog output.
- G. Each Building Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The Building Controller shall provide both local and remote annunciation of any detected component failures and for repeated failure to establish network communications.
- H. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with current IEEE Standard C62.41.
- I. In the event of the loss of normal power, there shall be an orderly shutdown of all Building Controllers to prevent the loss of database or operating system software. Programs residing in memory shall be protected by using EEPROM under capacitor backup. The backup power source shall have sufficient capacity to maintain volatile memory in event of an AC power failure. Where interruptible power source is rechargeable (a rechargeable battery), provide sufficient capacity for a minimum of seventy-two hours backup. Charging circuitry, while the controller is operating under normal line power, shall constantly charge the rechargeable power source. A non-rechargeable power source shall not be permitted. Batteries shall be implemented to allow replacement without soldering.

1. Upon restoration of normal power, the Building Controller shall automatically resume full operation without manual intervention. If manual intervention is required upon loss of normal power, an uninterruptible power supply will be furnished within each control panel to provide a minimum of 2 hours of back-up power. This function will be field demonstrated for each controller.
 2. Should Building Controller memory be lost for any reason, the user shall have the capability of reloading the Building Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
- J. Building Controllers that lose communication or control due to a single sensor failure are not permitted.
- K. Building Controllers shall be used in each equipment room for the control of major pieces of equipment or systems. In addition, two (2) building controllers per floor shall be provided to manage the AAC devices for the east and west sides of the floor. The use of AAC devices for critical or main system equipment will not be permitted.
- L. All points associated with a given mechanical system (i.e., an air handling unit) will be controlled from a single Building Controller or point expansion panels from the respective building controller. No points from a given mechanical system may be distributed among multiple panels - points must be run back to a single Building Controller dedicated to that mechanical system. Closed-loop control must never depend upon network communications. All inputs, program sequences, and outputs for any single DDC control loop shall reside in the same Building Controller.
- M. Each Building Controller shall be provided with label indicating the building, floor, and what unit / piece(s) of equipment / area it serves. Labels to be posted on front corner of controller.
- N. Each Building Controller shall have label indicating what electrical panel and circuit it is fed from. Label to be on inside of front cover of controller.
- O. Each Building Controller will be furnished with a duplex receptacle within the panel enclosure. The controller power supply shall be provided with a UL listed plug to be served from one of the two receptacles. The other receptacle will be used for convenience. Power to duplex receptacle to be fed from J-box located in vicinity of the BC connection from the J-box to the duplex receptacle to be by the BAS Contractor.

2.5 Building Controller Resident Software Features

A. General:

1. All necessary software to form a complete operating system as described in this specification shall be provided.
2. The software programs specified in this Section shall be provided as an integral part of Building Controllers and shall not be dependent upon any higher level computer for execution.
3. Point naming convention shall be per NCH Standard. Coordinate with NCH Operations prior to submitting shop drawings. The BC shall support a 128 character object name length. BCs that only permit a 32 character length will not be permitted.

B. Control Software Description:

1. The Building Controllers shall have the ability to perform any or all the following pre-tested control algorithms:

- a. Two-position control
 - b. Proportional control
 - c. Proportional plus integral control
 - d. Proportional, integral, plus derivative control
 2. Control software shall include a provision for limiting the number of times that each piece of equipment may be cycled within any one hour period.
 3. The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads. This feature shall be resident in all Binary Output objects. The use of custom programming to prevent an excessive demand on start-up shall not be required.
 4. Upon the resumption of normal power, each Building Controller shall analyze the status of all controlled equipment, compare it with normal occupancy scheduling and turn equipment on or off as necessary to resume normal operations.
- C. All programs shall be executed automatically without the need for operator intervention and shall be flexible enough to allow user customization. Programs shall be applied to building equipment as described in the Sequence of Operations. Building Controllers shall have the ability to perform any or all the following energy management routines:
1. Time-of-day scheduling
 2. 365 day Calendar-based scheduling
 3. Holiday scheduling
 4. Temporary schedule overrides
 5. Start-Stop Time Optimization
 6. Automatic Daylight Savings Time Switch over
 7. Night setback control
 8. Enthalpy switch over (economizer)
 9. Peak demand limiting
 10. Temperature-compensated duty cycling
 11. Fan speed/ control
 12. Heating/cooling interlock
 13. Cold deck reset
 14. Hot deck reset
 15. Hot water reset
 16. Chilled water reset
 17. Condenser water reset
 18. Chiller sequencing
 19. Chiller load monitoring
- D. Building Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.
1. It shall be possible to use any of the following in a custom process:
 - a. Any system measured point data or status
 - b. Any calculated data

- c. Any results from other processes
 - d. User-defined constants
 - e. Arithmetic functions (+, -, *, /, square root, exponential, etc.)
 - f. Boolean logic operators (and/or, exclusive or, etc.)
 - g. On-delay/off-delay/one-shot timers
 - 2. Custom processes may be triggered based on any combination of the following:
 - a. Time interval
 - b. Time-of-day
 - c. Date
 - d. Other processes
 - e. Time programming
 - f. Events (e.g., point alarms)
 - 3. A single process shall be able to incorporate measured or calculated data from all other controllers on the network. In addition, a single process shall be able to issue commands to points in all other controllers on the network.
 - 4. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.
 - 5. The custom control programming feature shall be compiled and documented via English language descriptors. These descriptors (comment lines) shall be viewable from local operator I/O devices to facilitate troubleshooting.
- E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each Building Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the Building Controllers ability to report alarms be affected by either operator activity at a PC workstation, local I/O device, or communications with other panels on the network.
- 1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.
 - 2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each Building Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.
 - 3. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs.
 - 4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200-character alarm message to describe the alarm condition or direct operator response more fully.

- a. Each Building Controller shall be capable of storing all custom alarm text for each alarm. The alarm text shall be unique, and user defined; custom text shall be available for all BACnet alarms and shall reside in the BC, not in an OWS or PC.
 - b. Alarms shall have ability to be acknowledged from the local operator I/O device, (once the problem is resolved).
 5. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device. Coordinate which alarms will need to initiate a call to an operator device with NCH Operations. This function will occur through the BACnet Webserver and shall be part of the scope of NCHs BACnet integrator.
- F. A variety of historical data collection utilities shall be provided for manual or automatic sampling, storing, and displaying system data for points.
1. Building Controllers shall store point history data for selected analog and digital inputs and outputs:
 - a. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each Building Controller. Two methods of collection shall be allowed: either by a pre-defined time interval, or upon a pre-defined change of value. Sample intervals of 1 second to 7 days shall be provided. Each Building Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of 10,000 data samples.
 2. Trend data shall be stored at the Building Controllers and uploaded to the workstation through the BACnet web server when retrieval is desired. Uploads shall occur based upon either; user-defined interval, manual command, or automatically when the trend buffers are full. Furthermore, the BACnet web server shall notify the end-user if the hard drive capacity is low or if the database size is excessive. The BACnet web server shall use a standard MSDE or SQL database handler for all trend log management. All trend data shall be available to all BACnet web servers and for use in 3rd party personal computer applications. File format type to be comma delineated.
 3. Building Controllers shall also provide high resolution sampling capability for verification of control loop performance. Operator-initiated automatic and manual loop tuning algorithms shall be provided for operator-selected PID control loops. Provide capability to view or print trend and tuning reports. (Do not initially set up any auto loop tuning algorithms.)
 - a. The Loop object shall display the most recent historical data of its own performance. It shall illustrate the number of setpoint crossings and the maximum and average deviation from setpoint.
 - b. Loop tuning shall be capable of being initiated either locally at the Building Controller, from a network workstation or remotely using dial-in modems. For all loop tuning functions, access shall be limited to authorized personnel through password protection.
 4. BAS manufacturer shall provide programming time to set up a minimum of 12 different trends and create one custom report for each Building Controller. The NCH BACnet

integrator shall program the existing BACnet web server to create historical trend reports for the trends set up by the BAS Contractor.

G. Building Controllers shall automatically accumulate and store run-time hours for digital input and output points associated with all pieces of equipment.

1. The totalization routine shall have a sampling resolution of one minute or less.
2. The user shall have the ability to define a warning limit for run-time totalization. Unique, user- specified messages shall be generated when the limit is reached.

H. Building Controllers shall automatically sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and digital pulse input type points.

1. Totalization shall provide calculation and storage of accumulations of up to 99,999.9 units (e.g., kWh, gallons, BTU, tons, etc.).
2. The totalization routine shall have a sampling resolution of one minute or less.
3. The user shall have the ability to define a warning limit. Unique, user-specified messages shall be generated when the limit is reached.

I. Building Controllers shall have the ability to count events such as the number of times a pump or fan system is cycled on and off. Event totalization shall be performed on a daily, weekly, or monthly basis.

1. The event totalization feature shall be able to store the records associated with a minimum of 9,999.9 events before reset.
2. The user shall have the ability to define a warning limit. Unique, user-specified messages, up to 200 characters, shall be generated when the limit is reached.

J. Advanced Application Controllers:

1. Each Building Controller shall be able to extend its performance and capacity through the use of remote Advanced Application Controllers. Each Advanced Application Controller shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each Advanced Application Controller shall be a microprocessor-based, 32-bit, multi-tasking, real-time digital control processor. Provide for control of terminal equipment including, but not limited to, the following:

- Edit for Specific Project -

- a. Rooftop units
 - b. VAV Boxes
 - c. Heat pumps
 - d. Fan coils, Univents
 - e. Other terminal equipment or monitoring
2. Advanced Application Controllers must have the same resident software features as a building controller as indicated in the paragraphs above and must be peer-to-peer devices. Advanced Application Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Provide a hand/off/automatic switch for each digital output for manual override capability. Switches shall be

mounted either within the controller's key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides. In addition, each switch position shall be supervised in order to inform the system that automatic control has been overridden. Switches will only be required for non-terminal applications or where controllers are readily accessible (not required for VAVs, Heat pumps, etc. that are above ceilings or inaccessible). All inputs and outputs shall be of the Universal type, allowing for additional system flexibility. A minimum of 12 global points (i.e., chilled water temperature, hot water temperature, etc.) must be able to be accessed through the Advanced Application Controller. If global point access is unavailable with the Advanced Application, then a Building Controller must be furnished.

3. Each Advanced Application Controller shall support its own real-time operating system. Provide a time clock with battery backup to allow for stand-alone operation if communication with its Building Controller is lost and to insure protection during power outages. If the AAC does not support a real time clock (RTC) function. It cannot be used to extend the performance and capacity of a building controller associated with critical or system level. AAC devices without RTC functionality will be permitted for use on terminal or unitary equipment such as VAV boxes, fan coils, heat pumps, uninvents and auxiliary monitoring and control.
4. Provide each Advanced Application Controller with sufficient memory to accommodate point databases, operating programs, local alarming, and local trending. All databases and programs shall be stored in non-volatile EEPROM under capacitor backup (lithium or rechargeable battery backup will not be permitted). Advanced Application Controllers must be fully programmable with a minimum of 200 lines of code available for custom programming. All programs shall be field-customized to meet the user's exact control strategy requirements. Advanced Application Controllers utilizing pre-packaged or canned programs shall not be acceptable. As an alternative, provide Building Controllers for all central equipment to meet custom control strategy requirements.
5. Programming of Advanced Application Controllers shall utilize the same language and code as used by Building Controllers to maximize system flexibility and ease of use. Should the (AAC) controller utilize a different control language, provide a Building Controller to meet the specified functionality.
6. Local alarming and trending capabilities shall be provided for convenient troubleshooting and system diagnostics. Alarm limits and trend data information shall be user-definable for any point.
7. Each controller shall have connection provisions for a portable operator's terminal (laptop computer). This tool shall allow the user to display, generate or modify all point databases and operating programs. All new values and programs may then be restored to EEPROM via the programming tool.
8. Advanced Application Controllers that lose communication with master panels, and/or lose control due to a single sensor failure, are not acceptable.
9. At all Advanced Application Controllers include a hardwired, concealed and secured, RJ-11 or RJ- 45 jack for use by the Portable Operators Workstation. The local operator, using the Portable Operators Workstation shall plug into this jack, and shall perform all monitoring, control, and programming of sequences for all building-wide points and sequences while standing at any Advanced Application Controller.

10. At all Advanced Application Controllers, include the point database of the following minimum building-wide system data:

- a. Building Primary Hot Water Return and Supply Temperatures
- b. Building Primary Chilled Water Return and Supply Temperatures
- c. Building Common Outside Air Temperature
- d. Database for 7 other building-wide points, as field selected by NCH.

2.6 Advanced Application Controllers (AAC) For “ASC” Use

- A. Application Specific Controllers are not permitted for use unless otherwise approved by NCH. AAC devices shall be used for all intended ASC functionality. By default, ASCs do not support the required BIBBs, or Read/Write capabilities as desired by NCH.
- B. Each AAC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each AAC shall be a microprocessor- based, 32-bit, multi-tasking, real-time digital control processor.
- C. The use of these AACs is limited to the monitor and control of building HVAC equipment that are outside of any mechanical equipment room, or outside of any electrical equipment room. All equipment located within, or controlled from within, any mechanical equipment room or electrical equipment room shall use the peer-to-peer Building Controller.
- D. The electrical power source for these Advanced Application Controllers shall be from local circuit breaker with appropriate fused, class 2, 100VA power-limited output. The breaker shall be dedicated to the Advanced Application Controllers, labeled accordingly, and locked-out from inadvertent casual shutoff.
- E. Advanced Application Controllers:
 - 1. Provide for control of each piece of building HVAC equipment, including, but not limited to, the following:

- Edit for Specific Project -

- a. Variable Air Volume (VAV) Terminal Boxes
 - b. Constant Air Volume (CV) Terminal Boxes
 - c. Fan Coil Units
- 2. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. All inputs and outputs shall be of the universal type; that is, the outputs may be utilized either as modulating or two-state, allowing for additional system flexibility. Analog outputs shall be industry standard signals such as 24V floating control and 0-10 VDC allowing for interface to a variety of modulating actuators. Terminal equipment controllers or AACs utilizing proprietary control signals and actuators shall not be acceptable. As an alternative, provide Building Controllers or other AACs with industry standard outputs for control of all terminal equipment.
 - 3. Each controller performing space temperature control shall be provided with a matching room temperature sensor. The sensor shall be 10K Type-3 thermistor based providing the following minimum performance requirements are met:
 - a. Accuracy: $\pm 0.36^{\circ}\text{F}$
 - b. Operating Range: 32° to 158°F

- c. Set Point Adjustment Range: 55° to 85°F (adjustable)
 - d. Set Point Modes:
 - Independent Heating
 - Independent Cooling
 - Night Setback Heating
 - Night Setback Cooling
 - e. Calibration Adjustments: None required
 - f. Installation: Up to 500 ft. from Controller
 - g. Each room sensor shall also include the following auxiliary devices or options:
 - Set point Adjustment Dial or equivalent buttons
 - Digital LED Temperature Indicator
 - 2% on board humidity sensor (where called for on drawings and in sequence of operations)
 - RJ-11 or RJ-45 port for interface with BAS system
 - h. The set point adjustment shall allow for modification of the temperature in a minimum of .5° F increments by the occupant. Set point adjustment may be locked out, overridden or limited as to time or temperature through software by an authorized operator at the central workstation, Building Controller, or via the portable operator's terminal.
 - i. The temperature indication shall be a digital display visible without removing the sensor cover.
 - j. An override switch shall initiate override of the night setback mode to normal (day) operation when activated by the occupant. The override function may be locked out, overridden or limited as to the time through software by an authorized operator at the central workstation, Building Controller, or via the portable operator's terminal.
4. Each controller shall perform its primary control function independent of other DDC Controller LAN communications, or if LAN communication is interrupted. Reversion to a fail-safe mode of operation during LAN interruption is not acceptable. The controller shall receive its real-time data from the Building Controller time clock to ensure LAN continuity. Each controller shall include algorithms incorporating proportional, integral, and derivative (PID) values for all applications. All PID values and biases shall be field-adjustable by the user via terminals as specified herein. This functionality shall allow for tighter control of space conditions and shall facilitate optimal occupant comfort and energy savings. Controllers that incorporate proportional and integral (PI) control algorithms only, without derivative (D) control algorithms, shall not be acceptable.
5. Provide each terminal equipment controller with sufficient memory to accommodate point databases, operating programs, local alarming, and local trending. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or capacitor backup. The controllers shall be able to return to full normal operation without user

intervention after a power failure of unlimited duration. Provide uninterruptible power supplies (UPS's) of sufficient capacities for all terminal controllers that do not meet this protection requirement. Operating programs shall be fully customizable for specific applications (programming language shall be identical to the Building Controllers). In addition, specific applications may be modified to meet the user's exact control strategy requirements, allowing for additional system flexibility. Controllers that require factory changes of any applications or that are algorithm based will not be acceptable.

6. Variable Air Volume (VAV) Box Controllers

a. As a minimum, shall support the following types of applications for pressure independent terminal control:

- VAV, cooling only
- VAV, with hot water reheat
- VAV, with hot water reheat and perimeter heating

b. All VAV box control applications shall be fully programmable such that a single controller may be used in conjunction with any of the above types of terminal units to perform the specified sequences of control. This requirement must be met to allow for future design and application changes and to facilitate system expansions. Controllers that require factory changes of any applications or that are algorithm based will not be acceptable.

c. The VAV box controller shall be powered from a 24 VAC source and shall function normally under an operating range of 20 to 28 VACS allowing for power source fluctuations and voltage drops. The BAS contractor shall provide a dedicated power source and separate isolation transformer for each controller unable to function normally under the specified operating range. The controllers shall also function normally under ambient conditions of 32° to 130°F (0° to 50°C) and 10% to 95%RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.

d. The VAV controller shall include a differential pressure transducer that shall connect to the terminal unit manufacturer's standard averaging air velocity sensor to measure the velocity pressure in the duct. The controller shall convert this value to actual airflow in cfm. Single point air velocity sensing is not acceptable. The differential pressure transducer shall have a measurement range of 0 to 1 in WC and measurement accuracy of $\pm 5\%$ throughout its range, ensuring primary air flow conditions shall be controlled and maintained to within $\pm 5\%$ of set point at the specified parameters. The BAS contractor shall provide the velocity sensor if required to meet the specified functionality.

e. The VAV box controller shall include provisions for manual and automatic reset of the differential pressure transducer to maintain stable control and insuring against drift over time. Reset shall be accomplished by stroking the terminal unit damper actuator to 0%, full closed, position so that a 0 cfm air volume reading is sensed. The controller shall automatically accomplish this

whenever the end user desires. Manual reset may be accomplished by either commanding the actuator to 0% via the POT or by depressing the room sensor override switch (where available). Reset of the transducer at the controller location shall not be necessary.

f. The VAV box controller shall interface to a matching room temperature sensor as previously specified. The controller shall function to maintain space temperature to within $\pm 1.5^{\circ}\text{F}$ (adj.) of set point at the room sensor location.

g. The VAV box controller performing space heating control shall incorporate a program allowing for modulation of a hot water reheat valve, as required to satisfy space heating requirements. Box controllers with perimeter heating requirements shall be able to stage the reheat coil valve and the perimeter heating valve in series to eliminate heating and cooling simultaneously. Each controller shall also incorporate a program that allows for resetting of the associated air handling unit discharge temperature if required to satisfy space cooling requirements. This algorithm shall function to signal the respective DDC Controller to perform the required discharge temperature reset to maintain space temperature cooling set point.

7. Constant Air Volume (CAV) Box Controllers:

a. As a minimum, shall support the following types of applications for pressure independent terminal control:

- CAV, cooling only
- CAV, with hot water reheat
- CAV, with hot water reheat and perimeter heating

b. All CAV box control applications shall be fully programmable such that a single controller may be used in conjunction with any of the above types of terminal units to perform the specified sequences of control. This requirement must be met to allow for future design and application changes and to facilitate system expansions. Controllers that require factory application changes or those that are algorithm based will not be acceptable.

c. The CAV box controller shall be powered from a 24 VAC source and shall function normally under an operating range of 20 to 28 VACS, allowing for power source fluctuations and voltage drops. The BAS contractor shall provide a dedicated power source and separate isolation transformer for each controller unable to function normally under the specified operating range. The controllers shall also function normally under ambient conditions of 32° to 130°F and 10% to 95%RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.

d. The CAV controller shall include a differential pressure transducer that shall connect to the terminal unit manufacturer's standard averaging air velocity sensor to measure the velocity pressure in the duct. The controller shall convert this value to actual airflow in cfm. Single point air velocity sensing is not

acceptable. The differential pressure transducer shall have a measurement range of 0 to 1 in WC and measurement accuracy of $\pm 5\%$ throughout its range, ensuring primary air flow conditions shall be controlled and maintained to within $\pm 5\%$ of set point at the specified parameters. The BAS contractor shall provide the velocity sensor if required to meet the specified functionality.

e. The CAV box controller shall include provisions for manual and automatic reset of the differential pressure transducer to maintain stable control and insuring against drift over time. Reset shall be accomplished by stroking the terminal unit damper actuator to 0%, full closed, position so that a 0 cfm air volume reading is sensed. The controller shall automatically accomplish this whenever the end user desires. Manual reset may be accomplished by either commanding the actuator to 0% via the POT or by depressing the room sensor override switch (where available). Reset of the transducer at the controller location shall not be necessary.

f. The CAV box controller shall interface to a matching room temperature sensor as previously specified. The controller shall function to maintain space temperature to within $\pm 1.5^{\circ}\text{F}$ (adj) of set point at the room sensor location.

g. Each controller performing space heating control shall incorporate an algorithm allowing for modulation of a hot water reheat valve as required to satisfy space heating requirements. Box controllers with perimeter heating requirements shall be able to stage the reheat coil valve and the perimeter heating valve in series to eliminate heating and cooling simultaneously. Each controller shall also incorporate a program that allows for resetting of the associated air handling unit discharge temperature if required to satisfy space cooling requirements. This program shall function to signal the respective DDC Controller to perform the required discharge temperature reset to maintain space temperature cooling set point. Control of the terminal unit damper to maintain cooling set point shall not be permitted.

8. Unit Conditioner Controllers:

a. As a minimum, shall support the following types of applications for terminal control:

- Fan coil units

b. As a minimum, shall support the following types of fan coil units:

- Fan Coil, 2-pipe, heating only
- Fan Coil, 2-pipe, cooling only
- Fan Coil, 4-pipe, heating, or cooling

c. All Unit Conditioner control applications shall be fully programmable such that a single controller may be used in conjunction with any of the above types of terminal units to perform the specified sequences of control. This requirement must be met to allow for future design and application changes

and to facilitate system expansions. Controllers that require factory application changes or those that are algorithm based will not be acceptable.

d. The Unit Conditioner controllers shall be powered from a 24 VAC source and shall function normally under an operating range of 20 to 28 VAC, allowing for power source fluctuations and voltage drops. The BAS contractor shall provide a dedicated power source and separate isolation transformer for each controller unable to function normally under the specified operating range. The controllers shall also function normally under ambient conditions of 32° to 130°F (0° to 50°C) and 10% to 95%RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly (unless mounted above ceilings or in a general area that is normally not accessible).

e. The Unit Conditioner controller shall interface to a matching room temperature sensor as previously specified. The controller shall function to maintain space temperature to within $\pm 1.5^{\circ}\text{F}$ (adj) of set point at the room sensor location.

f. The Unit Conditioner controller performing space temperature control shall incorporate a program allowing for modulation of a hot water reheat and chilled water valve, as required to satisfy space heating and cooling requirements.

2.7 Portable Operator's Terminal (POT) Existing Bas Workstation Software:

- Confirm Requirement for POT with NCH Operations -

A. Provide software and licensing agreement for two (2) portable operator terminal (POT). The POT shall be a laptop configuration and plug directly into any control panel. Provide the BACnet BAS software as required to provide complete functionality for viewing and modifying of all data (including custom programs). In addition, provide an upgrade of the existing BAS workstation in the operation shop. Software shall be the latest version of the manufacturer's configuration and tool sets.

1. Delta-Orcaview Workstation Software Package
2. Siemens - Apogee Insight Software Package
3. Johnson - Metasys Workstation Software Package

B. Portable Operator's Terminal (laptop) shall be provided by the Hospital's IT department. The BAS Contractor shall coordinate minimum hardware requirements to the Construction Manager with shop drawing submittals.

C. Functionality of the portable operator's terminal and the existing BAS workstation shall be:

1. Access all controllers on the network.
2. Backup and/or restore DDC Controller databases for all system panels, not just the DDC Controller connected thereto.
3. Display all point, selected point, and alarm point summaries.
4. Display trending and totalization information.
5. Add, modify and/or delete any existing or new system point.
6. Command, change setpoint, enable/disable any system point.
7. Program and load custom control sequences as well as standard energy management programs.

8. System Configuration and Definition:

- a. All temperature and equipment control strategies and energy management routines shall be definable and fully programmable by the operator. System definition and modification procedures shall not interfere with normal system operation and control.
- b. The system shall be provided complete with all equipment and documentation necessary to allow an operator to independently perform the following functions:
 - Add/delete/modify stand-alone Building Controllers
 - Add/delete/modify stand-alone Advanced Application Controllers
 - Add/delete/modify operator workstations
 - Add/delete/modify Application Specific Controllers, if used
 - Add/delete/modify points of any type and all associated point parameters and tuning constants
 - Add/delete/modify alarm reporting definition for points
 - Add/delete/modify control loops
 - Add/delete/modify energy management applications
 - Add/delete/modify time and calendar-based programming
 - Add/delete/modify totalization for points
 - Add/delete/modify historical data trending for points
 - Add/delete/modify custom control processes
 - Add/delete/modify all graphic displays, symbols and cross-reference to point data
 - Add/delete/modify dial-up telecommunication definition
 - Add/delete/modify all operator passwords
 - Add/delete/modify alarm messages

D. Definition of operator device characteristics, any controller's individual points, applications and control sequences shall be performed using instructive prompting software.

1. All custom programming language must be line sequential, English text with a real time compiler. The operator shall be able to view all live data within the program with no exceptions. The use of secondary software or manual intervention shall not be required.
2. If programming must be done with the PC workstation off-line, the BAS contractor shall provide at least 2 operator workstations.
3. Inputs and outputs for any process shall not be restricted to a single DDC Controller but shall be able to include data from all other network panels to allow the development of network- wide control strategies. Processes shall also allow the operator to use the results of one process as the input to any number of other processes (cascading).
4. Provide the capability to backup and store all system databases on the workstation hard disk. In addition, all database changes shall be performed while the workstation is on-line without disrupting other system operations. Changes shall be automatically recorded and downloaded to the appropriate controller. Similarly, changes made at any Controllers shall be automatically uploaded to the workstation, ensuring system

continuity. The user shall also have the option to selectively download changes as desired.

5. Provide context-sensitive help menus to provide instructions appropriate with operations and applications currently being performed. The help menus shall be readily accessible by selecting an icon or by pressing a function button on the keyboard.

E. Connection of a POT to a distributed control processor shall not interrupt nor interfere with normal network operation in any way, prevent alarms from being transmitted or preclude centrally initiated commands and system modification.

F. Portable operator terminal access to controller shall be password-controlled.

G. Interface to graphical viewing and control environment shall be through the existing BACnet web server via web page access.

- Include for Informational Purposes Only -

2.8 Existing BACnet Web Server Interface

A. All work associated with the existing BACnet web server shall be performed by the NCH BACnet integrator.

B. Basic Interface Description of Existing System

1. The following is the specification information for the existing BACnet server:

- Verify with NCH Operations -

- 1 HP ProLiant DL360 G5
- 1 Dual Core Intel® Xeon® 5160 3 GHz Processor 2 GB RAM
- 1 HP Smart Array P400i/256 Controller with battery
- 2 Embedded NC373i Multifunction Gigabit Network Adapters
- 3 HP 72 GB Hot Plug 2.5 SAS 15K Hard Drive
- 1 HP 1u Server 700w Hot Plug Power Supply or Compatible HP Redundant Fans
- 1 PCI-X Riser Cage
- 1 Slim Line CD-RW/DVD-ROM 24X Combo Drive Option Kit
- 1 HP NC7771 PCI-X Gigabit Server Adapter
- 1 Licensed Copy of Veritas NetBackup for Windows
2. Operator workstation interface software shall minimize operator training using English language prompting, English language point identification and industry standard PC application software. The software shall provide, as a minimum, the following functionality:
 - a. Graphical viewing and control of environment
 - b. Scheduling and override of building operations
 - c. Collection and analysis of historical data
 - d. Definition and construction of dynamic and animated color graphic displays
 - e. Editing, programming, storage and downloading of controller databases
3. Provide a graphical user interface, which shall minimize the use of a typewriter style keyboard using a mouse or similar pointing device and "point and click" approach to

menu selection. Users shall be able to start and stop equipment or change setpoints from graphical displays using a mouse or similar pointing device.

- a. Provide functionality such that all operations can also be performed using the keyboard as a backup interface device.
- b. Provide additional capability that allows at least 10 special function keys to perform often- used operations.

4. The software shall provide multi-tasking operating system such that alarm notification occurs while user is running other applications such as Word or Excel; trend data uploads occur in the background while other applications are running. The mouse shall be used to quickly select and switch between multiple applications. This shall be accomplished using Microsoft Windows^a or similar industry standard software that supports concurrent viewing and controlling of systems operations.

- a. Provide functionality such that any of the following may be performed simultaneously, and in any combination, via user-sized windows: (Vector based graphics)

- Dynamic and animated color graphics and graphic control
- Alarm management
- Time-of-day scheduling
- Trend data definition and presentation
- Graphic definition
- Graphic construction

- b. If the software is unable to display several different types of displays at the same time, the BAS contractor shall provide at least two operator workstations.

5. Multiple-level password access protection shall be provided to allow the user/manager to limit workstation control, display and data base manipulation capabilities. Privileges shall be customizable for each operator; the main menu shall reflect the privileges upon log on showing only the applications appropriate for the operator.

- a. Customizable such that operators can monitor, command, or edit an application or group of points. An operator can be defined with privileges for access to a building, group of buildings, or areas, by application: the operator has monitor, command, and edit capability for time of day schedules and calendars (only) for the entire campus: or by function: the operator has ability to view/monitor all areas of the campus and receive alarms, etc.
- b. A minimum of 50 unique passwords, including user initials, shall be supported.
- c. Operators will be able to perform only those commands available for their respective passwords. Menu selections displayed shall be limited to only those items defined for the access level of the password used to log-on.
- d. The system shall automatically generate a report of log-on/log-off time and system activity for each user.
- e. User-definable, automatic log-off timers of from 5 to 60 minutes shall be provided to prevent operators from inadvertently leaving devices on-line as

well as have the capability to generate a report of log-on, log-off time, parameters modified, and system activity for each user.

6. Software shall allow the operator to perform commands including, but not limited to, the following:

- a. Start-up or shutdown selected equipment
- b. Adjust set points
- c. Add/modify/delete time programming
- d. Enable/disable process execution
- e. Lock/unlock alarm reporting for points
- f. Enable/disable totalization for points
- g. Enable/disable trending for points
- h. Override PID loop set points
- i. Enter temporary override schedules
- j. Define holiday schedules
- k. Change time/date
- l. Automatic daylight savings time adjustments
- m. Enter/modify analog alarm limits
- n. Enter/modify analog warning limits
- o. View limits
- p. Enable/disable demand limiting for each meter
- q. Enable/disable duty cycle for each load
- r. Operator shall have ability to schedule reports to print at a pre-specified time and frequency and directed to displays, printers, disk, or emails. The reports shall be capable of querying all BACnet devices for all BACnet data and shall be available in industry standard formats such as Acrobat, Microsoft Word, Microsoft Excel, and Crystal Reports.
 - Summaries shall be provided for specific points, for a logical point group, for a user-selected group or groups or for the entire BACnet network without restriction due to the hardware configuration of the building automation system. At a minimum, the report function shall provide all required BACnet data for the previously identified BACnet objects.

C. Update Scheduling Functions on the Existing BACnet Web Server as described below:

1. Provide a graphical spreadsheet-type format for simplification of time-of-day scheduling and overrides of building operations. Provide the following spreadsheet graphic types as a minimum:
 - a. BACnet schedules
 - b. BACnet calendars
2. Weekly schedules shall be provided for each building zone or piece of equipment with a specific occupancy schedule. Each schedule shall include columns for each day of the week as well as holiday and special day columns for alternate scheduling on user-defined days. Equipment scheduling shall be accomplished by simply inserting occupancy and vacancy times into appropriate information blocks on the graphic. In addition, temporary overrides and associated times may be inserted into blocks for

modified operating schedules. After overrides have been executed, the original schedule will automatically be restored.

3. Zone schedules shall be provided for each building zone as previously described. Each schedule shall include all commendable points residing within the zone unless custom programming is used to enable/disable the points. Each point may have a unique schedule of operation relative to the zone's occupancy schedule, allowing for sequential starting and control of equipment within the zone.
4. Monthly calendars, until the year 2020, shall be provided which allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device and shall automatically reschedule equipment operation as previously defined on the weekly schedules.

D. Update Collection and Analysis of Historical Data Function on the Existing BACnet Web Server as described below.

1. Provide trending capabilities that allow the user to easily monitor and preserve records of system activity over an extended period. Any system point may be trended automatically at time-based intervals or changes of value, both of which shall be user-definable. Trend data may be stored on hard disk for future diagnostics and reporting. In addition, the BAS system shall automatically trend and archive all alarms and user activity (no exceptions).
2. Trend data report graphics shall be provided to allow the user to view all trended point data. The BAS system shall employ the use of Multiple Trend-Logs which may be customized to include up to 8 individual single trends in one viewable and printable format. Provide additional functionality to allow any trended data to be transferred easily to Microsoft Office, Excel[®]. This shall allow the user to perform custom calculations such as energy usage, equipment efficiency and energy costs and shall allow for generation of these reports on high-quality plots, graphs and charts.
3. Provide additional functionality that allows the user to view trended data on trend graph displays. Displays shall be actual plots of both static and/or real-time dynamic point data. A maximum of 8 points may be viewed simultaneously on a single graph, with color selection and line type for each point being user definable. Displays shall include an 'X' axis indicating elapsed time and a 'Y' axis indicating a range scale in engineering units for each point. The 'Y' axis shall have the ability to be manually or automatically scaled at the user's option. Different ranges for each point may be used with minimum and maximum values listed at the bottom and top of the 'Y' axis. All 'Y' axis data shall be color-coded to match the line color for the corresponding point.
 - a. Static graphs shall represent actual point data that has been trended and stored on disk. Exact point values may be viewed on a data window by pointing or scrolling to the place of interest along the graph. Provide capability to print any graph on the system printer for use as a building management and diagnostics tool.
 - b. Dynamic graphs shall represent real-time point data. Any point or group of points may be graphed, regardless of whether they have been predefined for trending. The graphs shall continuously update point values. At any time, the user may redefine sampling times or range scales for any point. In

addition, the user may pause the graph and take "snapshots" of screens to be stored on the workstation disk for future recall and analysis. As with static graphs, exact point values may be viewed, and the graphs may be printed.

E. Create New Dynamic Color Graphic Displays on the Existing BACnet Web Server as described below.

1. Color graphic floor plan displays and system schematics for each piece of mechanical equipment, including air handling units, chilled water systems and heating systems, room level terminal unit equipment, etc. shall be provided by the BAS contractor to optimize system performance analysis and speed alarm recognition. The operator interface shall allow users to access the various system schematics and floor plans via a graphical penetration scheme, menu selection or text-based commands.
2. Dynamic temperature values, humidity values, flow values, percent load, and status indication shall be shown in their actual respective locations and shall automatically update to represent current conditions without operator intervention.
3. The windowing environment of the PC operator workstation shall allow the user to simultaneously view several graphics at a time to analyze total building operation or to allow the display of a graphic associated with an alarm to be viewed without interrupting work in progress.
4. Graphic generation software shall be provided to allow the user to add, modify or delete system graphic displays.
 - a. The BAS contractor shall provide libraries of pre-engineered screens and symbols depicting standard air handling unit components (e.g., fans, cooling coils, filters, dampers, etc.), complete mechanical systems (e.g., constant volume-terminal reheat, VAV, etc.) and electrical symbols.
 - b. The graphic package shall use a mouse or similar pointing device in conjunction with a drawing program to allow the user to perform the following:
 - Define symbols
 - Position and size symbols
 - Define background screens
 - Define connecting lines and curves
 - Locate, orient and size descriptive text
 - Define and display colors for all elements
 - Establish correlation between symbols or text and associated system points or other displays
 - Ability to import scanned images and CAD drawings in Autodesk®, DWG format.
 - c. Graphical displays can be created to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout or any other logical grouping of points that aids the operator in the analysis of the facility.
 - To accomplish this, the user shall be able to build graphic displays that include point data from multiple controllers.
5. Dynamic system status graphic of the site-specific architecture showing status of system hardware, including quantity and address of networks, field panels, terminal equipment controllers, and printers.

6. The BAS contractor shall employ the use of accurate floor plans as part of the overall graphics package. The floor plans shall illustrate the location of room sensors and equipment. In addition, the floor plans shall utilize a thermos-graphic scheme to instantly alert the end user of hot and cold areas. The thermograph shall illustrate and automatically intensify the red and blue gradient fills for each area, as to indicate the severity of the overheating or overcooling problem.
 7. Create refrigeration and room temperature and humidity monitoring graphics and alarm reporting for all points identified in the Sequence of Operations.
- F. Update Web Interface to the Existing BACnet Web Server as described below.
1. Update the existing Web-based interface to allow access to the Replacement Hospital BAS system based on client-server architecture. An operator shall be able to access all the information in the system via the standard Web browser.
 2. Existing browser is a standard version of Internet Explorer 5 (or higher) or Netscape 6 (or higher). No special vendor-supplied software is needed on the thin-client computers running the above browsers. All information shall be viewable, real-time and updated automatically without user interaction.
 3. Web page graphics shown on the browser shall be replicas of the BAS displays. Operators shall need no additional training to understand the information presented on the Web pages when compared to what is shown on the BAS displays.
 4. The Web interface shall automatically discover and display new devices that are connected to the BACnet network. In addition, all objects and associated properties will be automatically displayed without “mapping” or user intervention.
 5. An operator, via the Web, shall have the ability to:
 - a. Navigate real-time through the system
 - b. Change all setpoints
 - c. View and acknowledge active alarms
 - d. Configure the system to email alarms to any other computer on the wide-area network (WAN).
 - e. Create and edit building schedules
 - f. Trend any point or value and display graphically or in table format
 - g. Manually override any input, output, or value.
 - h. Display a summary of overridden points
 - i. Create new users or user groups, assign access privileges, and edit existing user access privileges
 - j. Link graphics to .PDF files, AutoCAD files and Visio files to display sequence of operations and as-built documentation.
 - k. View and edit programs, and all input and output points
 6. All “BAS” displays shall be converted to HTML files automatically. The operator shall not be required to program in HTML.
 7. All Web page graphics shall have dynamic graphic links with full animation of system components
 8. The Web site shall automatically generate a “network” tree, indicating all devices connected to the network.

9. Access via the Web browser shall utilize the same hierarchal security scheme as the BAS system. User shall be asked to log in once the browser makes connection to the Webpage. Once the user logs in, all changes that are made shall be tracked by the BAS system. The user shall be able to change only those items that the user has authority to change.

G. Hardware

1. The PC requirements for the Web interface shall be industry standard "off the shelf" technology. Furthermore, the Web interface software and standard BAS software shall be installed on the same PC.

2.9 Field Devices

- Confirm All Model Numbers with Manufacturers -

- A. **Temperature Sensors:** Each temperature sensor shall match the requirements of the associated temperature controller and shall be based upon 10-K Type-3 thermistors. Each sensor shall be designed for the appropriate application (i.e., duct, immersion, etc.) and be provided with all necessary installation accessories. Ranges shall be selected to the middle of the control range. Temperature sensors must have a minimum accuracy of ± 0.5 degrees F or .5 % of scale; whichever will provide the least error in measurement.
1. Electronic: A modulating solid state controller with built-in detector, P, PI, or PID controller, as required, with continuous voltage or current output. Each controller shall have individual set point, proportional band, start point, and span adjustments. Input voltage shall be 24 VAC or less. Each controller to be provided with night setback, summer/winter switchover or remote reset capabilities as required. Controllers shall be of matching type to the input detectors and output drives or sequencers.
 2. Cast aluminum thermostat guards shall be provided on all sensors except those in offices or mounted on equipment (i.e. unit heaters). Guards shall be firmly attached to wall and thermostat cover shall be visible through the guard. All room sensors in public areas will have concealed set point adjustments.
 3. All space sensors shall have LCD display and service port. Space sensors in offices shall also have set point adjustment and integral humidity sensor.
 4. Install thermostats and sensors at 4'-6" AFF to bottom unless otherwise noted on Architectural Drawings. Coordinate installation with the work of other trades before any rough ins are made.
 5. Provide temperature sensors as required to meet the sequence of operation; in addition, provide temperature sensors in the following locations: return air, mixed air and discharge air sections if not required by the sequence of operation.
- B. **Humidity Sensors:** The relative humidity transmitter monitors and transmits changes in humidity, accurate to ± 2 % RH. Operating range shall be 0 to 99% RH.
- C. **Pressure Sensors:** Static pressure analog sensors shall be high accuracy $\pm 1\%$ of range suitable for the low pressures and selected for at least 50% over range. Sensors shall have industry standard 4-20 mA output and zero end span adjustments.

- D. **Control Dampers (Multiple Blade Dampers):** Automatic dampers furnished by the BAS Contractor shall be single blade or multiple blades as applicable. All dampers are sized on the drawings. All blank-off plates and conversions necessary to install smaller than duct size dampers are the responsibility of the HVAC Contractor. All dampers furnished by air handling unit manufacturers must meet the requirements listed in this section.
- a. All damper frames are to be constructed of No. 13 gauge galvanized sheet metal and shall have flanges for duct mounting. Damper blades shall not exceed 6 inches width. All blades are to be airfoil type construction will be equal to Ruskin CD 50 control dampers with blade and jamb seals. Blades are to be suitable for high velocity performance.
 - b. Damper bearings to be composed of
 - i. A celcon fixed around a 7/16" aluminum hexagon blade pivot pin rotating within a polycarbonate outer bearing inserted in the frame OR Nylon bushings that turn in the bearings that are oil impregnated sintered metal. Dampers hung with blades mounted vertically shall be provided with thrust bearings.
 - c. All damper bearings are to be made of nylon. Bushings that turn in the bearings are to be oil impregnated sintered metal. Dampers hung with blades mounted vertically shall be provided with thrust bearings. Butyl rubber seals are to be installed along the top and bottom of the frame and along each blade edge. Independent, self-compensating, stainless steel end seals shall be installed to ensure minimum leakage between blade ends and damper frame. Seals shall provide a tight closing low leakage damper. Damper sections shall not exceed 48" in length or 16 sq. ft. and shall have minimum of one operator per damper section. All dampers in modulating applications shall have opposed blades. Dampers in two position services shall have parallel blades. Where sequence requires, submittals shall include damper sizes and leakage characteristics. Leakage shall not exceed 1 % at 4" W.C. when tested per AMCA Standard 500.
1. Dampers by the following manufacturers of the same type and meeting other requirements may be furnished at the Contractor's option:
- a. Tamco (preferred)
 - b. American Warming and Ventilating
 - c. Greenheck
2. Control dampers used for outside air or exhaust air applications will be installed a minimum of 6" away from wall penetrations to allow for external mounting of their respective damper motors. Jack shafting in these applications will only be allowed to prevent having to mount motors in the outside airstream. When internal damper motor mounting is required the sheet metal contractor shall provide access panels at each motor location to allow for ease of service.
- E. **Damper Operators:** Operators shall be electronic, spring return, low voltage (24VAC), and shall be properly sized to stroke the damper smoothly and efficiently throughout its range. Actuator responses shall be linear in response to sensed load.

1. Damper operators on outside air intake/exhaust shall be spring return closed.
- F. Automatic Control Valves: All valves shall be equipped with throttling plugs and removable composition discs and shall be manufactured by Siemens, Johnson, or Belimo. All valves are to be sized by the Control Contractor and shall submit pressure drop calculations and guarantee sufficient size to meet the requirements of the equipment being served. Valve operators shall be of such design to provide adequate operating power for valve positioning.
1. Globe Valves (Closely coordinate the pressure rating of each control valve with the Mechanical Contractor. Valve rating is dependent on system type and actual location within the building.)
 - a. Globe valves, as specified, shall be by Belimo, Johnson, or Siemens.
 - b. Two-way and three-way globe valves may be used only if characterized control valves do not fit the sizing criteria or application.
 - c. Globe valves may be used for chilled or hot water, steam, or glycol solutions to 60%. Screwed and flanged water valves shall have equal percentage or linear flow characteristics for two-way or three-way valves, respectively. All stems shall be stainless steel.
 - d. Screwed globe valves 1/2" through 2" shall have bronze bodies rated at ANSI Class 250. For water up to 35 psi or steam up to 15 psi, trim shall include a brass plug, a spring-loaded TFE packing, and a bronze seat. The maximum differential shall be 4 psi for water and 15 psi for steam.
 - e. Two-way and three-way flanged globe valves 2-1/2" to 6" shall have cast iron bodies rated for ANSI Class 125 or ANSI 250 (see note above). The maximum differential shall be 4 psi for water and 10 psi for steam. Trim shall include stainless steel stems, bronze plugs, bronze seats, and a TFE V-ring packing.
 - f. For steam inlet pressures higher than those stated above, furnish globe valves with stainless steel trim specifically rated for the application.
 2. Butterfly Valves (Closely coordinate the pressure rating of each control valve with the Mechanical Contractor. Valve rating is dependent on system type and location within the building. In some instances, high performance butterfly valves may be required.)
 - a. Butterfly valves, as specified, shall be by Belimo, Johnson, Siemens
 - b. Butterfly valves 2" to 12" shall have a fully lugged, drilled and tapped, cast iron body, rated to 200 psi body pressure, with 14" and larger valves having a body pressure rating of 150 psi. Flanges shall meet ANSI 125/150 standards. The one-piece body shall feature an extended neck allowing sufficient clearance for flanges and 2" of piping insulation. The disc shall be 304 stainless steel and provide bi-directional bubble-tight close off in either direction for chilled or hot water or 50% glycol applications. The disc shall be polished and contoured to minimize torque and wear. Shaft shall be mechanically retained in valve body using split-thrust washer and internal retaining-ring design for ease of service. The valve body shall employ ISO5211 actuator mounting and shaft connection standards.
 - c. The disc shall have full 360 degree concentric seating. Valves up through 12" shall utilize an internal spline for the disc-to-stem connection. External mechanical

methods to achieve this mechanical connection, such as pins or screws, shall not be employed. Valves 14" and larger will utilize a dual-pin method to prevent the heavy disc from settling onto the liner, causing distortion. A phenolic backed, non-collapsing, EPDM seat shall be field replaceable and shall create a positive seal between flange face and valve body. No gaskets shall be required between the valve and flange faces. The shaft shall be supported at four locations by RPTFE bushings.

- d. The flow characteristic shall be modified equal percentage for two-way valves and linear for three-way valves. Valves 2" through 12" shall be rated for standard HVAC service of up to 50 psi close-off, or for heavy commercial service of up to 200 psi close-off. Valves 14" and larger shall be rated for up to 150 psi close-off.
- e. A permanent metal tag shall designate manufacturer, series number and materials of construction.
- f. Butterfly valves may be used in all two-position applications and modulating applications larger than 4", or where the close off rating of other valve styles does not meet the design requirements.
- g. Butterfly valves shall be sized primarily by using velocity calculations to prevent fluid velocities from exceeding 12 feet per second. For modulating applications, CV factors at sixty (60) degrees shall be used for determining delta P once size has been determined by the velocity calculations.
- h. High torque industrial valve actuators, >300 in-lb. of rated torque, may be used where low torque actuators are not suitable. High torque actuators shall be as manufactured or provided by Belimo.

3. Electronic Valve Actuators (for valves 6" and under)

- a. Electronic actuators, less than 600 in-lb. of rated torque, shall have ISO 9001 quality certification and be cUL or UL listed under standard 873, CSA C22.2 No. 24 and have CE certification.
- b. Electronic actuators used on valves shall be designed to directly couple and mount to a stem, shaft or ISO style-mounting pad.
- c. Actuators shall be fully modulating/proportional, floating/tri-state, or two positions as required and be factory or field selectable.
- d. Optional auxiliary switches shall be available.
- e. Actuators shall have an operating range of -22°F to 122°F.
- f. Proportional actuators shall accept a 0-10 VDC or 0-20 mA input signal and provide a 2-10 VDC or 4-20 mA (with a load resistor) operating range.
- g. Actuators shall be capable of operating on 24 VAC, 120 VAC or 230 VAC, or 24 VDC and Class 2 wiring as dictated by the application. Power consumption shall not exceed 10 VA for AC, including 120 VAC actuators, and 8 watts per actuator for DC applications.
- h. NEMA 2 rated actuators shall be provided with either a covered terminal strip, or a three, six, or ten foot pre-wired, electrical cable.
- i. For power-failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Spring return actuators shall

- be capable of CW or CCW mounting orientation. Spring return actuators with more than 60 in-lb. of torque shall have a metal, manual override crank.
- j. Actuators using “on-board” chemical storage systems, capacitors, or other “on-board” non- mechanical forms of fail-safe operation are unacceptable.
- k. Upon loss of control signal, a proportional actuator shall fail open or closed based on the minimum control signal. Upon loss of power, a non-spring return actuator shall maintain the last position.
- l. Actuators utilizing brushless DC technology shall be capable of being mechanically and electrically paralleled to increase torque if required. Valves requiring greater torque or higher close off may be assembled with two low torque actuators.
- m. Dual mounted actuators using additional anti-rotation strap mechanical linkages or special factory wiring to function are not acceptable. Actuators in a tandem pair must be “off the shelf”, standard actuators ready for field wiring.
- n. Valve actuators will not produce more than 62 dB (A) when furnished with a mechanical fail- safe spring. Non-spring return actuators shall conform to a maximum noise rating of 45 dB (A) with power on or in the running or driving mode.
- o. Proportional actuators shall be fully programmable. Control input, position feedback and running time shall be factory or field programmable. Diagnostic feedback shall provide indications of hunting or oscillation, mechanical overload, mechanical travel, and mechanical load limit. The actuators shall also provide actuator service data, at minimum, number of hours powered and number of hours in motion.
- p. Proportional actuators shall be capable of digital communication, as built.
- 4. Industrial Actuators (for valves over 6”)
 - a. The valve actuator shall consist of a thermally protected capacitor-type reversible electric motor, a patented planetary worm combination drive, heater, limit switches and wiring termination blocks, all contained in a die cast aluminum enclosure. The drive system will provide continuous, smooth torque transmission throughout a 90 degree travel. Adjustable stops provide mechanical adjustment of end-of-travel. The transmission shall allow continuous duty operation of a manual override hand wheel without the need to remove power, or de- clutch the manual system.
 - b. Enclosure shall be designed to meet NEMA 4, 4X (weatherproof) requirements, or CSA approved for non-hazardous locations.
 - c. The actuator shall employ ISO5211 mounting standards to provide for a wide range of international applications.
 - d. The enclosure will have an industrial quality coating.
 - e. Actuator shall have a motor rated for a minimum of 25% duty cycle in modulating applications.
 - f. Actuator shall be suitable for operation in ambient temperature ranging from - 4°F to +150°F.
 - g. The motor shall be fractional horsepower; permanent split capacitor type designed to operate on 24 VAC, 110 VAC or 220 VAC, 1 pH, 50/60 Hz supply. A

self-resetting thermal switch shall be imbedded in the motor for overload protection.

- h. Internal terminal blocks shall be clearly marked for field wiring. A wiring diagram shall be permanently attached to the OUTSIDE of the actuator housing.
- i. Actuator will have a suitable sized NPT entry for external connections.
- j. Gears shall be hardened alloy steel, permanently lubricated. The worm drive system negates the need for a brake.
- k. Two adjustable cam actuated end travel limit switches shall be provided to control electrical movement of the actuator.
- l. 2 PSDT auxiliary switches, rated 10A at 250 VAC shall be included. The switches are factory pre-set at 3 degrees and 87 degrees rotation and may be field adjusted.
- m. Actuator shall be equipped with a hand wheel or shaft for manual override to permit operation of the actuator in the event of electrical power failure or system malfunction. Hand wheel, where applicable, must be permanently attached to the actuator. (SY2 and larger)
- n. The hand wheel override shall be continuously operational regardless of the powered state of the actuator in, without the need to remove electrical power if present during the override phase. (Belimo SY2 and larger)
- o. The hand wheel will not rotate while the actuator is electrically driven.
- p. The actuator shall provide a visual indicator beacon on the top of the housing for position status of the actuator and attached devices.
- q. Actuator shall have an internal heater and thermostat to minimize the build-up of moisture inside the sealed enclosure.
- r. Modulating units shall operate under 2-10 VDC, 4-20 mA, and 1`-5 VDC control modes. The default shall be 2-10 VDC control.
- s. Valves installed outdoors shall have heaters in the actuator. Power by this Contractor.

5. Pressure drop through modulating control valves shall not exceed 7 feet. Control valves for 2- position applications shall be line sized.

G. Air Volume Measurement: Provide Tek-Air or Ebtron air flow measuring system including microprocessor panel and air flow measuring sensor struts as required to measure outside air intake flow as denoted on the Drawings.

- 1. DDC air flow measuring system shall have a velocity range from 350 to 6000 ft./min. with duct measurement accuracy (including repeatability, zero offset, and temperature compensation) of plus or minus 0.5 percent.
- 2. Pilot tube arrays and differential pressure arrays are not acceptable.
- 3. The air flow measurement stations shall include a digital LCD display that illustrates the actual CFM, not FPM or other variables.

H. Low Limit Detection Thermostat: Low limit detection thermostats equal to Siemens 134-1511 shall be of the vapor tension capillary type having a sensing element a minimum of 20 feet in length. These thermostats shall be of the manual reset type. The elements shall be complete with necessary fittings to permit installation in the duct so as to sense the correct discharge

temperatures. One low limit detection thermostat will be installed for every 24 square feet of protected area and arranged to stop their respective units and close the outside air dampers in the event discharge temperatures fall below 38 degrees F. The normally closed contact shall be wired to the fan circuit and the normally open contact (close on alarm) shall be wired to a DDC input. One common circuit is suitable for multiple thermostats on a single AHU coil area.

- I. Electric Thermostats: Heavy-duty snap action type with key operators rated at 10 FLA at 120 RIAC contacts suitable for the intended service. Provide manual selector switches as required in the sequence of operation.
- J. Fan and Pump Proof: Proof points for air handling unit fans, exhaust fans and pumps will be accomplished using current sensing relays at the motor control center or motor starters. Current sensing relays shall be split-core design, for installation over any single power lead. Current sensing relays shall include field adjustable set screw for amperage set point adjustment and shall include integral LED status light to locally indicate the 'on' and 'off' condition.

2.10 Labeling

- A. Provide labels for all field devices including sensors, transducers, thermostats, and relays. Exception: Room temperature and/or humidity sensors shall not be labeled.
- B. Labels shall be black laminated plastic and epoxy glue or screw fasteners. Labels shall be located adjacent to device and permanently affixed to device mounting surface. Labels for sensors in pipes may be secured using chain around the sensor well. Labels shall be 1/16" thick laminated plastic or 0.020" thick aluminum; black face, 3/8" high white or natural aluminum letters.
- C. Labels shall include system virtual/pseudo point name as well as English language name of device being controlled, or specific condition being sensed.
- D. Identify all control wiring and air piping at each end with a wire tags or labels. Wiring to be labeled as to what the wire serves not just to identify ends of wire. In addition, use standardized color scheme for control wiring to designate type of control each wire serves.

2.11 Indicating Thermometers

- A. Thermometers shall be of the dial type, minimum 3-1/2" diameter, duct mounted, bi-metal element, uniform scale of suitable range. Accuracy: plus, or minus 1-1/2% of total range of thermometer.
- B. Furnish thermometers for the following locations at each air handling and combustion air unit:
Outside Air
- C. Return Air Supply Air Mixed Air

2.12 Filter Pressure Drop Indication

- A. Furnish and install differential pressure draft gauge across filter section of each air handling and combustion air unit to indicate the total pressure drop through each prefilter and final filter section. Gauge shall be like Dwyer "Magnahelic" Series 2000. Range as required. Install gauges at unit a maximum 5'-0" above floor.

2.13 Water Sensor

- A. Water sensor to be tape style water detector with weatherproof enclosure, SPDT alarm and trouble relay contacts, continuous tape integrity self-check, Power/Alarm Trouble status, LED, 24 V DC, and consumes 60 mA max. Water sensor to be like Kele Model WD-2-T.

PART 3 EXECUTIONS

3.1 Wiring and Conduit

- A. All control wiring incidental to the Temperature Control System shall be by the Temperature Control Contractor except as follows:
 - 1. Line voltage thermostats shall be turned over to the Electrical Contractor for installation and wiring.
 - 2. Wiring shown on the Electrical Contract Drawings shall be wired by the Electrical Contractor.
- B. All temperature control panels shall be completely prewired by the BAS Contractor to terminal strips within the control cabinet. All internal interlock wiring within the control panel shall be complete to the terminal strips.
- C. All 120V and low voltage electrical control wiring exposed throughout the building and within walls shall be run in conduit in accordance with the Electrical requirements as specified in Division 26, the National Electric Code, and all applicable local codes. All low voltage wiring that is concealed in accessible ceilings may be run in plenum rated cable per the National and Local Electrical codes. All conduit used for BAS wiring shall be blue.
- D. All conduit and conduit installation, including conduit utilized for plastic pneumatic tubing, shall be in accordance with the requirements of Division 26, Electrical Specification.

3.2 Temperature Control Diagrams

- A. Complete temperature control diagrams including motor control schematics, wiring diagrams and a written description of the system operation shall be provided by the Temperature Control Manufacturer. Diagrams shall include face elevations of the temperature control panels.
- B. Prepare, as a part of Temperature Control shop drawings, complete terminal-to-terminal wiring diagrams. These will show terminal designations on control items and equipment. Wiring diagrams to be compatible with Electrical Drawings.
- C. The Control diagrams, along with product literature on all system components shall be submitted as "Shop Drawings" for review by the Engineer prior to starting work. Submit two sets of drawings for "preliminary" review before making a formal submittal.
- D. Control diagrams, laminated in plastic or in full size heavy plastic binders with mounting rings, shall be hung adjacent to each control panel showing all schematic diagrams and descriptions related to the systems served by that panel.

- Verify Quantity -

- E. Furnish four (4) complete sets of Operating and Maintenance Instructions for Temperature Controls, including control diagrams, to the HVAC Contractor for inclusion in the "Operating and Maintenance Manuals". As built control drawings must show set points and spring ranges.

3.3 Adjusting

- A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
3. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
4. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
5. Provide diagnostic and test instruments for calibration and adjustment of system.
6. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: Provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.4 Control Access

A. All control elements shall be placed in locations affording easy access for service. All devices remote from control panels shall be identified as specified for control items in control panels.

3.5 On-Site Testing

- A. Field Test: When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. The installer shall complete all testing, calibrating, adjusting and final field tests. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power. Upon completion of the work, notify the Owner, and Engineer that the system is ready for final tests and inspection.
- B. At the time of final inspection, this Contractor shall be represented by a person with the proper authority, who shall demonstrate, as directed by the Engineer that his work fully complies with the purpose and intent of the Specifications and Drawings. Labor, services, instruments, and tools necessary for demonstrations and tests shall be provided by the Contractor.
- C. The Contractor shall test and adjust each instrument specialty and equipment furnished by him, prior to final acceptance. The Contractor shall demonstrate, for approval by the Engineer, subsystems operate as coordinated and properly functioning, integrated system.
- D. The Contractor shall furnish labor to provide adjustments and incidentals necessary to obtain the desired and intended results.
- E. The Contractor shall turn over a printed copy and electronic copy of the completed and debugged operating software to NCH at the conclusion of the two-year warranty.

3.6 Service and Guarantee

- A. General Requirements: Provide all services, materials, and equipment necessary for the successful operation of the entire BAS system for a period of two years after completion of successful performance test. Provide necessary material required for the work. Minimize impacts on facility operations when performing scheduled adjustments and non-scheduled work.
- B. Description of Work: The adjustment and repair of the system includes all computer equipment, software updates, transmission equipment and all sensors and control devices. Provide the manufacturer's required adjustments and all other work necessary.
- C. Personnel: Provide qualified personnel to accomplish all work promptly and satisfactorily. The NCH shall be advised in writing of the name of the designated service representative, and of any changes in personnel.
- D. Systems Modifications: Provide any recommendations for system modification in writing to NCH. Do not make any system modifications, including operating parameters and control settings, without prior approval from NCH. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected.
- E. Software: Provide all software updates and verify operation in the system. These updates shall be accomplished in a timely manner, fully coordinated with the system operators, and shall be incorporated into the operations and maintenance manuals, and software documentation.

3.7 Training

- Coordinate Training Requirements with NCH Operations -

- A. The Contractor shall provide competent and certified instructors to give full instruction to designated personnel in the adjustment, operation and maintenance of the system installed rather than a general training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. All training shall be held during normal work hours of 8:00 a.m. to 4:30 p.m. weekdays as follows:
- B. Provide 40 hours of training for the NCH operating personnel. Training shall include:
 - 1. Explanation of drawings, operations, and maintenance manuals
 - 2. Walk-thru of the job to locate control components
 - 3. Operator workstation and peripherals
 - 4. Building Controller, Advanced Application Controller operation/function
 - 5. Operator control functions including graphic generation and field panel programming
 - 6. Operation of portable operator's terminal
 - 7. Explanation of adjustment, calibration, and replacement procedures
- C. Provide 8 hours of additional training quarterly for a period of one year from final completion of the project.
- D. Since NCH may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor. If NCH requires such training, it will be contracted later. Provide description of available local and factory customer training.

- 3.8 Piping of compressors, tank and appurtenances as shown on drawings and recommended by the manufacturer.
- 3.9 Install filter and regulator on discharge line from compressor.
- 3.10 HVAC contractor shall install compressor on seismic vibration isolators on 4" high concrete pad.
- 3.11 Install trap in discharge from dryer and pipe to nearest floor drain.

23.21.13 – Hydronic Piping:

PART 1 GENRAL

- 1.1 Victaulic fittings are approved (no equals) for all HVAC systems.
- 1.2 Victaulic Butterfly Valves will be used for HVAC systems. Equal By Keystone
- 1.3 Piping 2-1/2" and larger may be stainless steel or copper with grooved Victaulic fittings. Steel pipe must be approved by NCH and will be schedule 80. Welded joints are allowed for steel pipe. Any stainless-steel pipe and fitting welding must be purged during the welding process.
- 1.4 Copper Press Fittings by Viega. No Exceptions
 - A. Contractors shall use copper press fittings for the condenser water, chilled water, heating water, process chilled water, condensate drain and make-up water piping system fittings ½" to 4"
 - 1. Copper press fittings shall be Pro Press manufactured by Viega North America.
 - 2. Copper press fittings for ½" to 2" hard copper tubing shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM and have SC (Smart Connect) feature design (leakage path).
 - 3. ProPress Fitting: Copper press fittings (2-1/2" to 4" hard copper tubing) shall conform to the material and size requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM and shall be incorporate a stainless-steel grip ring.
 - 4. ProPress Fitting: Bronze press fittings (2-1/2" to 4" hard copper tubing) shall conform to the material and size requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM and shall incorporate a stainless-steel grip ring.
- 1.5 Copper Press Fittings - Copper press fittings shall be installed in accordance with the manufacturer's installation instructions.
 - A. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.
 - B. The copper fitting system shall be tested for joint tightness. The piping system shall be filled with water and pressurized to the pressure and length of time specified. The system shall have no leaks at the rated pressure and time.
 - C. The material and installation of copper tubing distribution systems shall conform to the requirements of the ICC International Plumbing Code and listed buy NSF 61.
- 1.6 Steel Pipe

- A. Stainless steel pipe schedule 10 welded and grooved may be used at contractor's option. All welded joints will be purged during welds.
- B. At the contractor's option, weld lets butt or threaded type, may be used for branch connections that are less than 2/3 main size. Use welded or grooved fittings for branch connections 2/3 main size or larger.
- C.

23.21.16 – Hydronic Piping Specialties:

PART 2 PRODUCTS

- 2.1 Pete's Plugs – ITT Grinnell
- 2.2 Vents – Bell+Gossett
- 2.3 Expansion Tanks – Bell+Gossett
- 2.4 Flow Sensors – Bell+Gossett
- 2.5 Flow Switches – McDonnell-Miller/Magnetrol
- 2.6 Gauges, Pressure & Vacuum – Treice, Weiss, Marshalltown, or Ashcroft. All gauges to have isolation ball type valves
- 2.7 Thermometers – Treice, Ashcroft, Weiss. All thermometer wells installed in water flow.
- 2.8 Altitude Gauge – Treice, Ashcroft, Weiss, Marshalltown.
- 2.9 Balance valves – Victaulic or Ball+Gossett.
- 2.10 Balance valves will NOT be used for isolation. Ball valves to be used for isolation.
- 2.11 All Pet Cocks to be Apollo ball valves rated for the system in use
- 2.12 Expansion joints installed as engineered. Manufactured by Hyspan or Metroflex
- 2.13 Thermometer wells shall be stainless-steel, no brass allowed

23.21.23 – Hydronic Pumps:

PART 1 GENERAL

- 1.1 Numbering/Tagging and Identification - (refer to nomenclature standards, attached)

PART 2 PRODUCTS

- 2.1 Pumps (25-150 hp) – Peerless, Weinman, Aurora or Bell+Gossett
- 2.2 Pumps (2-25 hp) – Pacific, Bell+Gossett, Peerless or Weinman
- 2.3 Pumps (boiler feed) – Grundfos or Worthington
- 2.4 Pumps (transfer) – Pacific, or Burks
- 2.5 Pumps (chemical feed) – Milroy
- 2.6 Pumps (fuel oil) – DeLaval

- 2.7 Variable Frequency Drives (VFDs) – ABB (No Equals or Substitutions)
- 2.8 Soft Starters - Must be of the solid state type - ABB, Square D
- 2.9 Circulation Pumps – Bell+Gossett with Brass Impellers.

23.22.00 – Steam and Condensate Piping and Pumps:

PART 2 PRODUCTS

- 2.1 Electric Steam Condensate Pumps –Skidmore, Manufactured by Bell+Gossett and equals by Russel Mfg.
- 2.2 Condensate Pump Discharge Check Valves – shall be SS spring loaded type
- 2.3 Package hot water boilers - Manufactured by Cleaver Brooks. Review all specified occurrences with NCH PM.
- 2.4 Steam/Condensate Piping - Schedule 80
- 2.5 Steam PRV's –Manufactured by Spence, equal by Sarco Steam Traps.
- 2.6 Steam Traps –Manufactured by Spence, equal by Watson McDaniels and Sarco.
- 2.7 Steam Gate Valves – Velan (see Owner)
- 2.8 Steam Pumps – Manufactured by Watson McDaniels, equal by Johnson Kadent
- 2.9 Steam Strainers – Sarco or Keckley or Velan
- 2.10 Balance Valves – Victaulic or Ball+Gossett
- 2.11 Flanged fittings must use flexitauleic gaskets with inner ring. No garloc gaskets allowed.
- 2.12 All Pet Cocks to be Apollo ball valves rated for the system in use
- 2.13 Expansion joints installed as engineered. Manufactured by Hyspan or Metroflex.
- 2.14 Steam Relief Valves – all relief valves to be piped out of the building or safe area. No Trip PRV reliefs allowed. Manufactured by Consolidated, Kunkle or Spence.

A. All High Pressure Drips to utilize universal mount bucket traps. Manufactured by Spence, equal by WM Wilson CO.

23.23.00 – Refrigerant Piping:

PART 2 PRODUCTS

- 2.1 Chillers - Package – York, Trane, Carrier, or /Liebert
- 2.2 AC - DX (up to 2 ton) – Mitsubishi, York, Trane, Carrier, Ruud, or Daikin – When used in telecom rooms (TR/MER), the supplemental cooling unit is to be placed on the wall, directly above the door.
- 2.3 All brazing performed on refrigeration lines will be purged through the entire project.

23.25.00 – HVAC Water Treatment:

PART 1 GENERAL

- 1.1 All chemical distribution and testing areas must have appropriate ANSI Z358 eye wash station and safety shower area.

23.30.00 – HVAC Air Distribution:

PART 1 GENERAL

- 1.1 Air Handling Units (custom) Ingenia. Discuss alternates with NCH Project Manager.
- 1.2 VAV – Lab controllers – Phoenix Valves.
- 1.3 VAV Locations – Proposed locations within office area require approval by NCH PM.
- 1.4 Supply/Return Air Fans – Buffalo, Trane, or New York Blower
- 1.5 Ducts - sheet metal type for supply and return, exterior insulation with foil face, STATE the seal class for all ductwork include for exhaust/return ducts, ALL ducts should be sealed. Duct tape is NOT permitted. Flex duct <6' typically. Flex duct typical on return diffusers/grilles; verify if hard connection is warranted. Paint w/ gloss black where visible from room (through diffusers or grilles)
- 1.6 Main duct runs to include directional flow arrow. Labels and flow arrow tape shall be like Brady B-946 indoor/outdoor marking film with high gloss, durable, flexible, pressure-sensitive adhesive product. Flow arrow tape background color shall match label background color. Furnish a minimum of 12 additional labels for each service and a minimum additional roll of arrow tape for each service. Size of labels and letters shall be per ASME A13.1

PART 2 PRODUCTS

- 2.1 Air Diffusers – Titus, or Ruskin, white finish, ceiling mounted
- 2.2 Filters – Farr, Glossfloss or Cambridge - accessible for maintenance
- 2.3 HEPA - verify location - use Bag-in, Bag-out type
- 2.4 Mixing Boxes – Depends on building – Johnson, verify with NCH Engineering.
- 2.5 Exhaust Fans /Strobic Fans– Cook, Greenheck, Jennaire, Aerovent, or Hartzell
- 2.6 Return grills for open plenum systems will have sheet metal box above to prevent view into open ceiling above.

23.34.00 – HVAC Fans:

PART 2 PRODUCTS

- 2.1 Package and Custom Fan Coil Units – Trane, Modine Daiken.
- 2.2 Custom Unit For inpatient healthcare and ambulatory occupancy. Basis of design Buffalo equal by Ingenia
- 2.3 Custom Unit For Research and Business Occupancy Buildings. Basis of design Nortek/Ventrol equal by Air Enterprise

- 2.4 Unit Heaters – Modine, Trane, Dayton, or Reznor

23.63.13 – Air-Cooled Refrigerant Condensers:

PART 2 PRODUCTS

- 2.1 Air Cooled Condensers – Carrier, Liebert, York, Trane, or BAC

23.65.00 – Cooling Towers:

PART 2 PRODUCTS

- 2.1 Cooling Towers – Marley/BAC
- 2.2 Separators – Lakos, or DeLaval
- 2.3 Deduct Meters to be installed on all domestic water make-up and blow-down systems.

DIVISION 26: ELECTRICAL

26.05.00 – Common Work Results for Electrical:

PART 1 GENERAL

- 1.1 All Electrical work is to comply with Current versions of the following: National Electrical Code, NFPA requirements, Ohio Building Code and NCH Design Standards.
- 2.2 No under slab electrical conduits. Where permitted, Contractor must provide prints and photos of ALL exterior conduit runs and ALL conduits below slabs. This also applies to ALL J-boxes located outside.
- 2.3 Technology Rooms – refer to Division 27 requirements for special requirements
 - A. All low voltage wiring shall be supported independently by bridal rings or j-hooks (if structured cabling is used), at distances no greater than 5' apart, utilize approved manufacture raceways (ex. EZ-Path) or electrical conduit with bushed ends when penetrating walls and/or floors, is labeled on both ends of cable and/or at every termination point. Attaching low voltage cabling to all thread or ceiling grid support wires is prohibited. Independent ceiling wires can be used if a unique identifier is used to distinguish low voltage supports from ceiling system support wires.
- 2.4 All panels and equipment on exposed exterior walls are to use galvanized strut or approved mounting means to avoid moisture damage.
- 2.5 In exterior or damp locations, no top entry allowed on devices, cabinets or junctions.

26.05.19 – Low-Voltage Electric Power Conductors and Cables:

PART 1 GENERAL

- 1.1 All feeders and branch circuit wiring will be identified at all junction boxes and terminating points using NCH color code - See attached sheet. Factory-applied coloring on all wiring 600V and less
- 1.2 Color-coded conduits are to be utilized for the following systems:

- A. Yellow = Fire Alarm
- B. Blue = Building Automation/Controls
- C. Red = Emergency Power

- 1.3 All circuits to be minimum 20 amp
- 1.4 All wiring to be of stranded AWG and type THHN unless otherwise specified
- 1.5 All Fire Alarm wiring to be installed in yellow conduit
- 1.6 Control wiring: ALL control wiring is to be labeled at each splice and termination point, no handwritten labels.
- 1.7 Control wiring: All in-wall control wiring to be in conduits
- 1.8 Control wiring above ceilings is to be exposed but sleeved when passing through a wall.
- 1.9 Control wiring leaving the BAS cabinet is to be in conduits.
- 1.10 Control wiring in equipment, mechanical or high abuse areas to be in conduit.
 - A. All low voltage cables to match designated jacket coloring
 - B. Zip Ties not allowed as means of support. Use J hooks for low voltage cables.
- 1.11 Multi-Wire Circuits—NOT PERMITTED at any NCH Location
- 1.12 Cubical/wall partitions that are wired with multi-wire system shall be provided with a circuit breaker that simultaneously disconnects all ungrounded conductors (hot wires) at the panel board.
- 1.13 Pigtails MUST be made. Feed thru wiring is NOT accepted.
- 1.14 Wire nuts must be used. Push in wire connectors and tap splice connectors are NOT accepted. Do NOT use Scotch-loc wire nuts
- 1.15 ¾" EMT conduit minimum for all home runs.
- 1.16 ½" EMT conduit is only acceptable within walls with minimal clearance.
 - A. HCF and FMC cable acceptable for lighting whips. All wiring of this type must be stranded AWG and be color coded to meet the NCH color code - See attached sheet.
 - 1. Preferred method would be to use FMC and install wire with correct color. (Where acceptable.)
- 1.17 Junction boxes, Homeruns: minimum size of 4-11/16" for home runs to panel
- 1.18 Junction Boxes: ALL are to be labeled with PANEL#, CIRCUIT# and include VOLTAGE.
- 1.19 Junction Box Cover:
 - A. ALL emergency covers to be spray painted red.
 - B. Fire Alarm - Spray painted yellow.
 - C. Building Automation System (BAS) – Spray painted blue.

- 1.20 Surface Mounted Wiremold and similar – shall be positioned with vertical drops/risers in corners of rooms and horizontals extend from the corners. All layouts to be discussed with project manager BEFORE installation. Wiremold 4000: preferred for surface mounting.
- 1.21 Feeder Conduits above ceilings and in Tunnels must have voltage and description of what it feeds labeled on outside of conduit at least every 20 feet and within 6' of every wall penetration.

26.05.53 – Identification for Electrical Systems:

PART 1 GENERAL

- 1.1 See Maintainable Asset List (MAL)

26.09.23 – Lighting Control Devices:

PART 1 GENERAL

- 1.1 Ceiling Mount Sensor Switch Acuity CM10
- 1.2 Wall Switch Sensor Switch Acuity WSD PDT IV, equal by Watt Stopper.
- 1.3 Sensor Switch Power Pack Acuity PP-20
- 1.4 If mounting a ceiling sensor, a wall switch or dimmer is also required, no ceiling only sensors.
- 1.5 GTD lighting control devices should NOT be used unless required by code
- 1.6 Wireless lighting controls will not be accepted.

26.09.36 – Modular Dimming Controls:

PART 1 GENERAL

- 1.1 Fluorescent and can lights – Lutron Maestro dimmer.
- 1.2 Philips SofTrace LED Fixtures – Philips Sunrise Preset Electronic Wall Dimmer
- 1.3 Dimmers are to match the driver of the light fixtures for make and model to ensure compatibility. Verify with NCH Construction / Project Manager.

26.10.00 – Medium-Voltage Electric Distribution:

PART 1 GENERAL

- 1.1 Panelboards – Square D preferred
- 1.2 Breakers – Square D preferred
- 1.3 Switchboards – Square D preferred
- 1.4 Safety Switches – Square D preferred
- 1.5 Motor Control Centers – Square D preferred
- 1.6 Variable Frequency Drives (VFD's) - ABB preferred – ACH 580
- 1.7 Transformers – “K” rated for harmonic interference control – Square D preferred

- 1.8 All electrical gear including all the above will have an identification label in which the building, location, system, and # or letter will be displayed on the front of the gear - See attached sheet for specifications.
- 1.9 All panelboards, switchboards, motor control centers shall have an additional label which lists the means of identification for the grounded and ungrounded conductors of that system - See attached sheet

Example:	A—Brown	A-Black
	B—Purple	B-Red
	C—Yellow	C-Blue
	N—Gray	N-White
	277/480v 3Ph 4w	120/208v 3Ph 4w

26.27.26 – Wiring Devices:

PART 1 GENERAL

- 1.1 Switches must be rated 20 amps or larger. Color: (V) Ivory for Normal power, (RD) Red for Emergency power. Eaton/Arrow Hart wiring device #AH1221, AH1222, AH1223, and AH1224 preferred.
- 1.2 Receptacles must be rated 20 amps or larger. Color: Ivory for Normal power, Red for Emergency Power. Eaton/Arrow Hart wiring device # TR8300V or TR8300RED
- 1.3 All receptacles regardless of location are to be of the tamper-resistant type are to be of the tamper-resistant type (20 amp two prong activated) NOT requiring ground prong for activation/energizing). This includes patient rooms, bathrooms, waiting rooms, playrooms, activity rooms, and patient care areas, Cafeteria/ food service areas, business offices, and garages. Eaton/Arrow Hart wiring device # TR8300V. Color: Ivory for Normal Power, TR8300RED Red for Emergency power
- 1.4 Cover Plates Stainless Steel - All switch plates are required to be labeled with PANEL# & CIRCUIT #. Labels are to be ½” wide.
- 1.5 Every emergency receptacle plate is to be labeled with PANEL # & CIRCUIT #. Labels are to be ½” wide.
- 1.6 Every Normal receptacle plate is to be labeled with PANEL # & CIRCUIT #. Labels are to be ½” wide.
- 1.7 Every Switch cover plate is to be labeled with PANEL # & CIRCUIT #. Labels are to be ½” Wide.
 - A. For Behavioral Health Facilities, labels may be placed inside cover.
- 1.8 If BLUE POWER is used, discuss with NCH Engineering (REMOVE BLUE POWER CIRCUITS all the way back to the source. NCH has made the decision to remove all blue power in existing buildings such as Tower, A- Building and the J-Building.
- 1.9 All Receptacles to be installed with “grounds up” unless specifically needed otherwise.

26.32.13 – Engine Generators:

PART 2 PRODUCTS

- 2.1 Caterpillar preferred. Alternates: Detroit Diesel, Cummins, or Kohler Alternates with approval of NCH Engineering Department.

26.36.00 – Transfer Switches:

PART 2 PRODUCTS

- 2.1 Russelectric – No Alternates. Switches must have Isolation Bypass.
- 2.2 Life Safety and Critical Branch must be single motor switch
- 2.3 Include Toggle switch for testing purposes
- 2.4 TD2 timer at 5 minutes
- 2.5 Use approved Belden Cable or Single mode fiber for communication distances over 300'

26.41.00 – Facility Lightning Protection:

PART 1 GENERAL

- 1.1 Lightning Protection – UL Master Label specification is typical on NCH campus, but LPI specification has been utilized in some newer NCH installations. Verify correct specification with NCH Engineering Project Manager.
- 1.2 Lightning Protection required on roof-top equipment, including equipment replacement. Tie into existing system as applicable.

26.43.13 – Surge Protective Devices for Low-Voltage Electric Power Circuits:

PART 1 GENERAL

- 1.1 Surge Suppression Devices (SPDs) also known as TVSS
- 1.2 All SPD devices shall be external to the equipment being protected with isolation for service or replacement without powering down the equipment being protected. Internal devices are not acceptable. SPD Modules must be in a space where they can easily be replaced without powering off switchgear or panel boards.
- 1.3 Manufacturer: Square D

26.50.00 – Lighting:

See Master Lighting Schedule

DIVISION 27: COMMUNICATIONS

27.00.00 – Communications:

PART 1 GENERAL

- 1.1 All design requirements contained in this document must be present in the resulting Division 27 Specifications in the same section numbers as presented here. NCH CNS must approve any omissions or changes.

Specific products and part numbers must be listed in the corresponding Division 27 documentation. Approved manufacturers are listed in the Design Requirements sections and Reference Part Numbers are provided for a subset of the products. It is the responsibility of the Division 27 Contractor to validate manufacturer's part numbers. NCH CNS via the NCH PM must approve all substitutions.

1.2 Purpose

- A. Design Requirements are based on current applicable versions of NFPA 70 (NEC), NFPA 72, NFPA 101, OBC, National Electrical Safety Code (NESC), Institute of Electronic and Electrical Engineers IEEE, ANSI/TIA Telecommunication Building Wiring Standards, and BICSI methodologies. The requirements within those documents are not superseded herein unless specifically stated. As required, NEC and NESC code requirements cannot be superseded by this document at any time. ANSI/TIA standards and BICSI methodologies may be superseded, as specified, or may be made stricter by this document. Where ANSI/TIA standards and BICSI methodologies conflict with individual manufacturer standards, the more stringent standard or methodology shall be applied. The absence of a specific reference to an element of these codes, standards, and methodologies does not relieve all parties of compliance with them.

1.3 System Description

- A. It is the intent of the project drawings and specifications to provide complete and workable Division 27 communication systems, ready for use by the Owner. Any item, not specifically shown in the project drawings or called for in the project specifications but normally required for a fully functional system, is to be considered a part of this contract.

1.4 Codes & Standards

- A. All work shall follow the following codes and agencies. Nothing contained within these specifications shall be misconstrued to permit work not in conformance with the most stringent of applicable codes and standards. It is assumed that bidders have access to, and specific knowledge of, the listed reference materials as they pertain to Division 27 to ensure conformity with them.

1. National Electrical Code (NEC)
2. National Electrical Safety Code (NESC)
3. National Fire Protection Association (NFPA)
4. Federal, State, and Local Codes.
5. National Electronic Manufacturer's Association (NEMA)
6. Institute of Electronic and Electrical Engineers (IEEE)
7. American National Standards Institute/Electronic Industries Association/Telecommunication Industries Association (ANSI/EIA/TIA)
8. Federal Communications Commission (FCC)
9. Joint Commission on Accreditation of Healthcare Organizations (JCAHO)
10. Americans with Disability Act Accessibility Guidelines for Buildings and Facilities (ADAAG)

- B. All new materials, equipment, and installation practices shall meet the requirements of the following standards, unless specifically instructed otherwise by the Engineer:

1. ANSI/TIA/EIA-568 – Most Recent Version

2. ANSI/TIA/EIA-569 – Most Recent Version
 3. ANSI/TIA/EIA-606, Administration Standard for Commercial Telecommunications Infrastructure – Most Recent Version
 4. ANSI J-STD-607, Commercial Building Grounding and Bonding Requirements for Telecommunications – Most Recent Version
 5. ANSI/TIA/EIA-758, Customer Owned Outside Plant Telecommunications Cabling Standard
 6. TIA-942, Telecommunications Infrastructure Standard for Data Centers - Most recent version
 7. IEEE 802.3af - Remote Powering via MDI/RJ-45
 8. IEEE 802.3an - 10GBASE-T 10 Gbit/s (1,250 MB/s) Ethernet over unshielded twisted pair (UTP)
- C. All new materials, equipment, and installation practices shall comply with accepted standards of workmanship as recognized by:
1. Building Industry Consulting Service International (BICSI) Telecommunications Distribution Methods Manual (TDMM) 12th, or most recent, edition.
 2. Information Transport Systems Installation Manual 4th, or most recent edition.
 3. Customer Owned Outside Plant Design Manual (CO-OSP) 3rd, or most recent, edition.

1.4 Quality Assurance And Control Requirements For Contractors

- A. Division 27 contractors and other trades involved in the construction of MER/TR spaces and low voltage pathways will be provided with the supplemental documents which shall serve as a guide for what items need to be closely coordinated between NCH, the contractor, and all Sub-Contractors working in MER/TR spaces and creating low voltage pathways. Contractors will be required to attend coordination meetings and provide coordination documentation as part of the QA/QC process.

1.5 Design Requirements for Architects, Engineers And Designers

A. Qualifications

1. All Division 27 design services shall be directly performed by a currently certified BICSI (Building Industry Consulting Service) RCDD (Registered Communications Distribution Designer). Specific duties assigned to the RCDD shall include, but not be limited to, the following: all aspects of structured cabling design, equipment rack elevations, low voltage pathways, building entrances, grounding, and bonding, etc. The Architect/Engineer design team shall be responsible to coordinate MEP systems design to support technology systems provided within the MER/ TR / ER spaces in compliance with applicable building codes, telecommunications industry standards and as described herein.

B. MER/TR Room Design

1. Telecommunications rooms shall be designed and constructed to support of NCH-CNS information transport systems and other low voltage technology systems supported within these spaces. These spaces are the MER (Main Equipment Room), TR (Telecommunications Room) and ER (Equipment Room). ER (Equipment Rooms) are

required where separation of commercial services (ISP/ CATV/ Satellite providers) from customer owned facilities is required for security.

2. A minimum of one (1) MER shall be required per building. The MER is the central building serving telecommunications space. The MER is typically linked to other campus buildings with OSP backbone cabled links and is also linked to TRs within the same building by indoor backbone cabled links. The preferred location of the MER is above grade or secondly on grade to minimize the potential for flooding and potential disruption of technology services to the entire building. The MER space typically also serves as a TR space for efficiency. MER spaces are typically larger than TR spaces due to the higher density of cable terminations, primary protection systems and centralized technology equipment housing. The MER space shall also be referred to as NCH "Distribution Layer".
3. TR (Telecommunications Rooms) are floor serving spaces. TRs shall be located to serve floor spaces such that a maximum IP cable footage of 90meters/ 295' is not exceeded. TRs are most efficiently located in central spaces to maximize coverage zones. The preferred distribution of TR's is at least one per floor. In cases where the building footprint and floor to floor elevation is small enough TR's may be provisioned to support the floor the TR is installed on and the adjacent floors above and below. Provisioning TRs that serve multiple floors should be coordinated with the NCH-CNS team. It is important that all building spaces fall within the coverage zone of at least one TR to ensure required technology services can be successfully and reliably provided.
4. All TR/MER to have VCT flooring. See Master Finish Schedule for additional information.
5. TR (Telecommunications Rooms) are floor serving spaces. TRs shall be located to serve floor spaces such that a maximum IP cable footage of 90meters/ 295' is not exceeded. TRs are most efficiently located in central spaces to maximize coverage zones. The preferred distribution of TR's is at least one per floor. In cases where the building footprint and floor to floor elevation is small enough TR's may be provisioned to support the floor the TR is installed on and the adjacent floors above and below. Provisioning TRs that serve multiple floors should be coordinated with the NCH-CNS team. It is important that all building spaces fall within the coverage zone of at least one TR to ensure required technology services can be successfully and reliably provided.
6. Mini-TR is a specific use case intended to extend the reach of a MER/TR beyond the distance 90 meters/295'. The Mini-TR consists of a NEMA rated cabinet and a small form factor switch. The primary use cases for Mini-TR's are tunnels, surface parking lots, green spaces and other areas where small quantities of network connections are required.

Number of Racks	Minimum Dimensions	Additional Requirements
1	8' x 11'-3"	
2	10' x 10'-4"	Side by Side rack configuration
2	8' x 16'-6"	Face to Face rack configuration
3	10'-4" x 12'-8"	Side by Side Rack configuration

4	10'-4" x 15'-4"	Side by side rack configuration
4	10' x 16'-6"	Face to Face rack configuration
5	10.6' x 18'	
6	10'-4" x 21'-8" OR 12'-8" x 16'-6"	- Configuration 1 – 6 Racks in a single row - Configuration 2 – 3 Racks in two rows

7. Minimum clearance requirements are as follows:

- a. Racks shall be mounted to allow a minimum of 43" access space in both front and rear for clearance to wall mounted equipment. Provide 43" minimum side clearance when wall mounted equipment perpendicular to the equipment rack assembly is required.
- b. The sides of a rack or group of racks mounted against a wall shall have a minimum of 6" clearance from rack to the adjacent wall.
- c. Clearance for the access "walk around" end shall be 24" at minimum. Increase to 30" where wall mounted equipment such as wall phones and fire pull stations are mounted.
- d. Clearance above finished floor (AFF) should minimally be 10' 6".

C. MER/TR Telephone

1. Provide a single wall mount phone at all MER, SER and TR spaces.
2. Typical installation of the wall mount phone shall be adjacent to the door.
3. Adequate clearance from surrounding devices must be observed to allow 8" radius from center of outlet.

D. MER/TR Wall Elevations

1. Items/Systems installed in violation of approved wall elevation shall be relocated at the contractor's expense.
2. Complete coordinated wall elevation drawings shall be developed for all projects that include location of wall mounted equipment within the MER/ TR spaces. Minimum clearances to equipment rack assemblies shall be maintained to wall mounted equipment.
 - a. Locations for electric panels within MER/ TR spaces shall be coordinated with the Division 26 designer to provide for code required clearances.
 - b. Locations for lighting fixtures within MER/ TR spaces shall be coordinated with the Division 26 designer to provide for the more stringent foot candle level required by the BICSI TDMM and applicable codes with regard to fully loaded cable trays and other planned equipment.
 - c. Actual sizes of all panels and equipment to be installed in the MER/ TR spaces shall be reviewed and approved for use in the MER/ TR spaces at submittal review. Adjustments to submittal items and/ or MER/ TR room layouts shall be made prior to construction.

E. MER/TR Access

1. MER/TR Access

- a. Telecommunications spaces shall be directly accessible through a common corridor and shall not be provisioned within sterile/environmentally controlled areas or mechanical/ electrical equipment rooms.

2. MER/TR Doors

- a. Doors on all MER/TR's shall swing out from the room wherever not in violation of applicable building codes.
- b. Doors on all MER/TR's shall have door sweeps and seals installed to inhibit the introduction of dust and debris from the corridor.

3. MER/TR Physical Security

- a. Entrance to all communication spaces shall be provided by an NCH owned, operated, and monitored electronic access control system with ID card swipe station and have a manual key override. Access to MER/TR's will be controlled by NCH – CNS.

F. MER/TR Ceilings

1. Suspended ceilings shall not be used in telecommunications spaces.

G. MER/TR Wall Construction

1. Extend MER/ TR walls to the floor above to contain 24/7/365 cooling, to prevent above ceiling dirt and contaminants from entering the rooms and to help minimize noise pollution from inside the MER/TR to surrounding areas.
2. Construct the walls to 2-hour rated barriers (as required by applicable code) where the MER/TR spaces are used to house dedicated two-way radio communications enhancement systems/ first responder radio systems risers and equipment per applicable local codes, NFPA1221, NFPA 72 and the AHJ.
3. Construct the walls with 5/8" drywall on each side of the walls over metal studs to the deck where two-way radio communications enhancement systems risers and equipment is not required by code and/ or AHJ.
4. Line interior walls of MER/ TR spaces with fire treated 3/4" B/C plywood from 6" AFF to 10'6" AFF. Plywood shall be secured to structural building members per NECA/BICSI 568-2006 using flush mount hardware. Paint all plywood surfaces with (2) coats latex paint. Protect plywood fire stamps with masking tape such that at least (1) stamp per sheet will be visible within the MER/TR space after painting is complete. See Master Finish Schedule for additional information.

H. MER/TR Firestop

1. All penetrations through rated barriers shall be fire stopped with re-enterable UL listed systems as described in section 27 01 06. STI #EZD44+ EZ Path devices are preferred at MER/SER/TR barrier penetrations. All UL firestop systems for low voltage cables through rated barrier penetrations shall provide for no less than 40% cable fill by cross-sectional fill. Visual cable fill ratings are not acceptable. UL systems with cable fill ratings more than 50% are not acceptable. Firestop pillows are not

acceptable. UL systems shall not use caulk, mortar, or other hard setting materials in direct contact with low voltage cables.

2. Provide UL system sheet bid submittals for review. UL systems sheets shall include at minimum UL system number, barrier construction and F rating, permitted cables, maximum and minimum allowable cable fills by cross sectional area, permitted firestop materials and application rates, permissible void between sleeve and barrier core.
3. Cable trays shall not pass through rated barriers.

I. MER/TR Flood Prevention

1. Plumbing supply, drain waste and vent pipes and fixtures shall not be located within or pass through MER, SER, TR & ER Telecommunication Spaces. This includes but is not limited to; low and high pressure water and/or steam drain lines, medical gas supply and/or drains/vents.
2. Fire suppression systems shall be a dry pipe system inside the MER/TR.
3. Condensation lines for supplemental cooling units are acceptable if they are not routed above or adjacent to active network electronics.
4. All OSP conduits shall be hydrostatically sealed gas and watertight to no less than 20PSI using UL systems and devices. Approved solution for 4" conduit is MaxCell split frame assembly #MXCTP4 with matching accessories required to seal all ports. Provide stainless swivel at rear of frame to secure MaxCell innerduct. Provide corrosion resistant hydrostatic seal to 20PSI between OSP conduits and void in cored exterior wall (Link-Seal environmental seal)
5. Provide corrosion resistant metal junction assembly in readily accessible area, immediately inside building at all OSP conduit penetrations to provide easy access to hydrostatic interior seal assemblies for subsequent moves adds and changes.

J. MER/TR Environmental Control Requirements

1. MER and TR spaces shall be environmentally controlled to maintain the room environment at a temperature range from 65 to 80 degrees Fahrenheit.
2. The setpoint of the HVAC system shall be set at 68 degrees Fahrenheit with an allowed variance of +/- 3 degrees Fahrenheit.
3. MER/TR environmental control meeting the above parameters shall be maintained 24 hours per day, 7 days per week, 365 days per year.

K. MER/SER/TR Electric Power Requirements

1. Electric power circuits serving the MER/TR spaces shall be designed by the project electrical engineer. Circuits shall be sourced from generator power and dedicated to the MER/ TR spaces where generator power is available. The preferred power source is from a building UPS system designed for and dedicated to serve only telecommunications electrical loads. The dedicated telecommunications/ building UPS primary power shall be from emergency generator. The project electrical design engineer shall notify NCH-CNS where generator power is not available so rack mounted UPS equipment can be sized appropriately by NCH-CNS.

2. The project electrical engineer shall review technology systems located within the MER/TR spaces with NCH-CNS and apply code required survivability and operation run times. The project electrical design engineer shall advise NCH-CNS of applicable generator load shedding for generator power during power coordination.
3. Electric distribution panels should only be located within MER/ TR spaces when providing dedicated power to MER/ TR spaces from a building UPS system dedicated to the MER/ TR spaces. Locations for electric panels within MER/ TR spaces shall be coordinated with the Division 26 designer to provide for code required clearances. Electric panels mounted within the MER/ TR spaces under these conditions shall be bonded to the local TMGB/ TGB grounding assembly with a 6 AWG stranded copper conductor in accordance with ANSI/TIA-607.
4. Primary circuits shall be fed from the main campus emergency power system. Secondary circuits in the same configuration connected to the main campus normal power system shall also be required. Other special power provisions may also be required in addition to the minimum requirements (e.g., Duplex convenience outlets).
5. For buildings without a central UPS, each MER/TR shall be designed with the following typical power requirements for NCH-CNS electronic equipment:

a. MER space

- Two (2) 120V NEMA L5-30 receptacles per rack from dedicated circuits to rack mounted UPS equipment.
- Provide small form factor listed disconnect at rear rack rails. Confirm UPS power requirements and rack mounted UPS locations with NCH-CNS.
- Normal power outlets in the same quantity and configuration shall be required and wall mounted.

b. TR

- Two (2) 120V NEMA L5-30 receptacles on dedicated circuits for rack mounted UPS equipment. Locate receptacle at rear equipment rack rails.
- Confirm UPS power requirements and rack mounted UPS locations with NCH-CNS.

6. For buildings with a central UPS the UPS shall be fed from the main campus emergency power system with a transfer switch to allow connection to the main campus normal power system. PDU's shall be installed in the telecom racks to distribute power to the NCH CNS electronics. NCH CNS shall provide specifications on the power requirements for equipment to be installed.

L. MER/TR Electric Lighting Requirements

1. Lighting fixture types and locations within MER/ TR spaces shall be designed by the project electrical engineer to provide the greater foot candle level, minimum 50-foot candles/ 538 lux (per BICSI TDMN) or as recommended by applicable IESNA standards. Light load shall be modeled with final cable-tray design, fully loaded with cable. Coordinate lighting options with NCH-CNS where typical chain hung LED fixtures are not sufficient to maintain minimum 50-foot-candles/ 538 lux throughout the MER/TR horizontal and vertical surfaces.

M. Telecommunications Outlet Configurations

1. The standard Telecommunications Outlet configuration is a dual.
 - a. A dual is defined as two (4) pair CAT6 or CAT6A UTP cables terminated in a 8P8C (8 position/8 contact) configuration on a common faceplate.
 2. Specialty Telecommunications Outlets are sometimes used. Confirm all specialty Telecommunications Outlet quantity and configuration with Engineering and NCH-CNS prior to installation.
 - a. Typical examples of specialty Telecommunications Outlets include:
 - Wireless Access Points
 - IP Cameras
 - Wall Phones
 - b. Note that wall phones require a minimum clearance of 8" from the center of the faceplate in all directions to allow for clearance for installation of the wall phone.
 - Building Automation Systems
 - Electronic Medical Record PC Connections
 - Physiological Monitoring
 3. The standard CATV link is a single RG6 quad shield coax listed for CATV.
 - a. The standard CATV link shall include a single RG6 quad shield CATV terminated coax link installed from an owner coordinated service provider multiport tap located at each TR wall-field to designated CATV work area locations on each floor. CATV links shall be listed for the environment in which they are placed (CATVR, CATVP or Wet/ flooded) and restricted to the same distance limitations, routing and pathway supports as Cat6 and Cat6A cabling about distribution from TR.
 - b. Active electronics, system design and associated installation requirements are typically not included in the Division 27 designers responsibilities. These functions are performed by an owner assigned service provider. Coordinated electrical power and grounding requirements for service provider equipment is the responsibility of the Division 26/ 27 AE designer.
 - c. Inter-building and riser backbone for both powered and non-powered CATV pathways in compliance with TIA-569, BICSI TDMM and the NEC are included in the Division 26/ 27 AE designers' responsibilities. Coordinate requirements with NCH project manager and CATV service provider.
 - d. Coordinate required horizontal CATV locations with NCH project manager.
- N. Provide connectivity logical diagram detail sheet for all Division 27 cables and systems. Division 27 connectivity logical shall show all termination hardware types and associated cable routing. Include cable schedules and symbol legend. Division 27 termination and system type shall include unique corresponding symbols. The symbols shown on the connectivity logical shall use the same symbols used on project floor plan and site plan sheets. Provide building

elevation drawings to show all MER/ TR locations and backbone riser cable distributions. Building elevation drawings shall contain required information to make clear cable detail specifics, systems associated with each cable type, intended termination rack location details and cable routing throughout the building and associated campus buildings.

O. Project Pathways Documentation

1. Show all new and existing pathway details including conduit sizes and quantities, duct banks, manholes, required UL listed firestop system locations, cable tray and open pathways on project site plan sheets and floor plan sheets.

1.6 Structured Cabling Manufacturer Requirements

A. Cabling Requirements per Building

1. NCH buildings shall support single manufacturer structured cabling solutions for fiber, backbone copper and horizontal copper.
2. New construction buildings directly connected to the Hospital backbone network shall require CAT6A horizontal copper cabling.
3. CAT6A UTP solution shall be recommended by NCH – CNS based on building design and user requirements.

B. New MER/TR in an Existing Building

1. Construction of a new MER/TR in an existing building shall require a mandatory review of CAT6 or CAT6A horizontal copper cabling.
2. Horizontal CAT6A cabling shall be CommScope Systimax GigaSPEED X10D.

C. Additions/Renovations to an existing MER/TR

1. Horizontal Copper

- a. Additions/Renovations to a portion of the area serviced by an existing MER/TR shall be the Siemon System 6 solution.
- b. Additions/Renovations to the complete area serviced by an existing MER/TR shall require a mandatory review of CAT6 or CAT6A horizontal copper cabling.
- c. Horizontal CAT6A cabling shall be CommScope Systimax GigaSPEED X10D

2. Backbone Fiber

- a. Additions/Renovations to an existing MER/TR shall be Corning Cable Systems.

1.7 Design Requirements for Existing Mer/Tr Spaces

A. Upgrades and retrofits to existing MER and TR spaces shall require a thorough examination including, but not limited to the following checklist. Findings shall be presented to NCH as per the Coordination procedure identified.

1. Cooling provisions sufficient for introduction of planned equipment.
2. Available rack space for new cabling terminations. Need to furnish and install an additional rack.
3. Rack grounding provisions.

4. Potential need to install supplemental cable tray and join to existing.
5. Potential need to install additional conduit sleeves.
6. Potential need to upgrade fiber backbone.
7. Electrical power provisions.
8. Flood prevention violations.

1.8 Partial Floor Construction

A. Inside the Construction Zone

1. Existing cabling inside the bounds of construction may be reused only if coordinated upon on a per project basis with NCH-CNS.

1.9 Cable Removal

- A. Cable removal shall be subject to the requirements of the NEC, most recent version.
- B. Contractors shall remove cabling back to the point of origin, leaving a 12" section of cable attached to the patch panel, shelf, frame or CATV hardware. Final removal from the termination hardware shall be made by NCH personnel.
- C. If abandoned cable cannot be removed safely without damaging other active cabling in the immediate vicinity, these location(s) shall be identified immediately to the NCH Engineering PM and the NCH-CNS PM.

1.10 Submittals

A. Provide at completion of each construction phase area, as defined by the construction manager:

1. Cable administration drawings, as requested to assist NCH in the planning process. Drawings will be requested prior to final documentation and as scanned digital reproductions of field copies.
2. Cable test and certification reports; summary digital format test results when requested by the construction manager, NCH CNS, or the engineer. Reports shall be submitted to the requesting party within seven (7) calendar days.
3. Backbone cable routing in digital format when included in the project scope. Reports shall be submitted to the requesting party within seven (7) calendar days.
4. All new and re-used firestop locations with UL listed specifications in digital format when included in project scope. Reports shall be submitted to the requesting party within seven (7) calendar days.

B. Provide at final completion:

1. For all projects that comprise greater than ten (10) installed telecommunications outlets, cable administration drawings in CAD and PDF format on compact disc. Reports shall be submitted to the requesting party within ten (10) business days
2. Cable test and certification reports; summary hard copy and full test results on disc. Test results shall be delivered at the completion of each project phase and at any time when called for by the Owner. Cable certification reports shall be provided with an

associated as-built floor plan for reference. All cable certification records shall be unconditional passing records. All cabled links associated with failed or conditionally passed records shall be replaced or repaired as permitted by the manufacturer's warranty program or as referenced in the Division specification and recertified until a passing test result is achieved and included in the project warranty.

3. Manufacturer Warranty Certificate for both the Backbone Fiber and Horizontal Copper cabling solutions installed.

a. Acceptable Manufacturer Warranties:

b. The Siemon Company – System 6 20 Year Warranty

c. Corning Cable Systems – LANscape Solutions 25 Year Warranty

d. CommScope Systimax – X10D 20-year Extended Product Warranty and Applications Assurance.

4. Warranty shall be assigned directly to Nationwide Children's Hospital and shall include the building name and project name.

5. Warranty contacts including but not limited to names, telephone numbers (office and mobile).

1.11 Bid Submittals

A. Cabling Contractor shall provide with bid documentation of the required minimum percentage of the installation work force. Minimum required workforce percentages are as follows:

1. One RCDD responsible to manage the contract.
2. A minimum percentage of twenty-five (25%) of the installation work force shall be BICSI ITS Technician certified.
3. A minimum percentage of fifty (50%) of the installation work force shall be BICSI ITS Installer Level II certified or higher.
4. Up to twenty-five percent (25%) of installation force may be BICSI Installer Level I certified.
5. 100% of the installation work force performing termination and testing shall be manufacturer certified.
6. Work crew, not involved in installing cable elements (e.g., laborers delivering/moving materials, installing grounding by an electrician, or workers installing pathway elements) do not require BICSI or manufacturer certification or registration.

B. Cabling Contractor shall provide with bid a current Manufacturer Certification for the system solution(s) bid, issued directly in the bidder's company name, valid for the time frame in which the installation will be completed.

1. Acceptable Manufacturer certifications include:

a. The Siemon Company – Siemon Certified Installer

b. Corning Cable Systems – LANscape Network of Preferred Installers (NPI)

c. CommScope Systimax – Authorized Business Partner or higher

C. Cabling Contractor shall provide with bid manufacturer cut sheets for all cabling and equipment included in the bid submittal.

- D. Cabling contractor shall provide with bid all logical/ connectivity diagrams and assembly drawings requested in the project design documents.
- E. Cabling contractor shall provide with bid all add/ delete pricing requested in the project design documents.

1.12 Final Payment

- A. Final payment for a project will be issued only after the criteria specified in Section 1.9 SUBMITTALS has been completed.

PART 3 EXECUTION

3.1 MER/TR Cleanliness

- A. Division 27 Contractor shall thoroughly clean all assemblies within all MER and TR spaces before they are turned over to NCH CNS for operation. Cleaning shall include, but not be limited to, all ladder tray, racks and wire managers (inside and out), copper and optical fiber panels (inside and out). Should the MER or TR be completed prior to the balance of the floor space that it serves, racks, cabinets, and wall frames shall be covered with plastic sheeting to repel dust and other contaminants to which they will be subjected. Regular cleaning of the MER and TR spaces shall be required after active equipment is installed to mitigate contamination of the equipment.

3.2 Warranty

- A. The contractors shall adhere to all warranty requirements for all installations.
- B. The contractor shall supply all necessary documentation needed to process and record the warranty(s) and to verify the installation solution for the Horizontal Copper and Backbone Optical Fiber solution(s) installed.

3.3 Ceiling Tiles

- A. The contractor shall document existing ceiling tile condition prior to beginning project.
- B. Any damage of ceiling pad or structural ceiling grid will be the responsibility of the contractor to repair and/or replace.

27.05.00 – Common Work Results for Communications:

PART 2 PRODUCTS

2.1 Hangers and Supports

- A. General note: All low voltage wiring shall be supported independently by bridal rings or j-hooks (if structured cabling is used), at distances no greater than 5' apart, utilize approved manufacture raceways (ex. EZ-Path) or electrical conduit with bushed ends when penetrating walls and/or floors, is labeled on both ends of cable and/or at every termination point. Attaching low voltage cabling to all thread or ceiling grid support wires is prohibited. Independent ceiling wires can be used if a unique identifier is used to distinguish low voltage supports from ceiling system support wires.
- B. Erico/Caddy Cablecat Wide Base Supports. No zip ties allowed for low voltage cable support

- C. Hubbell Kellems vertical Cable Support Grips, Reference: Sized by cable or bundle diameter
Panduit Corporation J-Mod and J-Pro Cable Support System. No zip ties allowed for low voltage cable support

2.2 Backbox Dimensions

- A. Network outlet backboxes are provisioned by Division 26, however should be verified by Division 27 contractor for correct dimensions prior to cabling. Notify NCH Project Manager of discrepancies prior to installation.
- B. Outlet boxes shall follow dimensions as:
 - 1. Basic in wall box shall follow the dimensions below, with a single gang device ring for the application of the network faceplate.
 - 2. If device box is 4" square, Depth required is 3 ½".
 - 3. If device box is 4 11/16" square, Depth required is 3 ¼" (preferred configuration).

2.3 Identification

- A. Comply with ANSI/TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure except where specific NCH-CNS requirements super cede. NCH building identifier acronyms shall be used and provided by bulletin prior to installation. Bulletin shall not result in additional cost to the project under any circumstances.

2.4 Plywood

- A. See 27.00.00 Section 1.5
- B. Class 1 per ASTM E84 – Most Recent Version Standard test Method for Surface Burning Characteristics of Building Materials.

2.5 Conduit Chase Pipes

- A. Electrical Metallic Tubing (EMT) and Fittings
 - 1. 4" trade size
 - a. Manufactured to ANSI C80.3 (EMT Zinc Coated)
 - b. UL Standard 797 (EMT – Steel)
- B. 4" Arlington insulated bushings Reference: EMT400
- C. Listed Fittings and hangers
 - 1. Size and manufacturer as specified by RCDD Designer or Electrical Engineer.
 - 2. Firestop devices for penetrations, Hilti Firestop FS-1 is the only acceptable manufacturer in addition to applicable support systems
- D. Wall Penetrations
 - 1. The approved pathway for corridor to corridor and corridor to TR penetrations, up to 8" thick, is the EZ Path (sleeve system) by STI. The Contractor shall identify penetration points for horizontal cabling but must obtain pre-approval from the electrical engineer prior to installation.

2. Refer to Division 07 84 00 – Firestopping for approved UL systems and devices for corridor to room penetrations.
 - a. The minimum cable fill rate for systems that pass through a wall with a 1 or 2 hour F Rating shall be 40% by cross sectional area.
 - b. The minimum cable fill rate for systems that pass through a wall with a 3 or 4 hour F Rating shall be 30% by cross-sectional area.

E. Cable Tray Penetrations

1. Cable tray penetrations shall not be allowed through a rated barrier. Cable tray shall be stopped on both sides of a rated barrier and EZ-Path devices matching the maximum allowable cable fill rate of the tray shall be installed. If an existing cable tray should be subsequently surrounded by a fire rated barrier due to renovation, then the electrical engineer shall provide a specific firestop solution to the Engineering PM for approval prior to installation.

F. Floor Penetrations

1. For new floor penetrations thicker than 8", the use of Hilti FS-1 .
 2. For penetrations where a Hilti Speed Sleeve is not feasible, the use of metallic conduit shall be approved. Metallic conduit sleeves shall be 4" minimum. The electrical engineer shall pre-approve the size, quantity, and locations of the pathways. Provide a compliant UL listed firestop solution for all rated barrier penetrations.
 3. Metallic conduit sleeves for both floor penetrations and wall penetrations shall be fire stopped using intumescent non-hardening putty within the sleeve to cable contact to allow for future entry using UL systems and devices. Provide a compliant UL listed firestop solution for all rated barrier penetrations.
- A. Reference Division 07 84 00 – Firestopping for approved products where a project firestop contractor is engaged. Coordinate firestop requirements for Division 27 to Division 7 firestop contractor in this scenario.
 - B. Conduit pathways by Division 26
 1. Coordinate UL listed firestop solutions with Division 26 where Division 26 provides conduit pathways through rated barriers for Division 27 cabling. A coordinated UL listed system must be provided at all rated penetrations. All UL listed firestop solutions must be by a common manufacturer and comply with the Division 27 firestop requirements.

PART 3 EXECUTION

3.1 Hangers and Supports

- A. Where cabling is installed within conduit, cable trays, and raceways, pathways shall be furnished and installed by Division 26 contractor.
- B. Where conduit, cable trays, or raceways are not provided, Division 27 contractor shall furnish and install independent supports so that no cable rests directly on ceiling tile, mechanical ductwork, or other supporting structures.

- C. Listed wide base pathway supports shall be used for adds/moves/changes or low cable count pathways.
- D. Suspended ceiling support wires shall not be used for cabling support. The Division 27 contractor shall provide independent support wires and wide base supports for cables routed above suspended ceiling spaces.
- E. The maximum separation between support points for all cabling shall be five (5) feet.
- F. All cable pathway support elements shall be manufactured for the intended purpose for wide based supports of twisted pair installation, when applicable. In all cases, support products shall be approved for the support of Category 6 or higher cables, including optical fiber.
- G. Minimum conduit size for TO's and quad drops is to be no less than 1" in diameter.

3.2 Identification

- A. All cables, conductors, racks, cabinets, frame, and panels shall be labeled as per the requirements of ANSI/TIA/EIA-606-A, Administration Standard for Commercial Telecommunications Infrastructure. Follow the NCH-CNS specific labeling format listed in associated sections.

3.3 Cable Routing, Separation, And Distance

- A. Primary cable routing paths shall follow the logical structure of the building. When a wall must be breached, provide bushed sleeved openings and UL firestop systems as required to return all rated barriers to their designed performance. Cabling shall enter and exit these areas at 90° angles. Route all cables and cable raceways parallel to or perpendicular to building structure. No diagonal runs shall be permitted, unless noted otherwise.
- B. To reduce or eliminate the field effect of EMI on data signaling, cable runs shall be kept a minimum distance from EMI sources. Refer to ANSI/NECA/BICSI-568-2006 Standard for Installing Commercial Building Telecommunications Cabling.

1. Minimum separation distance from possible sources of EMI:

- a. 5 inches (125mm) from power lines of 2 KVA or less.
- b. 12 inches (305mm) from lighting fixtures.

2. Minimum separation distance from possible sources of EMI exceeding 5KVA:

Condition	Min. Separation Distance
Unshielded power lines or electrical equipment in proximity to open or non-metal pathways.	24 in. (610 mm)
Unshielded power lines or electrical equipment in proximity to a grounded metal conduit pathway.	12 in. (300 mm)
Power lines enclosed in a grounded metal conduit (or equivalent shielding) in proximity to a grounded metal conduit pathway.	6 in. (150 mm)

Electrical motors and transformers.	47 in. (1200 mm)
-------------------------------------	------------------

- C. Communications cabling shall not be run in parallel with any high voltage electrical wiring.
- D. The maximum length of horizontal communications cables shall be limited to 90 meters from the TO (Telecommunications Outlet) to the MER or TR point of termination.
- E. All cabling shall be installed as single continuous homerun pulls from Connector Block to Patch Panel, and to the Patch Panel. No in-line connectors or splices in any form shall be permitted.

3.4 Communications Room Provisions

A. Plywood Backboards

1. Fire rate Plywood shall be 4' x 8' BC Grade or better, void-free.
2. Install plywood with the "B" side exposed
3. Furnish and install un-painted plywood backboards on all useable walls where indicated on project drawings. Mount plywood to cover entire area with the bottom edge 4"-6" above the floor on which ladder tray, equipment, terminating hardware, and cable management rings may be mounted.
4. Painting Fire-rate Plywood
 - a. Paint plywood with standard latex paint that does not adversely affect the plywood fire retardant properties.
 - b. Paint shall be white in color.
 - c. A minimum of one (1) fire rating stamp shall be visible per sheet of plywood after paint has been installed.

B. Conduit Chase Pipes

1. Furnish and install bushed 4" EMT conduit "Chase Pipes" within MER, TR, ER, and other information transport system spaces where communications cabling must pass through suspended ceiling tiles in- route to point of cabling termination.
2. All conduit sleeves installed for drop ceiling penetration shall be permanently attached to building structure with steel strut, listed hangers and mounting accessories. Conduit hangers attached to drywall are not acceptable means of attachment.

3.5 Firestopping

- A. All conduits, sleeves, and penetrations of fire-rated walls, into which communications cables are pulled or reserved for communications cables, shall be sealed after cabling has been installed or as requested by the NCH PM for periodic inspections whether filled, partially filled, or un-used, with a UL listed system and materials in accordance with UL listed system manufacturer's published documentation.
- B. The Division 27 contractor shall provide a compliant manufacturer's UL listed firestop system at all rated barrier penetrations. The UL listed system shall provide for no less than 40% cable fill by cross sectional area. Firestop systems shall use only intumescent putty in contact with cables inside conduit sleeves except where flexible intumescent materials are an integral permanent part of an approved listed manufactured firestop assembly.

- C. A factory supplied sticker shall be completed by the installing contractor including legal contractor name, address and telephone number, Firestop solution manufacturer and identifier code, installation date and maximum allowable cable fill. Attach legibly completed sticker in a clearly visible location.

27.05.26 – Grounding and Bonding for Communications Systems:

PART 1 GENERAL

1.1 System Description

- A. Provide a complete ANSI/TIA-607 compliant telecommunications grounding system. Provide system details in the project design documents.
- B. Communications grounding system components and practices shall comply with latest edition ANSI/TIA- 607-C and BICSI TDMM design standards, NFPA 70 (NEC) articles 250 and 800, UL 467, 486 and 514B.
- C. Telecommunications grounding system shall be provided complete for each new building from service entrance ground to all telecommunications rooms and spaces. Provide compliant system extensions to existing building telecommunications grounding systems.
- D. Label telecommunications grounding system busbar kits, backbone cables, connections and labeling and system testing shall be by qualified Division 26 electrical contractor whenever possible.
- E. Performance test each new and existing telecommunications grounding system per ANSI/TIA-607-C and provide complete test results with required O&M set.
- F. Extend telecommunications grounding system backbone conductors unbroken from the building service entrance ground bus through building telecommunications entrance room and all building telecommunications rooms.

1.2 AE Designer Requirements

- A. AE designer shall provide design for a complete telecommunications grounding system as described herein.
- B. Provide logical diagram showing busbars, locations, backbone conductors and labels, connections to service entrance ground bus and telecommunications busbars, dedicated power panels, structural steel and representative equipment bonding conductors.
- C. Show telecommunications grounding system backbone connections, conductors, and busbars in Division 26 one line riser diagram sheet.
- D. Specify all equipment cables, pathways, testing and labeling, methods, submittals, and O&M manual requirements.
- E. Telecommunications grounding system backbone shall extend, unbroken from and effectively bond to the building electrical service entrance ground at one point and extend through all building TR spaces, Entrance Facility and as otherwise noted. Backbone conductor sizes are to match trade size
- F. Telecommunications grounding busbar kits shall be listed TIA-607 compliant kits with tinned copper busbars drilled to TIA-607/ BICSI standard pattern with stand-off brackets and insulators.
- G. Coordinate actual TMGB/ TGB locations at rooms with owner and reflect on project design documents

PART 2 PRODUCTS

2.1 Approved Manufacturers

A. Telecommunications grounding system equipment and terminations shall be manufactured by;

1. Burndy (connectors only)
2. Erico
3. Harger
4. Panduit

B. Telecommunications grounding system busbar kits. TMGB and TGB kits.

1. Shall be furnished and installed by Division 26, as specified herein. Division 27 specifications for TMGB and TGB bars shall supersede any given in Division 26.
2. Busbar kits shall be complete listed kits with tinned copper busbar, stand-off bracket and insulators unless noted otherwise.
3. TMGB (PBB). Provide typical (1) per building. Listed kit, minimum 4"H x 20"L x 1/4" thick TIA- 607/ BICSI drill pattern with stand-off bracket and insulators, wall mount.

a. Panduit #GB4B0624TPI-1, or equal by Erico or Harger.

4. TGB (SBB); Provide typical (1) at each telecommunications room. Listed kit, minimum 2"H x 20"L x 1/4" thick TIA-607/ BICSI drill pattern with stand-off bracket and insulators, wall mount. TBB conductor terminates directly at last TGB in series to 1" hole spacing locations.

Otherwise

b. Panduit #GB2B0312TPI-1, or equal by Erico or Harger.

5. Rack-Mounted Grounding Bus (RBB), Provide typical (1) inside each telecommunications cabinet and at equipment racks where metallic armored cables, OSP media convertors or other telecommunications equipment and cables require a TEBC connection to bus. Listed Kit 19"W EIA-310 with (2) thread forming Rack Mount screws 12/24 & M6 with min (10) 5/8" drilled terminal connector locations.

a. Panduit Corporation # Panduit #RGRB19U

C. Telecommunications Equipment Bonding Conductor (TEBC).

1. Cables shall be stranded copper cables with green jackets listed for the intended application. Cables may be bare and labeled where placed in NEC CMP (plenum) spaces.
2. Provided by Division 27 unless noted otherwise.
3. Terminate with ANSI/TIA-607 compliant compression connectors with 5/8" spaced 2-hole pads unless noted otherwise.
4. Open-sourced stranded 6AWG stranded copper with green jacket/ insulation 600 Volt, listed for the intended application unless noted otherwise. Cables may be bare and labeled where placed in NEC CMP (plenum) spaces.

D. Telecommunications Backbone Bonding Conductors. (BCT/TBC, TBB, GE/ BBC, CBC)

1. Cables shall be stranded copper cables sized per longest installed cable link to Table 1 below to a maximum 4/0 AWG with green jackets, 600 Volt, listed for the intended application. Cables may be bare and labeled where placed in NEC CMP (plenum) spaces.
2. All Telecommunications Backbone Bonding Conductors shall be equal wire and gauge.
3. Provided by Division 26 unless noted otherwise.
4. Terminate with ANSI/TIA-607 compliant compression connectors with 2-hole pads unless noted otherwise.
5. Open-sourced stranded copper with green jacket/ insulation unless noted otherwise. Cables may be bare and labeled where placed in NEC CMP (plenum) spaces.

Table 1 – TBB/BCC conductor size vs length

TBB/BBC linear length m (ft)	Conductor size (AWG)
less than 4 (13)	6
4 – 6 (14 – 20)	4
6 – 8 (21 – 26)	3
8 – 10 (27 – 33)	2
10 – 13 (34 – 41)	1
13 – 16 (42 – 52)	1/0
16 – 20 (53 – 66)	2/0
20 – 26 (67 – 84)	3/0
26 – 32 (85 – 105)	4/0

6. BCT/TBC and TBB conductors terminate directly to TMGB/ PBB busbar compression terminals at 1" hole spacing locations.
7. TBB conductors terminate directly to TGB/ SBB busbars with 1" hole spaced terminal and TBB sized link parallel to unbroken TBB with listed HTAP and cover kit. Otherwise terminate TBB at last TGB/SBB in series with compression terminals at 1" hole spacing locations.
8. Bond multiple TBB conductors with GE/BBC conductor equal to TBB with listed HTAP and cover kits in accessible locations.

E. Telecommunications Bonding Conductor Terminals

1. Provide only non-reversible listed tin plated copper compression connectors with two-hole lug, long barrel with window. Hole size and spacing shall match ANSI/TIA-607 busbar drill pattern and hole sizes. Use only connector manufacturer recommended compression tools and dies.
2. Provide (2) stainless steel machine screw/ hex bolt, lock washer and nut assemblies per connection.
 - a. Backbone conductor terminal. Two-hole, long barrel lug with window, 4/0 AWG wire, 3/8 stud hole, 1" hole spacing; Panduit #LCC4/0-38DW-X. or approved equal by Burndy, Harger.

- b. Backbone terminal hardware kit. (1) per terminal attachment, Panduit #HDW3/8-KT
- b. TEBC conductor terminal. Two-hole, long barrel lug with window, #6 AWG wire, 1/4 stud hole, .63 hole spacing. Panduit #LCC6-14AW-L or approved equal by Burndy, Harger
- c. TEBC terminal hardware kit. (1) per terminal attachment, Panduit #HDW1/4-KT

F. HTAP kits

- 1. Provide HTAP compression connector for grounding backbone parallel connection sized for the applied run and tap conductors and a clear cover, Panduit #HTWC250-250-1 (alter part number as required for run and tap conductors).

G. C-Taps

- 1. Provide C-Tap heavy duty compression connector for parallel TEBC connections as permitted in ANSI/TIA-607-C. C-Tap shall be electroplated tinned copper or aluminum, irreversible compression type, Panduit CTAP4-6-L or approved equal by Harger, Burndy.

PART 3 EXECUTION

3.1 General

- A. Except as otherwise indicated, provide ANSI/TIA-607 compliant telecommunications grounding system materials as indicated, including but not limited to cable, conductors, connectors, terminals, compression lugs, grounding rod electrodes, grounding plate electrodes, bonding jumper braid, surge arresters, etc. Components shall be U.L. Listed for the purpose intended.
- B. The communication grounding and bonding system infrastructure shall originate with a low resistance connection to the electrical service entrance equipment ground bus, as per the NEC 250.94 and extend as an independent ground system throughout the building.
- C. The connection to the electrical service entrance ground bus (BCT/ TBC) shall be equal in size to the electrical service entrance ground conductor or a maximum #4/0 AWG copper conductor to the Telecommunication Main Grounding Bus bar (TMGB/ PBB), located in the telecommunication entrance facility or main telecommunications equipment room.

3.2 Telecommunications Grounding Bus Bars

- A. The Telecommunication Grounding Bus Bars shall be wall mounted on the telecommunications backboard in a protected location, adjacent to the "TBB" entrance point, near the local electrical power receptacle distribution panel (where provided), and accessible to the Telecommunication Room (TR) ladder rack system as indicated on the drawings or directed by the owner or engineer.
- B. The TMGB shall be in the entrance facility adjacent to the building entrance protection equipment where existing.
- C. Telecommunications room grounding busbars shall be provided by Division 26 in accordance with Division 27 specifications whenever possible.

3.3 Bonding Backbone Conductor and Bonding Conductors

- A. An ANSI/TIA-607-C compliant Communication Grounding System backbone cable shall be provided, tying all communication wiring closets, cabinets, etc. to a common ground point. The Telecommunication Bonding Backbone (TBB) shall be equal to the electrical service entrance ground or a minimum of a #2 AWG copper conductor unless noted otherwise.
- B. The TBB shall originate from the TMBG and be continuous to the farthest TGB.
- C. The only other connections to the TBB shall be H-Taps to intermediate TGBs.
- D. All telecommunications grounding backbone connections shall be labeled within 6" of termination with Panduit #LTYK or owner/ engineer approved equal.
- E. Telecommunications backbone cabling shall be provided by Division 26 in accordance with Division 27 specifications whenever possible.

3.4 Existing Grounding System Installation Verification

- A. The Contractor shall inspect and verify all the existing grounding systems to which attachments are being made, which shall include but not be limited to the following:
 - 1. Electrical Service Entrance Grounding
 - 2. Telephone Service Entrance Grounding
 - 3. Electrical System(s) Grounding
 - 4. Structural Building Steel Grounding
 - 5. Conduit and Raceway System(s) Grounding
- B. Existing grounding systems shall be checked, cleaned, re-tightened and/or re-made with a suitable antioxidant applied, to bring them up to code and standards. Discrepancies in existing systems shall be brought to the attention of the Owner and Engineer in writing, for additional corrective action.
- C. The Contractor shall include a written report with the system grounding Test Form.

3.5 System Testing

- A. Upon completion of the installation of the Communication Grounding System and/or servicing of the existing grounding systems, the Contractor shall perform approved standard ground resistance tests with an Owner and Engineer approved ground resistance test instrument (i.e., stake less clamp-on ground resistance tester, two-point and three-point fall of potential tester), using approved procedures as noted in this specification.
- B. The Contractor shall inspect, service and verify all the grounding systems as per this specification section. Failures of the existing grounding systems to meet the intent of Specification Section 27 05 26 shall be brought to the attention of the Engineer and Owner in writing.
- C. The Contractor shall perform Telecommunication Grounding System Testing as follows:
 - 1. Utilizing the Electrical Service Entrance Point Neutral Ground Bonding Point as the Test Reference Point, measure voltage, ground current and ground resistance on all Telecommunications Bonding Backbone (TBB) conductors at each "TMGB/TGB"
 - 2. Measure voltage, ground current and ground resistance readings on all bonding jumpers at each "TMGB/TGB".
 - 3. Extend the common test lead from the common test point through the facility to the furthest area for testing and work your way back to the starting point. Retain the test

instrument with you as you work your way through the facility. Always maintain the full length of the test leads in play.

4. Upon completion of taking all the required test readings and returning to the common test point, short the two (2) test leads together and record the voltage, current and resistance (voltage and current should equal zero (0), if there is current or voltage present, test results will be invalid). In the absence of current or voltage, the resistance reading of the leads shorted together becomes the "Test Rate Value". The difference between the Tare Value and the resistance recorded at the various tested points equals the system resistance.
 5. Record all readings on Test Form #1. Contractor to reproduce Test Form #1.
 6. Where test results indicate a ground current of 1 Amp or greater, the Contractor shall take appropriate action to identify and reduce the ground current to less than 1 Amp. The Contractor shall notify the Engineer in writing of the excessive ground current, the source and action taken to reduce the current.
- A. The Contractor shall demonstrate by testing that the communication grounding system to earth resistance value is 5 Ohms or less, utilizing a "clamp-on" or 3-point fall of potential tester.
 - B. The Contractor shall be able to demonstrate by test that the communication grounding system resistance from any grounded non-current carry conductor in the system to the electrical service entrance neutral/ground bonding conductor is less than 0.1 Ohms.
 - C. The Contractor shall record the test results on Test Report Form 1 included herein and provide a description of the testing procedures for submission to the Engineer for approval.
 - D. Ten (10) days prior to the communication system completion date the Contractor will provide the Engineer and the Owner the following:
 1. A description of the testing procedures used to include the make and model of the testing instrument.
 2. A copy of Test Report Form 1.
 3. The written report shall detail the inspection, service and verification procedures of the existing grounding systems performed by the Contractor and shall detail the findings and any actions taken (e.g., existing #4 ground conductor from main GEC and ground clamp removed from service side of water meter, all connections cleaned and burnished, anti-oxidant applied, reassembled and tightened).
 4. An 8-1/2" x 11" sketch produced in CAD of the Tele-communications Grounding System in Riser Diagram format, identifying the TMGB/TGB locations, TBB routing between and all bonding connections to the ground bus bars.
 5. A list by ground bar in an excel spreadsheet listing each ground wire attached to the ground bar and what the ground wire is attached to.
 6. Provide all this information in hard copy and electronically.
 - H. Contractor shall include copies of the completed and approved test report in the cabling system instruction manuals.

DATA/TELECOMMUNICATION GROUNDING SYSTEM REPORT

Facility: _____		Date: _____	
Testing Method: _____		Model No.: _____	
Test Equipment: _____		Serial No.: _____	
Manufacturer: _____			
Required Shop Drawings, Test Equipment and Test Procedures Submittals Made and Approved: ☐ Yes ☐ No			

Test Point	Location-Description	Ground Current	Ground Resistance	Remarks

Contractor: _____	ENGINEERING REVIEW
Tested/Inspected By: _____ Title: _____	Reviewed By: _____
Signed: _____ Date: _____	Date: _____

FORM 1: GROUNDING TEST REPORT

PG. _____ OF _____

DATA/TELECOMMUNICATIONS GROUNDING

27.05.36 – Cable Trays for Communications Systems:

PART 1 GENERAL

1.1 System Description

- A. Two predominant types of cable tray shall be furnished and installed in support of NCH-CNS Division 27 information transport systems.
 - 1. Welded steel plated wire mesh type tray for use outside the MER and TR communications spaces. These ladder tray systems are typically required to be by the Division 26 contractor due to above ceiling coordination requirements with other systems.
 - 2. Welded aluminum white ladder tray for use inside the MER and TR communications spaces. These ladder tray systems are typically required by the Division 27 contractor. This tray is covered under section 27 11 23 so it will not be repeated in this section.

1.2 AE Designer Requirements

- A. AE designer shall coordinate tray capacity with all building systems that incorporate low voltage cable distribution through the building and show the intended tray routing and sizes on Division 27 floor plans. Systems that use low voltage cable systems and must be included in the cable tray capacity planning include but are not limited to Data/ Voice cabling, Video Surveillance, Access Control, Building automation/ HVAC control and monitoring, Utility monitoring, Physiological monitoring, Nurse Call, Overhead paging, CATV, backbone optical fiber, backbone copper voice, P-Tube system, isolated patient monitoring and communication systems and distributed audio-visual systems. Tray and associated firestop devices shall be sized to include all low voltage cables that can be co-located with the Cat6 and Cat6A per applicable codes, standards and Cat6/ Cat6A manufacturer warranty guidelines. Wire mesh tray shall include capacity for all Division 27 backbone cables and associated innerducts that are approved for co- location with Cat6/ Cat6A without a divider. All firestop device locations and details shall be shown on Division 27 floor plans either singly or by reference to Division 26 floor plans. Initial tray fill shall not exceed 25% by cable cross sectional area leaving room for future (after project completion) expansion and reconfiguration without modification to tray. All low voltage cables that can be in the wire mesh tray without a divider shall be placed in the tray to minimize disorganization particularly in above suspended ceiling spaces. Coordinate and maintain minimum clearance to all access panels for adjacent systems equipment.
- B. Wherever possible wire mesh tray shall be installed by Division 26.
- C. Provide construction administration and change support throughout the project.

PART 2 PRODUCTS

2.1 Approved Manufacturers

- A. Wire mesh cable tray shall be manufactured round steel stock in 5mm or 6mm diameters forming 2" x 4" squares. Tray shall be minimum electro-galvanized steel to prevent corrosion at protected indoor environments. Tray shall be specified for higher corrosion resistance listed for the intended use where tray is routed through outdoor or other corrosive environments.
- B. All wire mesh tray and all associated supports and accessories shall be sourced from a single manufacturer. Approved manufacturers are listed below:

1. Chalfant "GR Magic" Mesh Tray
2. Eaton/Arrow Hart B-Line - Flextray
3. Legrand – Cablofil

2.2 Wire Mesh Cable Tray – Outside MER/ TR Spaces

- A. Provide compliant continuous wire mesh basket tray system as required to maintain maximum 25% cable fill by cross-sectional area for all Division 27 Backbone Cat6/ Cat6A and all permissible low voltage cabling as described herein.
- B. Provide compliant trapeze supports as described herein.
- C. Provide complete wire mesh tray system grounding and bonding as described herein.
- D. Provide compliant firestop systems at all rated barriers as described in 27 05 00 and required by applicable building codes.

1. Applicable quantity of STI, EZ-Path #EZD44+.

- E. Provide quantity of ganged 4-inch steel sleeves with non-metallic bushings at all non-rated barriers in quantities required to provide equal or greater tray cable fill by cross-sectional area. Secure sleeves to building structure with listed steel strut system.

PART 3 EXECUTION

3.1 Wire Mesh Tray Installation

- A. Coordinate tray capacity and associated sleeves to include all low voltage cabling for all building systems that incorporate low voltage cable distribution. Tray shall be sized to provide for no more than 25% fill by cross-sectional area.
- B. All low voltage and Division 27 backbone cables and associated innerducts that can be co-located with Cat6/ Cat6A cables by applicable codes, standards and the data cable manufacturer's warranty guidelines shall route through wire mesh tray to maintain orderly cable routing especially in above ceiling spaces.
- C. Tray shall be supported by trapeze type support systems as described by the tray manufacturer. Where tray is supported on one side by a wall mount bracket an outboard trapeze support shall also be installed to form the remainder of the required trapeze support and to prevent the tray from tilting outward over time. No center support systems shall be approved. All thread protection sleeves shall be installed for all locations using threaded rod that may expose the installed cabling to damage. Support spacing shall comply with the more stringent recommendations of tray manufacturer's loading tables and NEMA VE2- 2006.
- D. All tray sections shall be joined using bolted connections per manufacturers recommended assembly instructions. Chalfant GR magic tray solution may be used only with the requirement that each section shall be additionally joined with the manufacturer's proprietary bolted grounding assembly. Split bolts do not qualify for the bolted tray connection requirement.
- E. All changes in direction shall incorporate continuous support of installed cabling and shall minimum allowable cable bend radius as specified by the cable manufacturer. No hard 90 turns or cut ends of tray shall be permitted without cable radius support fittings. No changes in direction or installed cable radius support fittings shall be installed that reduce the usable cross-sectional area of the wire mesh tray.
- F. All wire mesh tray shall be installed so that it is fully accessible after installation of all systems, suspended and hard ceilings.

- G. Minimum continuous clearance for access to tray shall be no less than 12" above the tray and no less than 12" to at least one continuous side. Maintain clearances from sources of EMI as described in section 27 05 00. Coordinate and maintain minimum clearance to all access panels for adjacent systems equipment.
- H. Wire mesh tray shall be installed in compliance with all applicable codes, standards, and the NCH-CNS Division 27 design guide. Wire mesh tray shall be installed so that the tray routing and required clearances are fully coordinated with all other building systems throughout the project.
- I. Minimum tray size shall be 4" high by 6" wide.
- J. All wire mesh tray systems shall be grounded and bonded as required by applicable codes, standards, and the NCH Division 27 design guide. Provide continuous bonding conductor for all wire mesh tray systems and bond to each tray section with listed hardware sourced by the tray manufacturer whether required by tray manufacturer or not. Bond tray system to building steel and/ or electrical distribution panels at no more than 60' intervals per NEMA VE2-2006.
- K. All exceptions must be submitted with associated cost reduction to the NCH-CNS project manager and must be approved in writing with bid and prior to purchase and installation.

3.2 Wire Mesh Tray Firestop Systems

- A. Wire mesh tray shall not penetrate rated barriers. Stop and start wire mesh trays within 2 feet of all rated barriers. Provide large capacity re-enterable UL listed firestop device assemblies at all rated barriers. NCH- CNS standard solution is an appropriately sized quantity of STI brand EZ-Path devices. Typically, a ganged solution of EZZ-44+ devices that comply with the rated barrier specifications and the required cable fill ratios described in this section. Firestop assemblies shall be installed in strict compliance with the firestop manufacturer's UL listed system. Install completed UL listed firestop solution identification sticker in plainly visible location adjacent to each firestop system. Legibly complete all information on UL system identification label as described in section 27 05 00.

3.3 Wire Mesh Tray Sleeves

- A. Wire mesh tray shall not penetrate non- rated barriers. Stop and start wire mesh trays within 2 feet of all non-rated barriers. Provide ganged 4" conduit assemblies at all non-rated barriers. NCH-CNS standard solution is a quantity of bushed 4-inch steel conduit sleeves as required to comply with cable fill ratios described in this section. Secure ganged 4-inch steel conduit sleeve assemblies to building structure with listed steel strut system and conduit clamps.

3.4 Documentation

- A. Provide complete as-built documentation with final submittals and or O&M manuals. Show actual cable tray routing and associated sizes on project floor plans. Show all installed UL firestop locations on project floor plans with UL system identifiers. Show all installed sleeved locations with as-installed sizes and quantities on project floor plans.

27.11.13 – Communications Entrance Protection:

PART 1 GENERAL

1.1 System Description

- A. At a minimum all conductive cabled systems that fall under the requirements for primary protection as defined by the NEC shall incorporate primary protection and additional required protection as directed by NCH-CNS. The AE designer shall coordinate with NCH-CNS to review all conductive circuits that are installed outside the building and to determine system operating parameters including operating voltages, bandwidth etc. to specify a compliant and fully functioning primary protection systems.

PART 2 PRODUCTS

2.1 Approved Manufacturers

- A. CommScope Carrier Solutions
- B. Porta
- C. Circa Enterprises

2.2 Building Entrance Terminals

- A. Multi-pair indoor protector panel shall be constructed of metal housing with fire resistant plastic connecting block containing mountings for one hundred (100) protector modules.
- B. Protector panel assemblies shall include provisions for 110 punch down cable terminations, and two (2) connectors for external ground.
- C. Panels shall include cable pass-through capability for side-by-side and top-to-bottom installation.
- D. Protectors may also be specified to be compatible with high density copper backbone Floor Frames when included in project scope.
- E. Reference: CommScope Carrier Solutions ##489ACA1-100, Circa Enterprises #1880ENA1/NSC100 (with CPI #13433-701 or #13432-701 for Floor Frame Mount). Equal by CommScope Carrier Solutions, Porta, or Circa Enterprises.

2.3 Building Entrance Protector Modules

- A. Solid state 5-pin plug-in protector modules shall be furnished to completely populate protector panels. Module shall be available with and without heat coils.
- B. Modules shall be black in color.
- C. Reference: CommScope Carrier Solutions #4C1S, #4C3S. Equal by Porta or Circa Enterprises.

2.4 Single UTP Building Entrance Terminals

- A. UL497 rated protection modules shall be provided for all outdoor single UTP voice and data installations.
- B. Protector panel construction shall be 110 in and 110 out style wall mount units.
- C. Protector panel shall be certified to maintain 1000Mbps performance with mated 1000mbps modules.
- D. Reference: Porta #505E32-65

2.5 Single UTP Primary Protector Modules

- A. Solid state 5-pin plug-in protector modules shall be furnished to completely populate single UTP protector panels. Module shall maintain minimum 1000Mbps performance.

- B. Modules shall be sized to pass 48V for PoE powered devices.
- C. Reference: Porta #LVP6-65

2.6 Test Cord

- A. Furnish and install Test Cord to provide test access to individual cable pairs.
- B. Reference: CommScope Carrier Solutions #W4DD. Equal by Porta or Circa Enterprises.

PART 3 EXECUTION

3.1 Wiring Installation

- A. Ground all primary protector panels using solid 6AWG green insulated conductors direct to TMGB or TGB inside MER/ TR spaces. Comply with design guide and J-STD-607 standard.
- B. Contractors shall not inter-connect BETs with horseshoe-shaped conductors.
- C. Mount all primary protector panels only in accessible locations.

27.11.16 – Communications Cabinets, Racks, Frames and Enclosures:

PART 1 GENERAL

1.1 System Description

- A. The predominant types of open frame racks shall be furnished and installed in support of NCH-CNS information transport systems.
 - 1. Single Upright, Two-Post Open Frame Universal “Relay Rack” Style
 - 2. Dual Upright, Four-Post Open Frame Universal “Relay Rack” Style
 - 3. Wall/ Floor mounted Equipment Cabinets
- A. Open frame equipment racks, 19 inches wide x 96 inches high, shall be furnished and installed such that rear access is available for installation and maintenance. Racks shall be bolted to the floor. The tops of the racks shall be securely braced to rigid ladder tray and bracketed to the wall. All hardware shall be provided for seismic protection as required by NCH.
- B. Where 4-Post racks are specified, fixed racks shall be required.
- C. Use of wall/floor racks must be approved in writing and in each instance.
- D. Racks shall be mounted to provide a minimum of 43" access space in both front and rear.
 - 1. Minimum 43" clearance shall be provided at the side(s) where wall mounted technology equipment is intended to be installed.
 - 2. Where (2) rows of racks are designed to face each other the clearance between racks may be reduced to 36".
 - 3. All clearances shall be measured from the face of the equipment rack or attached vertical manager face whichever is closest to the opposite surface clearances are being provided for.
- A. The sides of a rack or group of racks situated against a wall shall have a minimum of 6" clearance from rack to the adjacent wall. Clearance for the access “walk around” end shall be 36" at minimum.
- B. In each instance, cabinets shall be specified as part of the system requirements contained within each individual systems specification (provided by others). Location of cabinets must be approved in writing and in each instance.

1.2 Materials For Use By Owner

A. Furnish materials to NCH CNS as described below:

1. All rack screws more than those required to install panels and devices shown in project drawings, packs of rack screws are to be left attached to rear rail vertical wire manager

B. Throughout installation, materials shall be securely stored at the project site. When called for by the Owner, materials shall be delivered by the Contractor who shall obtain a signature of acceptance and delivery from NCH CNS.

PART 2 PRODUCTS

2.1 Approved Manufacturers

- A. CPI (Chatsworth Products Inc.)
- B. Panduit Corporation (Structured Ground™ System Only)

2.2 Open Frame Equipment Racks – Single Upright, 2-Post

- A. Racks shall be manufactured from aluminum.
- B. Each mounting space shall be marked and numbered on the mounting channel.
- C. The assembled rack shall measure 8' (96") high x 20.3" wide x 15" deep. The sides (webs) of the equipment-mounting channels shall be punched to facilitate attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.
- D. The rack shall be rated for 1,500 lb. of equipment.
- E. The rack shall be UL Listed.
- F. Finish shall be epoxy-polyester hybrid powder coat, white in color.
- G. Reference: Chatsworth Products, Inc. (CPI) Self-Support Rack #55053-E15. No equal shall be accepted.

2.3 Open Frame Equipment Racks – Dual Upright, 4-Post

- A. Frames shall be manufactured from aluminum.
- B. Each mounting space shall be marked and numbered on the mounting channel.
- C. The assembled frame shall measure 8' (96") high x 20.3" wide x 41" deep. Fixed 4-Post racks shall have 29" between the front and rear mounting surfaces of the two (2) pairs of mounting channels. The sides (webs) of the equipment-mounting channels shall be punched to allow attachment of vertical cable managers along the sides of the frame or for frame-to-frame or frame-to-rack baying (frames shall be able to bay with a 2-post relay rack).
- D. The frame shall be rated for 2,000 lb. of equipment.
- E. Finish shall be epoxy-polyester hybrid powder coat, white in color.
- F. Reference: Chatsworth Products, Inc. (CPI) Self-Support Rack #55053-E15 plus #50110-E15 or #50120-E15. No equal shall be accepted.

2.4 Wall/Floor-Mounted Equipment Cabinets

- A. The cabinet shall be either wall-mount or floor-supported with a wheeled base.
- B. Confirm cabinet style and all required options with NCH – CNS prior to purchase and installation.

- C. Reference: Wall/Floor Cabinet – Chatsworth CUBE-iT PLUS Cabinet System Series
 - 1. CUBE-iT Wall-Mount Cabinet: Gen 3: 36" H x 24" W x 30" D 19U: #12-24 Tapped Rails: Plexiglass Door CPI #12419-E36
 - 2. Reference: Vertical Cable Manager #40970-704
 - 3. Reference: Fan Kit #40975-001
 - 4. Reference: Fan Filter Kit #40973-001
 - 5. Reference: Panduit #RGRB19U kit. (Reference Div. 27 grounding section)
- D. Reference: Mini TR Cabinet
 - 1. Cabinet – Chatsworth RM1039487

PART 3 EXECUTION

3.1 Equipment Installation

- A. All open frame rack assemblies and cabinets shall require horizontal rack grounding strips (RGS). Strips shall be mounted on the back side of the vertical rack rails for two-post assemblies and on the back side of the front post for four-post assemblies. These mounting arrangements apply both to racks based on UTP and F/UTP cabling. Contractor shall confirm details with NCH CNS prior to proceeding with the installation.
- B. Assemble relay racks according to manufacturer's instructions and project design documents.
- C. Each rack shall be individually grounded to the TMGB or TGB per section 27 05 26. The ground will comply with ANSI/TIA-607, meet local code requirements and will be approved by the Authority Having Jurisdiction (AHJ).
- D. In seismic areas, the rack shall have additional bracing as required by building codes and the project specific design of a licensed structural engineer.
- E. Cabinets placed outside of MER/SER/TR spaces shall be coordinated with NCH-CNS for review prior to CD phase and installation.
- F. Cabinets shall normally be secured fire treated B/C plywood. Where placed outside of MER/SER/TR spaces the cabinet shall be secured to CMU or structural steel with 13/16" slotted steel strut sections. Horizontal sections of 1-5/8" slotted steel strut shall be provided approximately 12" above and below the cabinet for conduit entry support.
- G. Electric power receptacle(s) shall be provided in locations accessible from the cabinet interior to prevent unauthorized power disconnect. Coordinate specific receptacle placement with NCH-CNS prior to installation. Do not route associated power conduit inside cabinet.

27.11.19 – Communications Termination Blocks and Patch Panels:

PART 2 PRODUCTS

2.1 Approved Manufacturers

- A. The Siemon Company (CAT6 only)
- B. Systimax (Cat6A only)
- C. Corning Cable Systems

2.2 Patch Panels for Copper Backbone/Riser Cabling

A. New Construction/Redesigned MER, TR, and other information transport distribution spaces:

1. Provide High Density 48-Port ANGLED Category 3 UTP Patch Panels with insulation displacement connecting blocks for termination of all voice riser cabling. Insulation displacement connecting blocks shall be based on individual modular snap-in jacks.
2. Patch Panels shall contain 8-position USOC RJ-45 UTP ports that meet or exceed transmission performance of Category 3 for voice feeder cabling.
3. Furnish and install manufacturer recommended rear cable manager for all patch panel installations.
4. Reference: The Siemon Company #MX-PNL-48-A
5. Reference: Systimax (2) # M2400A-1U-PS
6. Furnish and install rear cable manager for all patch panel installations. Reference: Mid Atlantic LBP-4A

B. Additions to existing MER, TR, and other information transport distribution spaces:

1. Provide High Density 24- or 48-Port (FLAT or ANGLED) Category 3 UTP Patch Panels with insulation displacement connecting blocks for termination of all voice riser cabling. Insulation displacement connecting blocks shall be based on individual modular snap-in jacks.
2. Note: Selection of flat or angled style shall be as required to match existing.
3. Patch Panels shall contain 8-position USOC RJ-45 UTP ports that meet or exceed transmission performance of Category 3 for voice feeder cabling.
4. Furnish and install manufacturer recommended rear cable manager for all patch panel installations.
5. Reference: The Siemon Company #MX-PNL-48-A, #MX-PNL-24-A, #MX-PNL-48, MX-PNL-24.

C. All panels and ports shall be black in color with green icons applied.

1. Reference Modular Jack: The Siemon Company #MX3-F-U4-01, Systimax #M1BH-H-003
2. Reference Icon: The Siemon Company #CT-ICON-07.
3. Reference Icon: Systimax # M61F-226.

2.3 Distribution Panels for Optical Fiber Cabling

A. Optical Fiber Distribution Panels shall be rack mount enclosures with front and rear removable doors, removable top, large front-mounted fiber guides, and integrated hinged optical jumper manager. "72-144" panels shall accept up to twelve (12) connector panels, supporting a minimum of one-hundred forty-four (144) "LC" style couplings in 4U rack space. "12-24" panels shall accept up to two (2) connector panels, supporting a minimum of twenty-four (24) "LC" style couplings in 2U rack space.

1. Reference: "72-144" (4U) Optical Fiber Distribution Panel shall be Corning Cable Systems #CCH-04U.
2. Reference: "12-24" (2U) Optical Fiber Distribution Panel shall be Corning Cable Systems #CCH-02U.

3. Reference: “12-24” (1U) Optical Fiber Distribution Panel shall be Corning Cable Systems #CCH-01U.
- B. Each panel shall include a full complement of blank adapter panels, labels, cable storage accessories, and optical fiber cable routing accessory kit.
- C. Optical Fiber Distribution Panels shall include duplex “LC” style coupler panels and connectors as required for the complement of optical fiber elements indicated on project drawings.
- D. Connector Panels shall each contain six (6), twelve (12) or twenty-four (24) “LC” style duplex adapters and shall be color coded according to the optical fiber type for which they are applied. 8.3/125µm single mode shall be blue, and laser-optimized 50/125µm multimode shall be aqua.
- E. Reference Multimode:
 1. 6-port LC-Duplex coupler panel, 50um LOMM, #CCH-CS06-E4-P00QE
 2. 12-port LC-Duplex coupler panel, 50um LOMM, #CCH-CS12-AD-P00QE
 3. 24-port LC-Duplex coupler panel, 50um LOMM, #CCH-CS24-AD-P00QE
- F. Reference Single mode:
 1. 6-port LC Duplex coupler panel, Single Mode, #CCH-CS06-A9-P00RE
 2. 12-port, LC-Duplex coupler panel, Single Mode, #CCG-CS12-AE-P00RE
 3. 24-port LC-Duplex coupler panel, Single Mode, #CCH-CS24-AE-P00RE
- G. Small format optical fiber termination panel for special small/ restrictive space applications shall be Corning
 1. Reference Single Panel Housing: #SPH-01P.
 2. Reference Single Panel Housing w/ Connector Panels: PH-CS12-E4-P00TE, SPH-CS24-E4-P00TE, SPH-CS12-A9-P00RE, SPH-CS24-A9-P00RE

2.4 Patch Panels For Copper Horizontal Cabling

- A. New Construction/Redesigned MER, TR, and other information transport distribution spaces:
 1. Provide High Density 48-Port ANGLED Category 6A UTP Patch Panels with insulation displacement connecting blocks for termination of all horizontal channels. Insulation displacement connecting blocks shall be based on individual modular snap-in jacks.
 2. Patch Panels shall contain 8-position RJ-45 UTP ports that meet or exceed transmission performance of Category 6A for the horizontal channel.
 3. Furnish and install rear cable manager for all patch panel installations. Reference: Siemon WM-BK
 4. Patch Panels shall terminate four (4) pairs of Category 6A UTP horizontal cabling per jack. Reference: Systimax (2) # M2400A-1U-GS, (48) #MGS600-003
- B. Additions to existing MER, TR, and other information transport distribution spaces:
 1. Provide High Density 24- or 48-Port (FLAT or ANGLED) Category 6 UTP Patch Panels with insulation displacement connecting blocks for termination of all horizontal channel cabling. Insulation displacement connecting blocks shall be based on individual modular snap-in jacks.
 2. Note: Selection of flat or angled style shall be as required to match existing. Wall mount cabinets shall always have flat panels.

3. Patch Panels shall contain 8-position RJ-45 UTP ports that meet or exceed transmission performance of Category 6 for the horizontal channel.
4. Furnish and install rear cable manager for all patch panel installations. Reference: Siemon WM-BK
5. Patch Panels shall terminate four (4) pairs of Category 6 horizontal cabling per jack. Reference: The Siemon Company #MX-PNL-48-A, #MX-PNL-24 #MAX-PNL-48

C. All ports installed for UTP shall be black in color with blue icons unless as referenced:

1. Network Ports = Blue
2. Patient Room Phones = Red
3. Nurse call = Violet
4. Philips = Orange

2.5 Termination Blocks For Copper Backbone/Riser Cabling

- A. Termination blocks shall be 5-pair 110-style, wall mounted with legs, or frame mounted without legs in increments of 100- or 300-pair per unit.
- B. Termination blocks shall only be used to populate new MC frames within the MER or to cross-connect with voice termination blocks within existing TR(s), HC(s), or IDF(s).
- C. Reference: The Siemon Company #S110 AA2-300FT, DW2-100, S110C-5.

PART 3 EXECUTION

3.1 Installation

- A. All Patch Panels and Distribution Panels shall be securely mounted in the rack with a minimum of four (4) rack screws located in the four corners of each panel.
- B. All Panels shall be arranged in sequential order from top to bottom and left to right within racks and shall be labeled in alphanumeric order according to the NCH labeling scheme.

27.11.23 – Communications Cable Management And Ladder Rack:

PART 2 PRODUCTS

2.1 Approved Manufacturers

- A. CPI (Chatsworth Products Inc.)
- B. Eaton/Arrow Hart /B-Line (Ladder Rack and Accessories Only)
- C. Panduit Corporation (Structured Ground™ System Only)

2.2 Cable Management

A. Vertical Cable Management for Racks/Frames

1. Every Rack/Frame shall have a minimum of one Vertical Cable Manager furnished and installed between racks and at the end of multiple rack line-ups. The Vertical Cable Manager shall create a space for storing and organizing cables along the side of each Rack/Frame.
2. A single Vertical Cable Manager shall be used in between bayed Racks/Frames if it is sized to match cable requirements for both Racks/Frames.

3. Vertical Cable Manager shall match the height of the Rack/Frame to which it shall be attached.
4. Vertical Cable Manager shall bolt to the side of Racks/Frames using factory-provided hardware and mounting provisions. The manufacturer of the Vertical Cable Manager shall be by the same manufacturer as the Racks/Frames.
5. Vertical Cable Manager shall be a double-sided H-shaped trough with covers as indicated in the project drawings. The double-sided trough shall provide independent front and rear cable pathways and shall have multiple evenly spaced edge-protected front-to-rear cable pass-through holes for cables in the center divider.
6. The cover shall be removable, hinged to open from the right or left side and shall include a latch that shall secure the cover in the closed position.
7. Vertical Cable Manager shall have cable openings along both sides of the trough. The openings shall be formed by evenly spaced T-shaped cable guides. The T-shaped cable guides shall be made from a composite plastic material (not metal) and shall have rounded edges to protect cables. When the Vertical Cable Manager is attached to a Rack/Frame, each cable opening shall align with a rack-mount space (RMU) on the Rack/Frame. Each opening shall pass a minimum of twenty-four (24) each .35" OD Patch Cords.
8. Finish shall be epoxy-polyester hybrid powder coat paint, white in color. Edge-protectors, T-shaped cable guides and latch hardware shall be black in color.
9. Reference: Chatsworth Products, Inc. (CPI) Evolution Cable Management. No equal shall be accepted.

a. #35524-E15, Double-Sided, 12" W x 96" H x 24.5" D.

B. Horizontal Cable Management for Racks/Frames

1. Furnish and install single-sided Horizontal Cable Managers 19" W x 1.75" H (1RU) and 19" W x 3.5" H (2RU) where specifically indicated on Project Drawings.
2. The Horizontal Cable Manager shall be a single-sided C-shaped trough with a cover. The single-sided trough shall have a slot or holes at the rear to facilitate front-to-rear cabling through the horizontal manager. The cover shall be removable, hinged to open or down and will snap on to secure the cover in the closed position.
3. Managers, including edge-protectors, T-shaped cable guides, and latch hardware shall be white in color.
4. Reference: Chatsworth Products, Inc. (CPI) #35441-E02. No equal shall be accepted

2.3 Ladder Rack and Accessories

- A. Ladder Rack shall be manufactured from tubular steel. Stringers (sides) shall be made from 3/8" wide by 1- 1/2" high tubular steel with .065" wall thickness. Cross members (rungs) shall be made from 1" wide by 1/2" high tubular steel with .065" wall thickness.
- B. Ladder Rack (stringers) shall be 9'-8 1/2" long. Cross members shall be welded in between stringers on 12" centers beginning 5 3/4" from one end so that there are thirteen cross members per Ladder Rack. There shall be 8" of open space in between each cross member.
- C. Finish shall be epoxy-polyester hybrid powder coat (paint) in the color(s) specified below.
- D. Furnish and install 6 inches wide 12 inches wide, and 18 inches wide ladder style cable runway sections in each MER, TR, and information transport systems space as indicated on Project

- Drawings. Ladder Rack shall be 12 or 18 inches wide and shall be white in color. Include J-Bolts and associated mounting hardware Reference: CPI #10250-E12, #10250-E18.
- E. Cable Runway Radius Bends and E-Bends shall be used where ladder must make 90-degree change in direction. Bends shall be white in color. Reference: CPI #10723-E12, #10724-E12, #10723-E18, #10724-E18, #10822-E12, #10822-E18.
 - F. Cable Runway Radius Drops shall be mounted to stringer and cross members without the use of tools, where cabling must turn down into tops of vertical cable managers. Drops shall be white in color. Reference: CPI ##14305-E00, 14305-E01, 14304-E06, 14304-E12, 14304-E18.
 - G. Channel Mounting Plates shall be 3". Plates shall be white in color. Include associated mounting hardware. Reference: CPI #10595-E12, #10595-E18.
 - H. Wall Mounting Angles shall be white in color. Include J-Bolts and associated mounting hardware. Reference: CPI #11421-E12, #11421-E18.
 - I. Vertical Wall Brackets. Reference: #10608-E01.
 - J. Cable Runway Foot. Reference: #11309-001.
 - K. Butt Splice Kits shall be gold. Reference: CPI #11313-001, 11314-001.
 - L. Triangular Support Brackets shall be white in color. Reference: CPI #11312-E01, 11312-E18.
 - M. Runway/Enclosure Junction Kits shall be white in color. Reference: CPI #12594-E01, #12595-E01.
 - N. Cable Runway Elevation Kit shall be used to transition between racks of unequal heights. Kits shall be white in color. Reference: CPI #10506-E02, #10506-E06.
 - O. Cable Runway Corner Brackets shall be installed at all "T"- or "L"-shaped intersections. Brackets shall be white in color. Reference: CPI #11959-E15.
 - P. Cable Retaining Posts shall be installed to create a cable trough effect using ladder style tray. Posts shall be black in color. Reference: CPI #10596-706, #10596-708, #10596-710.
 - Q. Cable Runway Pathway Dividers shall be installed to separately route backbone cabling away from horizontal cabling bundles where entering the MER or TR and routed to destination racks(s). Reference: CPI #14308-001, 14308-002.
 - R. Protective End Caps shall be black in color. Reference: CPI #10642-001.

PART 3 EXECUTION

3.1 Equipment Installation

A. Vertical Cable Management

1. Vertical Cable Managers shall be attached to the side of the Rack/Frame using the manufacturer's installation instructions and included hardware. No holes shall be drilled in Racks/Frames to install mismatched managers.
2. When a single Vertical Cable Manager is used in between two Racks/Frames, attach the Vertical Cable Manager to both Racks/Frames.

B. Ladder Rack

1. Ladder Rack shall be installed with side stringers facing down so that the ladder forms an inverted U- shape and so that welds between the stringers (sides) and cross members (middle) face away from cables.
2. Ladder Rack shall be supported every 5' or less in accordance with TIA-569, NEMA-VE1 and NEMA- VE2.

3. When the pathway is overhead, Ladder Rack shall be installed with a minimum clearance of 12" above the Ladder Rack. Leave a minimum of 12" in between Ladder Rack and ceiling/building truss structure. Leave a minimum of 3" in between Ladder Rack and the tops of equipment racks and/or cabinets. Multiple tiers of Ladder Rack shall be installed with a minimum clearance of 12" in between each tier of Ladder Rack. When located above an acoustical drop ceiling, leave a minimum of 3" clearance between the top of the drop ceiling tiles and the bottom of the Ladder Rack. Leave a minimum of 6" side clearance between the Ladder Rack and all other system components.
4. When installed under a raised floor, Ladder Rack shall be installed with a minimum 3" clearance between the top of the Ladder Rack and the bottom of the floor tiles or floor system stringers, whichever is lower in elevation.
5. Within each MER and TR, Ladder Rack should be bonded together, electrically continuous, and bonded to the TMGB and TGB, unless otherwise specifically noted in the Project Drawings.
6. Add 6" high cable retaining posts to the open sides of Ladder Rack as indicated in Project Drawings. Cable fill within any Ladder Rack should not exceed 6" in height.
7. When a single Ladder Rack supports different types of cable media, the cable media shall be separated within the pathway by cable spools that attach to the cross members on the Ladder Rack.
8. Use a radius drop to guide cables wherever cable exits overhead Ladder Rack to access a rack, cabinet or wall-mounted rack, cabinet, or termination field. Furnish and install a moveable cross member also to attach and align the radius drop in between the welded cross members of a Ladder Rack.
9. Cover the exposed ends of cable runway that do not terminate against a wall, the floor or the ceiling with end caps or an end closing kit.
10. Use auxiliary support brackets that attach to the side stringer of the Ladder Rack to support interconnect cabling (patch cords, equipment cords, jumper cords) that is routed between racks using the Ladder Rack. Auxiliary support brackets can be used to support other conductors that should be physically separated from cables within the Ladder Rack as defined by local code or the authority having jurisdiction (AHJ).

27.13.13 – Communications Copper Backbone Cabling:

PART 1 GENERAL

1.1 Multi-Pair Backbone Design

- A. The Multi-Pair backbone consists of both Intra-Building Backbone as well as Inter-Building backbone.
- B. Multi-pair copper backbone cables located in the MER shall be home-run routed directly to the racks located in the TR(s).
 1. Intra-Building backbone shall be terminated on a patch panel in both the MER and the TR.
- C. Verify design and terminations prior to execution with network team. Variations of patch panel to 110 blocks may exist in building.

PART 2 PRODUCTS

2.1 Approved Manufacturers

- A. CommScope/Systimax
- B. General Cable
- C. Superior Essex

2.2 Copper Backbone Cabling - Intrabuilding

- A. ISP Copper Backbone Cabling shall be Category 3 rated, multi-pair 24 AWG riser or plenum rated as required. Cabling shall consist of solid-copper conductors tested to meet Category 3 performance. Cabling shall be UL tested and listed as CMR or CMP as required for the environment into which it is to be placed.
- B. Cable shall be listed for wet locations when placed in damp or wet locations including underground duct. Cable shall be listed for UV exposure when placed in aerial and similar outside plant spaces.
- C. The cable shall be available in 25, 50, and 100 pair increments.
- D. Multi-pair cabling requirements per MER/TR shall typically be 25 pair. Confirm quantity and installation location with NCH-CNS during design and prior to installation.
- E. If multi-pair cabling is required to be installed in multiple racks the cable count shall be equal across all racks in which backbone cabling is shown.
- F. Open Source. Reference:
 - 1. Anixter Riser #CM-02524BAG-3, #CM-05024BAG-3, #CM10024BAG-3.
 - 2. Anixter Plenum #CMP-02524SPP-3, #CMP-05024SPP-3, #CMP-10024SPP-3 or most recent part numbers.

2.3 Copper Backbone Cabling – Interbuilding (Indoor/ Tunnel)

- A. Un-exposed ISP multi-pair copper backbone cables from other buildings shall be routed directly to the MC located in the MER.
- B. ISP Copper Backbone Cabling shall be Category 3 rated, multi-pair 24 AWG riser or plenum rated as required. Cabling shall consist of solid-copper conductors tested to meet Category 3 performance. Cabling shall be UL tested and listed as CMR or CMP as required for the environment into which it is to be placed. The cable shall be available in 25, 50, and 100 pair increments.
- C. Multi-pair cabling requirements per MER/TR shall typically be 25 pair. Confirm quantity and installation location with NCH-CNS during design and prior to installation.
- D. Open Source Reference:
 - 1. Anixter Riser #CM-02524BAG-3, #CM-05024BAG-3, #CM10024BAG-3-01.
 - 2. Open Source. ARMM Reference: Anixter #CMR-002524EAA, #CMR-005024EAA, #CMR-010024EAA, #CMR-020024EAA, #CMR-030024EAA, #CMR-040024EAA, #CMR-060024EAA, #CMR- 090024EAA or most recent part numbers.

2.4 Copper Backbone Cabling – Interbuilding (Osp/ Duct Bank)

- A. OSP Copper Backbone Cabling shall be RUS/REA PE89 design in conformance with ANSI ICEA 7CFR- 1755.890, foam skin filled core, solid conductor multi-pair 24AWG.

- B. Transition cabling from the EF splice to the termination panel shall be AR Series Riser cable (ARMM). OSP cable shall be available in 25, 50, 100, 150, 200, 300, 400, 600, and 900 pair increments.
- C. Multi-pair cabling requirement shall be sized by NCH-CNS staff on a per project basis.
- D. Cable count shall be as shown on project backbone/riser drawings.
- E. Cable count shall be equal across all racks in which backbone cabling is shown.
- F. Open Source. OSP Reference: Anixter #E-002524DFC, #005024DFC, #E-010024DFC, #E-015024DFC, #E-020024DFC, #030024DFC, #040024DFC, #060024DFC, #090024DFC or most recent part numbers.

2.5 Copper Backbone Splicing - Interbuilding Only (Osp)

- A. Modular IDC splicing system, available from 5- and 25-pair configurations, to splice 22 to 26 AWG conductors. Made of fire-retardant plastic and available as either dry or filled for moisture protection.
- B. Splice Case(s) for indoor splicing applications shall be non-filled, straight, or butt-splice configurations, sized according to pair count requirements for the cabling configurations furnished and installed.
- C. Splice Case(s) for outdoor splicing applications shall be gel-filled re-enterable configurations, sized according to pair count requirements for the cabling configurations furnished and installed.

PART 3 EXECUTION

3.1 Installation - Intrabuilding

- A. The Contractor shall use common vertical sleeve(s) for routing of all copper intra-building backbone/riser cables. Cables shall be supported vertically within the MER and TR spaces using wall mounted ladder rack and Hubbell Kellems Cable Support Grips, Reference: Sized by cable diameter. Contractors shall be required to coordinate riser sleeve usage with NCH-CNS project manager prior to populating the sleeves with cabling.
- B. Within the MER, the Contractor shall furnish a ten (10) foot service loop suspended from the Ladder Rack above the MC frame.
- C. Within the TR(s), the Contractor shall furnish a five (5) foot service loop suspended from the Ladder Rack above each of the Open Frame Rack(s).
- D. All cabling shall be continuous and without splices, except to attach to BETs.
- E. Bond and ground all cable shields and drain wires at each end.
- F. Cabling shall be arranged on the patch panels in sequential numerical order by cable pair.
- G. Copper Backbone Cabling shall be terminated on 110-style termination blocks at the MC.
- H. Copper Backbone Cabling shall be terminated on Patch Panels located in each rack within each TR.
- I. Furnish and install machine printed self-adhesive, self-laminating wrap around cable labels within 6" of cable jacket removal. Reference section 27 05 00.

3.2 Installation – Interbuilding

- A. OSP (Outside Plant) multi-pair copper backbone cables from other buildings shall break for termination and protection within an EF (Entrance Facility) within 50 ft. of the point at which cabling exits rigid entrance conduit. Cabling shall then be converted to listed CMR or CMP ISP

as required for the environment into which it is to be placed and routed directly to the MC located in the MER.

- B. OSP Copper Backbone Cabling shall be RUS/REA PE89 design in conformance with ANSI ICEA 7CFR- 1755.890, foam skin filled core, multi-pair 24AWG, at minimum. Transition cabling from the EF splice to the termination panel shall be AR Series Riser cable (ARMM).
- C. All OSP cables entering any building shall be properly protected and bonded to ground at both ends of the circuit.
- D. Designers and contractors shall furnish and install BET (Building Entrance Terminals), primary protection modules of the type and manufacturer specified in Section 27 11 13 – Communications Entrance Protection.
- E. The Contractor shall use common conduits and sleeve(s) for routing of all copper inter-building cables. Cables shall be supported vertically within the MER and TR spaces using wall mounted ladder rack and Hubbell Kellems Cable Support Grips, Reference: Sized by cable diameter.
- F. The Contractor shall secure all copper inter-building cables to the MER walls to prevent movement of the cable. D-rings shall be acceptable for this purpose. The Contractor shall secure the cables to the Ladder rack to prevent movement of the cable. The Contractor shall use the horizontal Ladder Rack to route the cable to the MC termination blocks.
- G. Within the MER, the Contractor shall furnish a ten (10) foot service loop suspended from the Ladder Rack above the MC frame.
- H. All cabling shall be continuous and without splices, except to attach to BETs.
- I. Bond and ground all cable shields and drain wires at each end.
- J. Cabling shall be arranged on the termination blocks in sequential numerical order by cable pair.
- K. Copper Backbone Cabling shall be terminated on 110-style termination blocks at the MC.
- L. Furnish and install machine printed self-adhesive, self-laminating wrap around cable labels within 6" of cable jacket removal. Reference section 27.05.00.

3.3 Splicing – Interbuilding

- A. Copper Inter-building cables, 5-pairs or larger, shall be spliced using the Modular Splicing System. Two (2) modular splice types shall be used, as follows.
 - 1. Straight
 - 2. Facility (future cable re-arrangement points)
- A. Copper cable pairs that are un-assigned shall be terminated in minimum 25 pair 710 modules within the splice closure.
- B. Copper splices shall be bonded with an approved braid or bar across the splice opening to maintain sheath bonding integrity.
- C. Within newly joined section of copper cable, all joined pairs shall be 100% tested good and useable, end- to-end.
- D. Copper building backbone cable sheaths shall be grounded, using ground braid wire, to the TMGB or TGB within each MER or TR.
- E. Furnish and install machine printed self-adhesive, self-laminating wrap around cable labels within 6" of cable jacket removal. Reference section 27 05 00
- F. Copper underground splice cases shall be properly racked, supported, and secured within the appropriate splice bay location in Manholes or splice boxes. The Contractor shall be

responsible for furnishing and installing all cable hooks. Copper underground cable splices shall be pressure tested for air leaks to ensure that the splice is waterproof.

3.4 Termination

- A. Patch Panels shall terminate one (1) pair of Category 3 UTP voice riser per jack unless otherwise noted on project drawings.
- B. Backbone/Riser cables shall be terminated on patch panel jacks in the following manner:
 - 1. One pair per jack except for jack 24 or unless otherwise noted on project drawings.
 - 2. The single pair will be terminated on pins 4/5 assuring proper polarity. In the case of jack 24, pairs 24 and 25 will be terminated on pins 4/5 and 3/6 respectively.
- C. Labeling on the face of each patch panel shall indicate the location of ALL 25 pairs i.e., 1,2,3,4...22,23,24,25 with jack 24 on the patch panel displaying both 24 and 25. Pair designation on each subsequent panel shall increment by 25 so that jack numbers correspond to pair numbers of a standard color coded 25 pair cable. Refer to Figure 1 below.

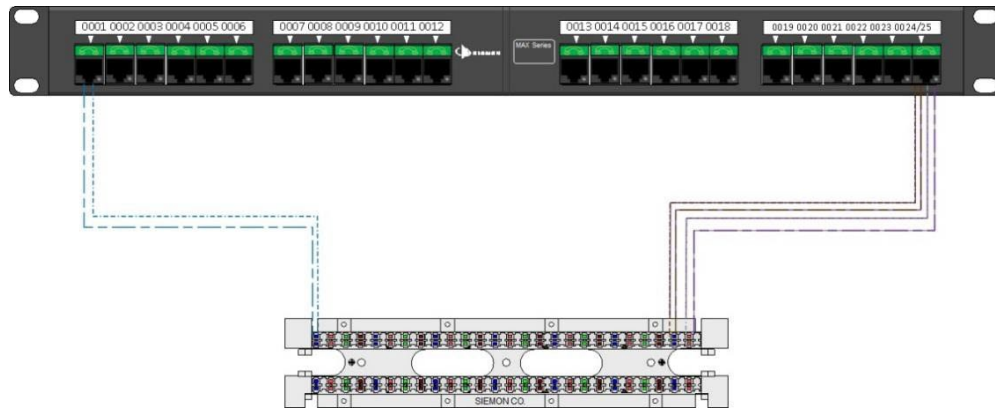


Figure 2 – CAT3 Termination

3.5 Testing

- A. New cable pairs shall be end-to-end tested as follows:
 - 1. DC loop resistance
 - 2. Wire map
 - 3. Continuity to remote end
 - 4. Shorts between two or more conductors
 - 5. Crossed pairs
 - 6. Reversed pairs
 - 7. Split pairs
- B. The Contractor shall prepare complete cable test reports for all installed cables for review and approval of NCH CNS prior to acceptance of the cabling system.

3.6 Firestopping

- A. Refer to Section 27 05 00 – Common Work Results for Communications

27.13.23 – Communications Optical Fiber Backbone Cabling:

PART 2 PRODUCTS

2.1 Approved Manufacturers

A. Corning Cable Systems

2.2 Optical Fiber Backbone Cabling

- A. New segments of multi-element optical fiber backbone cable shall meet the requirements of the National Electrical Code® (NEC) ® Section 770. The cable shall be listed OFNR (OFCR) for riser (non-plenum) applications or OFNP (OFCP) for plenum applications, as required. The indoor backbone fiber shall be a hybrid/composite multi-mode and single mode, utilizing a tight buffered, air-core design with all-dielectric strength member construction and outer jacket with jacketed interlocking armor. Where interlocking armor is used, innerduct shall not be required. Outdoor cable shall be of a loose buffer tube 100% dielectric design, utilizing a UV stabilized, flame retardant outer jacket. Extension of existing cabling segments shall utilize the same construction, core size, and performance factor as the existing segment to be mated.
- B. New Multi-mode Optical Fiber segments shall meet the requirements of EIA/TIA-492AAAC and ISO/IEC 11801 OM3. Multimode Optical Fibers.”
- C. New Single Mode Optical Fiber segments shall meet the requirements of EIA/TIA-492CAAB and ISO/IEC 11801 OS2. Color Coding
 - 1. For indoor applications, the color of the outer jacket shall be aqua for cables containing 50/125 µm Laser Optimized Fiber.
 - 2. For indoor applications, the color of the outer jacket shall be yellow for cables containing single mode fiber.
 - 3. For outside plant applications, the jacket shall contain carbon black to provide ultraviolet light protection.
 - 4. The optical fiber color coding shall be in accordance with TIA/EIA-598-Most Recent Version, "Optical Fiber Cable Color Coding."
- A. Each optical fiber backbone cable shall consist of a minimum number of elements as follows. Specific information contained within Project Drawings such as backbone/riser schematics shall take precedence as long as the minimum requirement has been met.
- B. For Central Campus Buildings
 - 1. Each MC (whether located in MER or other TR as redundant MC) to each TR
 - a. 48-elements FOMM, 50um laser enhanced
 - b. 24-elements FOSM, single mode
 - 2. Each MC (whether located in MER or other TR as redundant MC) to T0150, also referred to as “Ops”. T0150 is located within the lower level of the existing tower building.
 - a. 96-elements FOMM, 50um laser enhanced
 - b. 48-elements FOSM, single mode

3. MER to RII, also referred to as “Wexner Annex”

a. 48-elements FOMM, 50um laser enhanced

b. 48-elements FOSM, single mode

- A. For all other Campus Buildings coordinate with NCH-CNS on a per project basis.
- B. All remodels and additions to existing MER or TR spaces shall be retrofitted to achieve minimum requirements as listed herein.
- C. All optical fiber cables shall be shipped with OTDR results for each fiber. OTDR results shall show attenuation and bandwidth. The results shall be documented in such a manner that the information can be retained for future use.
- D. Backbone (riser) cable in non-plenum air spaces shall be NEC Type OFNR as follows:
 - 1. Corning FREEDM LST Gel-Free Cable
 - 2. Corning FREEDM Loose Tube, Gel-Free Cable
 - 3. Corning FREEDM One Riser Cable
 - 4. Corning MIC Riser Cable
 - 5. Corning MIC Unitized Riser Cable
 - 6. Corning Fan-Out Riser Cable
- J. Backbone (riser) cable in plenum air spaces shall be NEC Type OFNP as follows:
 - 1. Corning MIC Plenum Cable
 - 2. Corning MIC Unitized Plenum Cable
 - 3. Corning Fan-Out Plenum Cable
- I. Campus Backbone (Underground & Building Entrance) shall be of loose tube design with water blocking technology NEC OFNR as follows:
 - 1. Corning FREEDM LST Gel-Free Cable
 - 2. Corning FREEDM Loose Tube, Gel-Free Cable.
- J. Building entrance cables meeting the UL-1666 OFNR specification may enter a building without requiring a transition splice, i.e. Corning FREEDM LST Gel-Free or Corning FREEDM Loose Tube Gel-Free Cables.

2.3 Optical Fiber Connector

- A. All optical fiber cables shall be terminated with permanently installed in accordance with ANSI/TIA/EIA-568-C.3 and Fiber Optic Connector Intermateability Standard (FOCIS) document TIA/EIA-604 that corresponds to fiber connector type.
- B. Optical fiber connections shall utilize “LC” type connectors with ceramic ferrule and bend limiting strain relief.
- C. The maximum optical link loss for each rated connector pair shall not exceed 0.5 dB.
- D. Factory terminated lengths of optical fiber with “LC” connectors shall not be used for backbone or horizontal cabling. Field termination of “LC” connectors using fusion splice on connectors with “LC” connectors shall be acceptable.
 - 1. Reference: FL2-LC-900-OM4-6 or (-25), FL2-LCU-900-SM-6 or (-25)
- E. Connectors shall be color coded according to the optical fiber type for which they are applied. 8.3/125µm single mode shall be blue, and laser-optimized 50/125µm multimode shall be aqua.

2.4 Innerduct

- A. Innerduct shall be riser or plenum rated, as required for the environment in which it is placed.
- B. Innerduct shall be flexible, corrugated, and non-metallic.
- C. Innerduct shall be 1-1/4" diameter.
- D. Innerduct shall NOT be required where optical fiber cabling construction employs jacketed interlocking armor.

PART 3 EXECUTION

3.1 Installation

- A. The Contractor shall use common vertical sleeve(s) for routing of all optical inter-building backbone/riser cables. Cables shall be supported vertically within the MER spaces using wall mounted ladder rack and Hubbell Kellems Cable Support Grips, Reference: Sized by cable diameter. Contractors shall be required to coordinate riser sleeve usage with NCH-CNS project manager prior to populating the sleeves with cabling.
- B. All optical fiber cabling shall be installed within interlocking armor, 1-1/4" inner duct, or conduit. Innerduct shall be riser or plenum rated as required for the environment into which it is placed. Innerduct shall be tagged as, "Optical Fiber Cabling" at regular 20 ft. intervals. Pull points for innerduct and conduit solutions shall be required. Size and install pull points in accordance with TIA-569 and BICSI TDMM.
- C. The Contractor shall secure all optical intra-building backbone cables to the MER walls to prevent movement of the cable. D-rings shall be acceptable for this purpose. The Contractor shall secure the cables to the Ladder rack to prevent movement of the cable. The Contractor shall use the horizontal Ladder Rack above each of the Open Frame Rack(s).
- D. Within the MER, the Contractor shall furnish a ten (10) foot service loop suspended from the Ladder Rack above the Open Frame Rack(s).
- E. All Intrabuilding cabling shall be continuous and without splices of any kind.
- F. Splicing shall be allowed for Interbuilding cabling under the following conditions. All splices shall be fusion method.
 - 1. Where the length of the installed segment exceeds the maximum quantity allowed on a single reel.
 - 2. Where cable construction requires a transition due to conversion from OSP to ISP.
 - 3. Where specifically indicated within Project Drawings for purposes of dividing interbuilding entrance cable counts for distribution to primary and secondary MCs.
- A. Bond and ground all interlocking armor at each end of the cable to the TGB or TMGB.
- B. Cabling shall be arranged on the distribution panels in sequential numerical order by individual element according to optical fiber color code.
- C. Optical Fiber Backbone Cabling shall be terminated as follows.
 - 1. Optical Fiber Distribution Panels shall be rack mount enclosures with front and rear removable doors, removable top, large front-mounted fiber guides, and integrated hinged optical jumper manager.
 - 2. Each panel shall include a full complement of blank adapter panels, labels, cable storage accessories, and optical fiber cable routing accessory kit.

3. Optical Fiber Distribution Panels shall include duplex “LC” style coupler panels and connectors as required for the complement of optical fiber elements indicated on project drawings.
4. Connector Panels shall be color coded according to the optical fiber type for which they are applied. 8.3/125µm single mode shall be blue, and laser-optimized 50/125µm multimode shall be aqua.

J. A minimum 15 ft. of stored cable slack shall be provided at each TR.

3.2 Cable Termination Scheme

A. MER Fiber LIU Layout

1. MER Fiber layout is dependent on the number of TR’s. NCH-CNS shall provide a fiber termination layout to the Division 27 contractor for TR, MER, and MC fibers.

B. TR Fiber LIU Layout

1. Multimode fiber from TR to MER shall be installed on the left half of the LIU beginning in slot “A” and ending no farther than slot “F” in a 4U LIU.
2. Single Mode Fiber from the TR to MER shall be installed on the right half of the LIU beginning in slot “G” and ending in slot “L” in a 4U LIU.
3. Confirm fiber termination scheme with NCH-CNS prior to installation and termination.

3.3 Certification Testing

- A. All optical fiber elements/strands shall be 100% tested and documented as per procedures contained herein. All fiber elements/strands shall be useable.
- B. All single mode and laser optimized 50um multimode fiber links shall not exceed published maximum allowable channel insertion loss limits for 10GBASE-SR for multimode and 10GBASE-LR for single mode protocols regardless of connector and cable loss budget calculations. Loss limits shall be reduced to include deductions for required patch cables.
- C. Fiber end faces shall be inspected at 250X or 400X magnification. 250X magnification is suitable for inspecting multimode and single mode fibers. 400X magnification may be used for detailed examination of single mode fibers. Scratched, pitted or dirty connectors shall be diagnosed and corrected. It is preferable that the end face images be recorded in the memory of the test instrument for subsequent uploading to a PC and reporting.
- D. All Field-test instruments shall have the latest software and firmware installed. Calibration of the testing instruments shall be current as per manufacturer’s specifications. Test cords, adapters, and connectors shall be clean and maintained in good order. Test instruments shall be identified on the test summary forms as to make, model, software generic, and calibration date.
- E. The contractor shall perform a Tier 1 (attenuation, length, and polarity) certification test for each Intrabuilding optical fiber element/strand.
- F. The contractor shall also perform a Tier 2 (OTDR) certification test for each inter-building optical fiber element/strand.
- G. Multimode backbone links shall be tested at 850nm and 1300nm wavelengths in accordance with ANSI/EIA/TIA- 526-14A, Method B, One Reference Jumper, or the equivalent method.

- H. Single mode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper, or the equivalent method.
- I. Optical fiber splicing losses shall not exceed the following.
 - 1. Fusion splices shall not exceed 0.15dB loss.
- J. The length of each fiber shall be recorded. The detailed test results documentation data is to be provided in an electronic database for each tested optical fiber and shall contain the following information at minimum.
 - 1. The identification of the customer site as specified by the end-user
 - 2. The name of the test limit selected to execute the stored test results
 - 3. The name of the personnel performing the test
 - 4. The date and time the test results were saved in the memory of the tester
 - 5. The manufacturer, model and serial number of the field-test instrument
 - 6. The version of the test software and the version of the test limit database held within the test instrument
 - 7. The fiber identification number
 - 8. The length for each optical fiber
 - 9. Optionally the index of refraction used for length calculation when using a length capable OLTS
 - 10. Test results to include OLTS attenuation link and channel measurements at the appropriate wavelength(s) and the margin (difference between the measured attenuation and the test limit value).
 - 11. Test results to include OTDR link and channel traces and event tables at the appropriate wavelength(s).
 - 12. The length for each optical fiber as calculated by the OTDR.
 - 13. The overall Pass/Fail evaluation of the link-under-test for OLTS and OTDR measurements
 - 14. Note requirements for Tier 1 and Tier 2 test results and provide standards complaint results for all.
 - 15. OLTS results shall be provided as pdf summary sheets and as individual full scans. Summary sheet shall show actual loss results not budget margins.
 - 16. OTDR trace results shall plainly identify where terminal end faces are in the result, what launch cables were used and if they are included in the trace and what the event limits were included in each result. Event limits to be set low enough to identify any deviation from max allowable event.
 - 17. Note requirements for 10GBASE_SR and spliced DAS fiber to be NMT 2.9dB as applicable. **Provide a pass-fail test format using 10GBASE-SR or 2.9dB as the pass/fail criteria.** Test results that require an interpretation are not acceptable.
 - a. Do not submit failed test results.

3.4 Intrabuilding (Riser) Backbone Cables

- A. The Division 27 Contractor shall perform Tier 1 bi-directional attenuation testing on each optical fiber element/strand at both wavelengths.
 - 1. Multimode: 850 and 1300nm.

2. Single Mode: 1310 and 1550nm.
3. An attenuation equation shall be used to determine acceptance values based on standard component requirements at each applicable wavelength.

B. The Contractor shall correct all optical fiber elements/strands exceeding the end-to-end insertion loss allowance limits.

3.5 Interbuilding (Campus Underground & Building Entrance) Backbone Cables

A. The Division 27 Contractor shall perform Tier 1 bi-directional attenuation testing on each optical fiber element/strand at both wavelengths.

1. Multimode: 850 and 1300nm.
2. Single Mode: 1310 and 1550nm.
3. An attenuation equation shall be used to determine acceptance values based on standard component requirements at each applicable wavelength.

B. The Contractor shall perform Tier 2 bi-directional OTDR testing on each optical fiber element/strand at both wavelengths for building backbone cable greater than 300 feet in length.

1. Multimode: 850 and 1300nm.
2. Single Mode: 1310 and 1550nm.

C. At the completion of Tier 1 and Tier 2 testing, the Contractor shall review the test data to ensure that each element/strand's end-to-end loss does not exceed the maximum attenuation allowance value and shall correct all optical fiber elements/strands exceeding the end-to-end insertion loss allowance limits.

3.6 Labeling

A. The labeling scheme for the Optical Fiber Cabling system shall consist of the following components:

1. Cable Origin by MC/MER identifier
2. Cable Destination by MER/TR identifier
3. Cable Type:
 - a. "MF" = 62.5um multimode fiber
 - b. "LF" = Laser optimized multimode fiber
 - c. "SF" = single mode fiber

4. Element number

B. The resulting exterior cable jacket label would be "T01/A11-SF-001/048" for a 48 element single mode fiber cable from MC T01 to MER A11 in A Building.

C. The resulting fiber LIU label would be "T01/A11-SF-001/002" for elements 1 & 2 in a single mode fiber cable from MC T01 to MER A11 in A Building.

3.7 Firestopping

A. Refer to Section 27.05.00 – Common Work Results For Communications

27.15.13 – Communications Copper Horizontal Cabling:

PART 1 GENERAL

1.1 System Description

- A. Each floor of a building shall be served by a distinct Horizontal System, unless otherwise directed by NCH- CNS.
- B. Communications Copper Horizontal Cabling shall be sourced from, and certified by, only one of the following approved manufacturers per project.
 - 1. The Siemon Company (CAT6 Only)
 - 2. Systimax (CAT6A Only)

PART 2 PRODUCTS

2.1 Approved Manufacturers

A. Category 6 Solution

- 1. The Siemon Company, including all “Cable Allies” of The Siemon Company

B. Category 6A UTP Solution

- 1. Systimax, 360 GigaSPEED X10D 91 Series UTP cable

2.2 Copper Horizontal Cabling

A. Category 6 Solution

- 1. Horizontal cabling shall be performance rated EIA/TIA Category 6, at minimum. All cables shall be imprinted by the manufacturer as Category 6, at minimum.
- 2. Horizontal cable selection shall be from the approved Siemon “Cable Allies” as listed within this specification, thus permitting the Section 27 15 00 Contractor to issue a Siemon “System 6” Warranty.
- 3. Horizontal system cables shall CMR or CMP rated as required for the environment for which they are to be installed. These markings shall also include the name of the cable manufacturer and the category performance rating.
- 4. Cable jacket shall be sequentially marked at 2-foot intervals.
- 5. Horizontal cabling color shall be white in color.

B. Category 6A UTP Solution

- 1. Horizontal cabling shall be performance rated EIA/TIA Category 6A, at minimum. All cables shall be imprinted by the manufacturer as Category 6A, at minimum.
- 2. Horizontal cable selection shall be from the approved Systimax X10D listed cables as listed within this specification, thus permitting the Section 27 15 00 Contractor to issue a Systimax X10D 20-year extended product warranty and applications assurance. Horizontal system cables shall CMR or CMP rated as required for the environment for which they are to be installed. These markings shall also include the name of the cable manufacturer and the category performance rating.
- 3. Cable jacket shall be sequentially marked at 2-foot intervals.
- 4. Horizontal cabling color shall be white in color.

- C. Cat6 shall be acceptable for all Outside Plant or wet location installations and shall be recognized for use in the horizontal cabling extended warranty solution. Cables shall be listed for use in the intended environment, Horizontal OSP cable shall be flooded construction with a black UV resistant jacket and foil shield listed for aerial and/or direct burial applications.

PART 3 EXECUTION

3.1 Installation

- A. Horizontal copper cabling runs shall be placed in one continuous end-to-end length between the MER or TR and the TO, without splices of any kind.
- B. Cabling shall be arranged on the patch panels in sequential numerical order by cable number.
- C. Cabling shall be arranged on the termination blocks in sequential numerical order by cable pair.
- D. Provide a minimum of 15 ft. service loop in the station cable at the TO located above removable ceiling access spaces.
- E. WAP's
 - 1. Unless otherwise specified, a twenty-five (25) foot service loop per homerun of horizontal copper cabling shall be placed at each WAP (Wireless Access Point) located above removable access ceiling spaces.
 - 2. Unless otherwise specified, each WAP shall have 2 horizontal copper cables.

3.2 Cable Termination Scheme

- A. All balanced twisted pair cables, wired to the Telecommunications Outlet, shall have 4-pairs terminated in 8-position modular connectors. All pairs shall be terminated. Category 6 and 6A cabling shall be terminated according to EIA/TIA T568B pin-pair configuration as shown below in Figure 3:

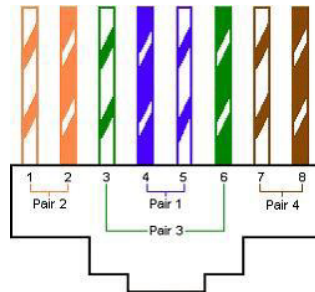


Figure 3 – T568B

- B. In order to prevent disruption of the termination sequence, Patch Panels are terminated from left to right in increments of (4) 4-pair Category 6/6A horizontal runs. Single cable runs begin at the last Patch Panel in the series and work backward in reverse numerical order. Equipment rack locations are planned and designed so as to allow expansion space in the “middle”. Figure 4 depicts the termination scheme.

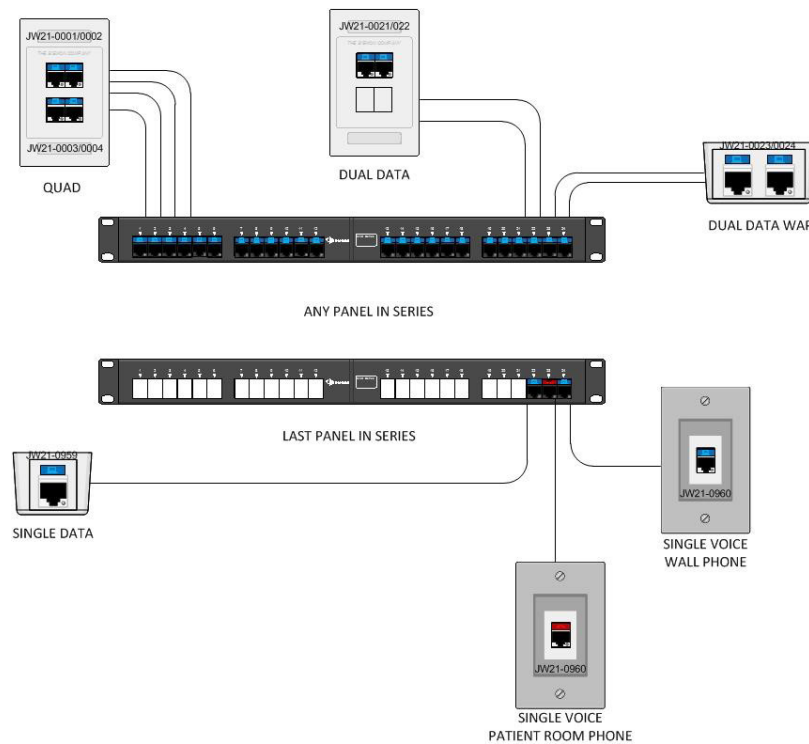


Figure 4 - MER/TR Cable Termination Scheme

- C. To sustain structured and manageable growth in the MER or TR, the following typical requirements shall be in place for all aspects of structured cabling. Confirm all details of rack elevations with NCH-CNS during design and prior to installation.
- D. One 2RU horizontal manager shall be installed at the top of the rack(s) for inter-rack cable routing.
- E. Copper backbone and copper horizontal cabling shall be terminated beginning in the leftmost rack and continuing to the rightmost rack (viewed from the front of the rack).
- F. Labeling for both backbone copper and horizontal copper shall begin in the leftmost rack and conclude in the rightmost rack (viewed from the front of the rack).
- G. All aspects of the structured cabling system shall comprise no more than the top 50% of the rack units available.
- H. The bottom 50% of the rack units shall be reserved for NCH-CNS network electronics and rack mount special systems.
- I. Figure 5 illustrates Typical Multi Rack TR Elevations.

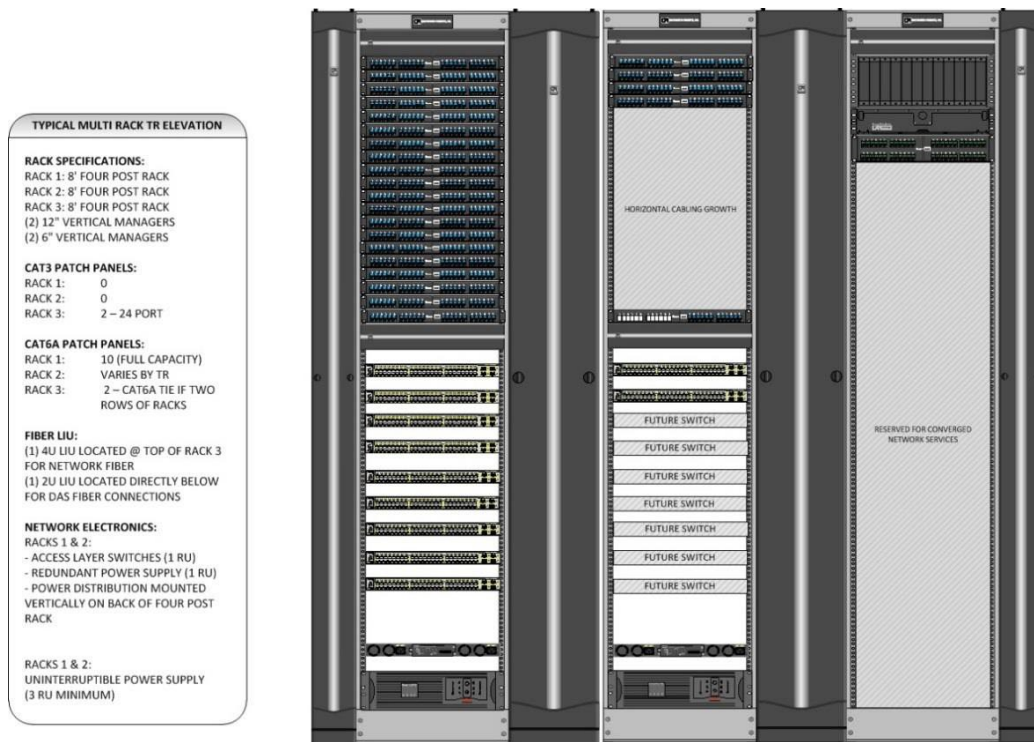


Figure 5 - Typical Multi Rack TR Elevation

J. Single Rack TR elevations will be developed on a project specific basis to account for all required systems.

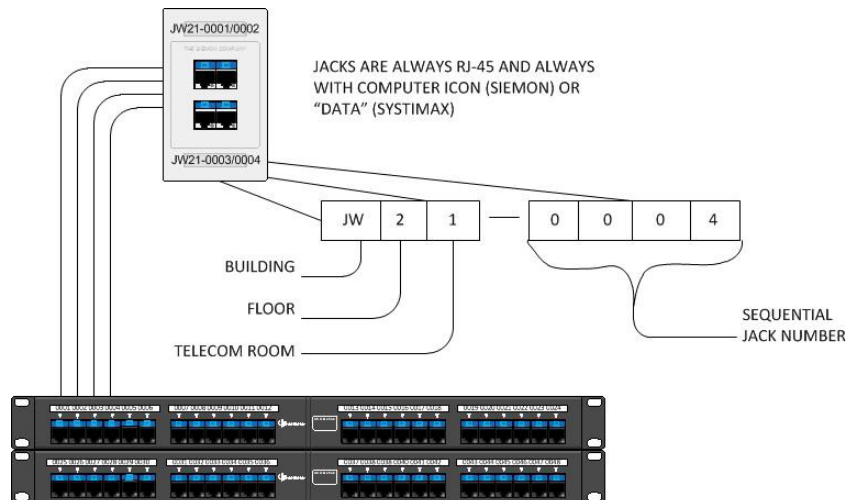
3.3 Certification Testing

- A. All copper certification testing shall be performed using test equipment and procedures supported by the manufacturer's warranty program.
- B. Full testing shall be performed on each Category 6 or Category 6A permanent link (Patch Panel to Patch Panel and Patch Panel to Telecommunications Outlet) by trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof. The test of each link shall include all the parameters as detailed below. To pass, the test measurements must all meet or exceed the limit value determined in the TIA/EIA Category 6 or Category 6A Standard. Perform and record the following tests and prepare full reports for inclusion in O&M Manuals.
 1. Wire Map (Continuity)
 2. Length
 3. Insertion Loss (Attenuation)
 4. NEXT Loss
 5. PSNEXT Loss
 6. ELFEXT Loss, Pair-to-Pair.
 7. PSELFEXT Loss
 8. Return Loss
 9. ACR (Attenuation to Crosstalk Ratio)
 10. PSACR
 11. Propagation Delay
 12. Delay Skew

- C. All new cable pairs shall be 100% tested and passed by the criteria as established herein.
- D. Horizontal cabling shall be PSNEXT tested such that any disturbed pair within the hybrid/bundle shall be 3dB better than the specified pair-to-pair NEXT of a single 4-pair cable of the same category.
- E. Alien cross talk testing shall be performed to NLT 1% of the CAT 6A links deemed most likely to fail at each TR.
- F. Testing shall be performed only after faceplates and outlets have been fixed in final position. Under no circumstances shall testing be performed while outlets are hanging loose, prior to being permanently “settled” into their back box or surface box.
- G. Any cable or component not satisfactorily passing the tests as described or failing to meet quality installation standards as described in this specification, shall be repaired and/or replaced at the Contractor's expense.

3.4 Labeling

- A. Wire and cable identification shall consist of self-laminating, permanently applied, machine-printed wrap-around markers. Marker shall be located within 3 to 6 inches of the termination. Labels must withstand the requirements of UL 969 as outlined in the EIA/TIA Standard.
- B. The labeling scheme for the Horizontal System shall consist of a seven-character or eight-character sequence for each port at the Telecommunications Outlet. The first three or four alpha-numeric characters, followed by a dash, designate the MER (Main Equipment Room) or TR (Telecommunications Room) from which the cabling originates. The last four numeric characters shall be assigned as a unique cable number, assigned to each patch panel port. Figure 6 depicts the cabling labeling scheme. Confirm all details of cable labeling with NCH-CNS during design and prior to installation.
- C. The labeling scheme for the Horizontal System shall consist of a 4-character numeric only sequence in the TR or MER. The four-character numeric sequence shall match the last four characters of the TO outlet and the minimum font size shall be 14 points. Confirm all details of cable labeling with NCH-CNS during design and prior to installation.



THIS IS THE FIRST PATCH PANEL IN TR "JW21" ON THE SECOND FLOOR OF J WEST

Figure 6 – Telecommunications Outlet Labeling Scheme

3.5 Firestopping

27.15.33 – Communications Coaxial Horizontal Cabling:

PART 1 GENERAL

1.1 System Description

- A. This section describes horizontal "drop" cabling for 75Ω Broadband CATV systems only. Horizontal coaxial cabling for systems other than CATV may be covered under separate subsection.
- B. Each floor of a building shall be served by a distinct Horizontal System, unless otherwise directed by the NCH-CNS. CATV coaxial "drop" cable shall originate from a coordinated wall space within each TR or MER.
- C. Communications Coaxial Horizontal Cabling shall be sourced from, and certified by, only one of the following approved manufacturers per project.

1. CommScope

1.2 AE Designer Requirements

- A. AE designer shall coordinate all CATV cabled locations with NCH-CNS and NCH project manager and show all locations on the Division 27 floor plans and cable termination logical drawings. CATV horizontal cabling shall be coordinated with other low voltage systems and be included in the basket tray sizing study. AE designer shall design all device boxes, surface raceway systems, surface boxes and other pathways to provide support for minimum bend radius and fill capacities of terminated and installed CATV cables. AE designer shall coordinate the required wall spaces and power requirements within the MER and TRs with NCH-CNS, NCH-PM, and NCH CATV service provider. Show all scaled MER/ TR elevations in project drawings with required support services. Show coordinated services on corresponding sheets including but limited to the electrical power plans. Coordinate and maintain minimum clearances to all access panels for adjacent systems equipment. Coordinate new and existing, intrabuilding and interbuilding CATV pathways with NCH project manager, NCH-CNS, and NCH CATV service provider. Show all new and existing pathway details including conduit sizes and quantities, duct banks, manholes, required UL listed firestop system locations, cable tray and open pathways on project site plan sheets and floor plan sheets. Provide construction administration and change support throughout the project.

PART 2 PRODUCTS

2.1 Approved Manufacturers

- A. CATVR (non-plenum rated spaces)
 - 1. RG6 quadshield CATVR rated coaxial cable as follows:
 - a. CommScope #F6SSVVR
- B. CATVP (plenum rated spaces)
 - 1. RG6 quadshield CATVP rated coaxial cable as follows:
 - a. CommScope #2227V WHRL RG6 QD 1000

C. CATV (wet rated spaces per 2011 NEC)

1. RG6 quadshield CATV wet rated, flooded coaxial cable as follows:

a. CommScope #F6SSVV APD

2.2 Coaxial Horizontal CATV Cabling

A. CATV Coaxial Solution

1. Horizontal CATV coaxial "drop" cabling shall be listed CATV. All cables shall be 60% inner and 40% outer quad shield construction with either copper-clad steel or solid copper 18-AWG center conductor and sweep tested to 1000MHz. All CATV coaxial cable shall be listed CATVR for non-plenum spaces and CATVP for plenum spaces. All CATV cables placed in locations identified as "wet" or "damp" by the 2011 NEC shall be flooded and listed for use in wet or outdoor locations. Coordinate compliant pathways for wet location cables to their respective TR such that the wet location cable is not required by code to splice to a higher fire rated cable type before it reaches the TR termination point.
2. All CATV coaxial drop cable shall be terminated with 360-degree compression connectors. No hex crimp, twist-on connectors shall be approved. All connectors shall be specifically listed for use with the installed cable part number by the connector manufacturer and/ or the cable manufacturer. All coaxial connectors for flooded outdoor CATV cable shall be listed for use wet locations in addition to the previous requirements.
3. Provide cable guide hardware at the TR/ MER to neatly bundle and maintain cable bend radius and tensions within cable manufacturer's recommended limits.
4. Horizontal CATVR drop cabling color shall be black in color.
5. Horizontal CATVP drop cabling color shall be white in color.
6. Horizontal CATV wet location drop cable shall be black in color.

PART 3 EXECUTION

3.1 Installation

- A. Horizontal CATV coaxial "drop" cabling runs shall be placed in one continuous end-to-end length between the MER or TR and the TO, without splices of any kind. CATV coaxial cables shall be home run to a TR/ MER on the same floor as the work area termination.
- B. CATV cable termination location at the TR/ MER shall be coordinated with Time Warner or other owner directed service provider. Standard CATV drop cable termination practice at the time of this revision is to wall mounted multi-port taps to be furnished and installed by Time Warner. The Division 27 contractor shall terminate the CATV coaxial drop cables in sequential numerical order by cable number. Time Warner or owner assigned service provider shall attach the terminated CATV drop cables to the termination hardware as required.
- C. Wall mounted cable guide hardware shall be rounded stock D-rings filled to no more than 40% by cable cross-sectional area. Secure D-rings to plywood backboards in the coordinated wall space provided to maintain cable manufacturer's recommended bend radius limits. Coordinate termination scheme with NCH- CNS and CATV service provider prior to installation of pathways and cables.

- D. Provide a minimum of 5 ft. service loop in the station cable at the TO located above removable ceiling access spaces up to a maximum terminated link distance of 295 feet.

3.2 Certification Testing

- A. All CATV coaxial certification testing shall be performed using test equipment and procedures supported by the manufacturer's warranty program.
- B. Full testing shall be performed on each coaxial CATV terminated link (TR/ MER to Telecommunications Outlet) by trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof. The test of each link shall include all the parameters as follows for RG6 75Ω Coax: Impedance, Length, Propagation Delay, Insertion Loss and HDTDR all tests shall be performed to 900MHz. Perform and record the following tests and prepare printed summary and full cable certification per cable in test equipment native electronic format on CD/ DVD with licensed reader software. Include both formats in O&M Manuals.
- C. All new cables shall be 100% tested and passed by the criteria as established herein.
- D. Testing shall be performed only after work area faceplates and outlets have been fixed in final position and final closet terminations are complete. Under no circumstances shall testing be performed while work area outlets are hanging loose.
- E. Any cable or component not satisfactorily passing the tests as described or failing to meet quality installation standards as described in this specification, shall be repaired and/or replaced at the Contractor's expense.

3.3 Labeling

- A. Wire and cable identification shall consist of self-adhesive, self-laminating, permanently applied, machine- printed wrap-around markers. Printed marker area shall be no less than 1-1/4" wide and located within 3 to 6 inches of each cable termination. Labels must withstand the requirements of UL 969 as outlined in the EIA/TIA Standard. Provide separate cable length label adjacent to cable identifier label. Cable length label shall conform to the same criteria as the cable identification label but shall include only the cable length in feet from termination to termination.
- B. The labeling scheme for the Horizontal System shall consist of a seven-character or eight-character sequence for each port. The first three or four alpha-numeric characters, followed by a dash, designate the MER (Main Equipment Room) or TR (Telecommunications Room) from which the cabling originates. The last four numeric characters shall be assigned as a unique sequential cable number starting at 0001. Confirm all details of cable labeling with NCH-CNS during design and prior to installation.

3.4 Firestopping

- A. Refer to Section 27 05 00 – Common Work Results For Communications

27.15.43 – Communications Faceplates and Connectors:

PART 2 PRODUCTS

2.1 Approved Manufacturers

- A. The Siemon Company

B. Systimax

2.2 Faceplates

- A. Furnish and install modular cover plates with four (4) modular outlet openings for NCH standard “Quad Voice/Data” configurations as well as exceptions for “Dual Data”, “Single Data”, and “Voice Only” styles as indicated on project drawings.
- B. Blanks shall be furnished and installed for all un-used modular openings.
- C. Cover plates shall be mounted on single gang plaster ring or modular mounting frames as required in surface wire mold.
- D. Modular cover plates shall match Div. 26 faceplate type – plastic or stainless steel unless otherwise directed by NCH - CNS. Modular furniture cover plates shall match the furniture’s kick plate color when possible.
- E. Reference Category 6: #MX-FP-S-04-80 (PVC) or MX-FP-S-04-SS-L (Stainless Steel).
- F. Reference CAT6A UTP: Systimax #M14L-262 (PVC) or M14SP-L (Stainless Steel).

1. MODULAR CONNECTORS (JACKS/OUTLETS)

- G. Furnish and install Modular Connectors consisting of RJ45 8-position modular jacks, meeting, or exceeding transmission performance of Category 6A.
- H. Modular Connectors shall be mounted in modular cover plates. For Cat6 & 6A installations all modules shall be flat.
- I. CATV cables shall terminate to faceplates using performance matched modular 75-Ω compression F- connectors attached to the rear of F-Coupler/ collar inserts. F-coupler insert collars shall match the faceplate manufacturer and color. Coordinate termination port position with NCH-CNS for each work area type prior to installation.
- J. Modular Connectors shall be UL listed and comply with EIA/TIA 568B.
- K. Modular Jack Use Identification Colors
 - 1. Modular jacks shall be identified with blue “PC” or “DATA” icons, unless otherwise directed by NCH - CNS. Modular jacks/outlets shall match the furniture’s kick plate color when possible.
 - 2. Modular jacks for patient room phones what be identified with red “PHONE” or “VOICE” icons, unless otherwise directed by NCH – CNS personnel.
 - 3. Modular jacks/outlets for Physiological Monitoring shall be identified with orange icons. These special locations shall be identified to the Contractor by NCH - CNS personnel.
 - 4. Modular jacks/outlets for Nurse Call shall be identified with violet icons. These special locations shall be identified to the Contractor by NCH - CNS personnel.
- L. Apply Blank Inserts to all un-used openings.
- M. Modular Jack Reference
 - 1. Reference Category 6: The Siemon Company #MX6-FX80 at WA, #MX6-FX01 at Patch Panels.
 - 2. Reference Category 6A UTP: Systimax #MGS600-262 at WA, #MGS600-003 at Patch Panels.
- N. Modular Icon Reference
 - 1. Reference Category 6: The Siemon Company #CT-ICON-07, #CT-ICON-09, #CT-ICON-02

2. Reference Category 6A UTP: Systimax # M61K-318, M61K-317, M61K-003, M61K-361

2.3 Modular Jack/Outlet Plate for Wall Telephones

- A. Flush mounted modular RJ-45 jack/plate to fit into a single gang 3-1/2-inch-deep box.
- B. RJ-45 modular jack shall be 8-position and shall meet at minimum the transmission performance requirements of Category 6A.
- C. The RJ-45 jack shall be mounted in a stainless-steel faceplate designed for the modular mounting of wall telephones.
- D. Reference Category 6: The Siemon Company #MX-WP-K6-SS
- E. Reference Category 6A UTP: Systimax M10LW4SP

2.4 Surface Mount Boxes

- A. Furnish and install surface mount box for full-size faceplates where Telecommunications Outlets are to be mounted in modular furniture. Boxes shall match color of faceplates installed.
- B. Furnish and install dual port surface mount box where Telecommunications Outlets are to be provided for Wireless Access Point locations.
- C. Furnish and install single port surface mount box where Telecommunications Outlets are to be provided for IP-based Camera locations.
- D. Reference: The Siemon Company # MX-SM1, MX-SM2
- E. Reference: Systimax # M202 PLENUMSMB-262, M202SMB-215

PART 3 EXECUTION

- 3.1 All Faceplates shall be labeled using machine generated type in alphanumeric order according to the NCH labeling scheme to be published by bulletin prior to installation. Bulletin shall not result in additional cost to the project under any circumstances.

27.16.19 – Communications Patch Cords, Station Cords and Cross Connect Wires:

PART 2 PRODUCTS

2.1 Approved Manufacturers

- A. Corning Cable Systems
- B. The Siemon Company
- C. Systimax

2.2 Optical Fiber Jumper Cables

- A. Duplex optical fiber jumper assemblies with 'LC' style connectors for multimode applications.
 - 1. Provide unit pricing for the following patch cable lengths to be used when final patch cable quantities and lengths are ordered. Do not order patch cables until a written agreement is reached with the NCH- CNS representative and recorded by the Construction Manager.
 - 2. Provide 100% of all optical jumper cables required for data network patching at the MER (Main Equipment Room) and TR (Telecommunications Room). Bid a budgetary

- quantity of cables based upon one (1) per group of twenty-four port coupler panel(s) as indicated on project drawings. Budget cables to be 3 meters.
3. Optical fiber jumper cables shall be duplex LC-LC, laser-optimized 50µm core diameter/125µm cladding diameter, 1.6mm jacketed, tested to support network transmission speeds up to 10Gb/s for up to 300m with a 850nm source and shall meet all TIA/EIA-568-B.3 requirements.
 4. Insertion loss per connection: 0.10dB typical; 0.30dB maximum. Factory terminated and 100% tested for insertion loss.
 5. All 50um patch cables shall be aqua in color.
 6. Reference: Corning Cable Systems LANscape #050502T5116003M Duplex LC to Duplex LC, OM3 (3 meters). No equal shall be accepted.

B. Optical fiber jumper assemblies for single mode applications.

1. Optical jumper cables for single mode applications will be specified on a case-by-case basis in accordance with the technology systems for which they are intended, i.e. campus data network backbone tie-ins, patient entertainment systems, CATV distribution, etc. This Contractor may be requested to include these items later by change order to the base contract as requirements are determined by NCH – CNS.
2. All single mode patch cables shall be yellow in color.
3. Reference: Corning Cable Systems LANscape #040402R5116003M (3 Meters). No equal shall be accepted.

2.3 Copper Patch/Station Cords – MER/TR

A. Category 6 copper patch cords with RJ45 plugs.

1. Provide unit pricing for the following patch cable lengths to be used when final patch cable quantities and lengths are ordered. Do not order patch cables until a written agreement is reached with the NCH- CNS representative and recorded by the Construction Manager.
2. Provide 100% of total drop count Category 6 patch cords required for patching at TR (Telecommunications Room) and MER (Main Equipment Room). Bid a budgetary length of 7' as needed to evenly dress rack design shown in project drawings. Refer to PART 3 EXECUTION for typical patch flow example.
3. Provide 75% of total drop count Category 6 patch cords for each modular cover plate at user end. Each patch cord shall be used for connecting to workstations and shall be 10' in length.
4. Patch cords for data shall be white w/ clear boots.

B. Category 6A, copper patch cords with RJ45 plugs.

1. Provide unit pricing for the following patch cable lengths to be used when final patch cable quantities and lengths are ordered. Do not order patch cables until a written agreement is reached with the NCH- CNS representative and recorded by the Construction Manager.
2. Provide 100% of total drop count Category 6A patch cords required for patching at TR (Telecommunications Room) and MER (Main Equipment Room). Budget length mix

according to 5' & 7' as needed to evenly dress rack design shown in project drawings.
Refer to PART 3 EXECUTION for typical patch flow example.

3. Provide 75% of total drop count Category 6A patch cords for each modular cover plate at user end. Each patch cord shall be used for connecting to workstations and shall be 10' in length. Where sit/stand workstations are installed patch cord length shall be 15' in length.
4. Patch cords for CAT6A systems shall be white.
- C. Patch cords shall match the warranted Category 6 or Category 6A permanent link solution installed.
- D. Patch cords shall be factory terminated and tested.
- E. Patch cords shall not degrade the required channel performance characteristics as specified in ANSI/TIA 568 – Most Recent Edition.
- F. Copper patch cords shall be supplied as a part of the manufacturer-certified cabling system.
- G. Reference Category 6A UTP: Systimax X10D 360
 1. Patch Cables - White
 - a. 3' CPC7732-08F003
 - b. 5' CPC7732-08F005
 - c. 7' CPC7732-08F007
 - d. 10' CPC7732-08F010
- H. Reference Category 6: The Siemon Company
 1. Patch Cables - White
 - a. 3' MC608-T-03-02
 - b. 5' MC608-T-05-02
 - c. 7' MC608-T-07-02
 - d. 10' MC608-T-10-02

PART 3 EXECUTION

3.1 Typical Multi Rack TR Patch Flow Arrangement (Refer to project drawings for specific design detail).

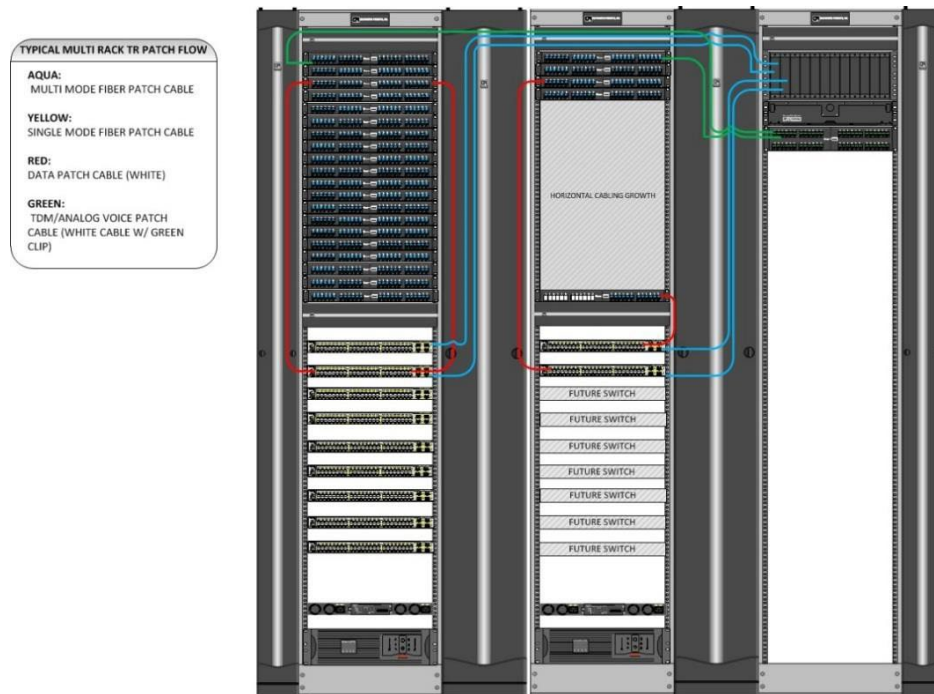


Figure 7 - Typical MER Patch Flow

3.2 Single Rack TR Patch Flow Arrangements will be developed on a project specific basis to account for all required systems.

27.20.00 – Data Communications:

PART 1 GENERAL

1.1 System Description

- A. Active electronic system components specified in this section are for design reference only and shall be provided to the Division 27 contractor for installation.

1.2 Wireless Access Points

- A. All Wireless Access Points (WAP) shall be removed and stored by a NCH CNS Engineer if they are not needed during a construction project.
- B. The NCH CNS Engineer shall determine the permanent location of the WAP.
- C. The IS PMO shall be responsible for coordinating any expenses with WAP relocation with the Engineering CM.

27.21.33 – Data Communications Wireless Access Points:

PART 1 GENERAL

1.1 System Description

- A. The Wireless Access Point (WAP) usually connects to a wired network and can relay data between the wireless devices (such as computers or printers) and wired devices on the network.
- B. Active electronic system components specified in this section are for design reference only and shall be provided to the Division 27 contractor for installation.
- C. The NCH CNS Engineer shall determine the permanent location of the WAP.
- D. The IS PMO shall be responsible for coordinating any expenses with WAP relocation with the Engineering CM.

1.2 Project Conditions

- A. Complete the CNS provided WAP Inventory worksheet and provide to CNS Engineer after all phases of project.
- B. Follow all NCH Epidemiology procedures.

PART 2 PRODUCTS

2.1 Approved Manufacturers

- A. Cisco Systems
- B. Ventev

2.2 Reference Part Numbers

- A. Wireless Access Points
 - 1. Cisco Systems 9100 series
- B. Wireless Enclosure
 - 1. Ventev 3900 Series
- E. Threaded rod attachment hardware for shelled and unfinished spaces

PART 3 EXECUTION

3.1 Installation

- A. Installation Requirements
 - 1. NCH-CNS shall provide final installation locations based on wireless survey results.
- B. Mounting the Wireless Access Point
 - 1. Prior to beginning work, confirm the WAP Serial Number on the CNS provided WAP Inventory worksheet.
 - 2. From the drawings and or picture determine the location in the ceiling where the WAP will be mounted.
 - 3. Follow all Epidemiology requirements before working or removing ceiling tiles.
- C. Connecting access point to network
 - 1. Connect one end of the CAT6A Ethernet cable to the 100/1000 Ethernet port on the WAP and connect the other to the CAT6A data jack in the ceiling.

- a. **Caution!** Be sure to connect the Ethernet cable to the Ethernet port; the cable can mistakenly be plugged into the Console port.

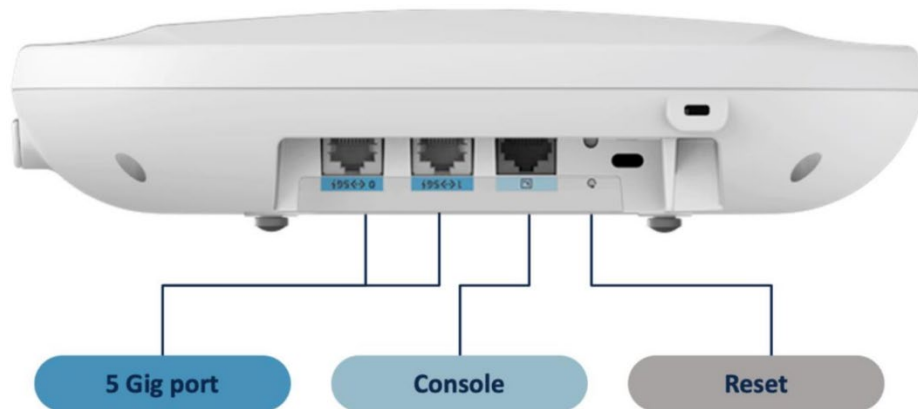


Figure 8 - WAP Rear View

2. Record the data jack number to the provided NCH-CNS WAP Inventory worksheet.
3. Report any damaged or broken tiles to NCH Engineering CM for repair/replacement.
4. Label ceiling tile grid with CNS specified WAP identifier.

3.2 Testing

- A. All testing shall be done by NCH-CNS.

27.32.23 – Elevator Telephones:

NCH specification document provided on a per project basis.

27.32.26 – Ring-Down Emergency Telephones:

NCH specification document provided on a per project basis.

27.51.26 – Public Address Systems:

PART 1 GENERAL

1.1 System Description

- A. This section describes the NCH standard overhead paging system.
- B. Typically, one location per building shall be located a main paging distribution point and interconnect to the hospital PBX. Buildings located in the main campus typically connect to the hospital PBX shall be by campus single mode optical fiber.
- C. The overhead paging system will normally locate in a MER/ TR space within a dedicated special system equipment rack. Multi-story buildings will normally require several equipment locations in coordinated special systems equipment racks located in coordinated TRs.
- D. The NCH standard overhead paging system is the BIAMP brand Vocia system.

1.2 AE Designer Requirements

- A. AE designer shall become conversant in all required paging system equipment nomenclature and functionality so that coordination meetings are correctly coordinated among effected trades and owners and that meeting minutes are accurately documented.
- B. AE designer shall coordinate all overhead paging requirements with the NCH project manager during Systems and Design Development stages. During these phases the AE designer will request that the NCH project manager provide all areas that require overhead paging and to provide disparate paging zones within those areas.
- C. Request and coordinate all integration with Fire alarm system, Nurse call system and other systems as required by hospital design guides and applicable building and safety codes.
- D. The AE designer will request available campus backbone optical fiber from NCH-Telecommunications where campus buildings are being added to the system.
- E. Coordinate required WAN link(s) with NCH-Telecommunications for connection where offsite facilities are included in the centralized overhead paging system.
- F. AE designer will design code compliant/ industry standard speaker mounting hardware details for all speaker locations. Provide uniform audio coverage and speech intelligibility at all areas in the designated coverage zones.
- G. AE designer will coordinate and provide necessary facilities and capacity in the project design for equipment rack spaces, effected TR spaces, electrical and UPS capacities, pathway capacities.
- H. Provide complete coordination with the current AV firm engaged to provide customer service contract for the overhead paging system to NCH to ensure compatible equipment and methods are used, that the system programming is consistent and that outages are planned and approved by NCH project manager
- I. Provide scaled MER/ TR elevations in project drawings with required support services. Show coordinated services on corresponding sheets including but limited to the electrical power plans. Coordinate and maintain minimum clearances to all access panels for adjacent systems equipment.
- J. Show all new and existing pathway details including conduit sizes and quantities, duct banks, manholes, required UL listed firestop system locations, cable tray and open pathways on project site plan sheets and floor plan sheets.
- K. Verify current manufacturer's part numbers and functionality. Provide construction administration and change support throughout the project.

PART 2 PRODUCTS

2.1 Approved Manufacturers

A. BIAMP Vocia system.

1. Amplifier:

- a. BIAMP_VA8600_modular_amp_chassis_w/_CobraNet_
- b. BIAMP_AM600_600W_amplifier_card_for_VA8600_

B. CobraNet Equipment as required at each TR special systems equipment rack for overhead paging. Include equipment at NCH PBX interface as required.

- 1. NETGEAR_FS728TP100NAS_24_port_POE_managed_switch or approved equal.
- 2. Cisco and Netgear compatible single mode optical fiber GBIC minimum (2)

3. UPS equipment and coordinated equipment rack distribution.
4. CobraNet IP cabling
 - a. All IP cabling shall terminate to modular patch panels assemblies that match manufacturer and part number of the Division 27 extended warranty program. Patch panel assemblies shall be provided certified and documented in compliance with Division 27 NCH-CNS design guidelines.
 - b. All IP cabling shall be at minimum Cat5e colored light blue to identify its use as CobraNet.

C. Network Paging input

1. BIAMP_#PARM (Page Active Relay Kit)
2. VOCIA network powered desk station #DS-10
3. VOCIA Input #VI-6
4. VOCIA Message Server #MS-1
5. VOCIA Text-to-Speech Server 1 #TTS-1 (optional)

D. Life Safety Input

1. VOCIA Control Interface #CI-1
2. VOCIA® Life Safety Interface #LSI-16

E. Nurse Call vent alarm and music source input

1. VOCIA Input #VI-6
2. Nexia “PM” DSP Presentation Mixer
3. Nurse Call input signal from Intego or legacy system.
4. Nurse call CAT computers (by NCH-CNS)
5. NCH provided music source

F. BIAMP Ambient Noise Suppression

1. Ambient_noise_sensing_mic_controller:_BIAMP_#ANC1_
2. Ambient Noise Sensing Microphones
 - a. Crown #PZM-11, (phantom powered)
3. When integrated ambient noise system is not warranted by project scope, standalone systems will be considered on as-needed basis

G. Suspended Ceiling Speakers. Include back cans, tile bridges and dedicated suspended supports

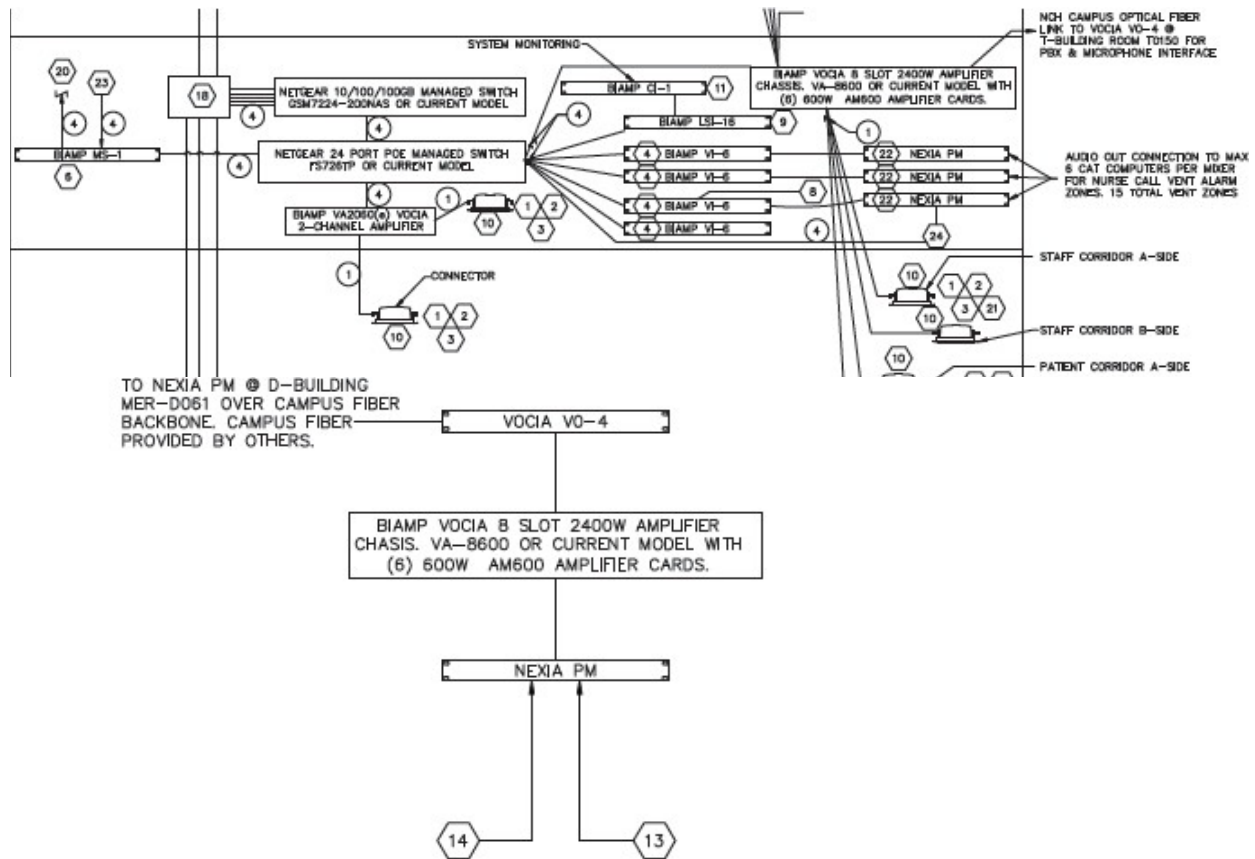
1. Atlas Sound FAP42TC (low profile)
2. QSC # AD-CI52ST (low profile damp locations)

PART 3 EXECUTION

3.1 Installation

- A. Engage NCH-Telecommunications approved AV customer support contractor in contract to review and advise on system design to ensure seamless integration with existing NCH system

- B. Installation of the overhead paging system shall be done in compliance with NCH approved system design, and in full compliance with life safety, hospital code requirements. Material mounting and testing shall follow industry standards and equipment manufacturer best practices.
- C. All IP cabling and network equipment shall comply with Division 27 codes and standards and be approved by NCH-CNS and NCH-Telecommunications.
- D. All CobraNet IP network installed equipment and cabling shall be parallel to the hospital IP network. All IP cabling for CobraNet shall be minimum Cat5e and shall be color coded light blue to distinguish its intended purpose.
- E. Comply with all Division 27 requirements for pathway supports, grounding and bonding, firestop, labeling, documentation, cable certification, submittals, and as-built documentation.
- F. Coordinate all connections to the hospital IP network with NCH-Telecommunications during design phase. ALL connections must be approved during the design phase. Coordinate and schedule all connections to hospital IP network with NCH-Telecommunications prior to installation.
- G. Provide minimum 1-year comprehensive labor and material warranty from date of substantial completion.
- H. See connectivity diagram below for installed system example: All possible installation scenarios may not be included in the diagram:



PAGING SCHEMATIC @ T-BUILDING HEADEND

PART 1 GENERAL

1.1 System Description

- A. This section describes Nurse Call/ Code Blue audiovisual and voice communications systems.
- B. Installed systems shall comply with all applicable codes, standards, and hospital regulatory requirements.
- C. All devices within in a defined floor space are assigned to a GCAT (Graphical Call Answer Terminal) located at an On-stage/ nurse station coordinated to selectively monitor all devices in the assigned area.
- D. All addressable devices, GCAT assemblies and system server shall be wired to the CCA (Central Control Assembly.) The CCA shall provide interconnectivity and functional testing for all attached Nurse Call devices and typically mount in a special systems equipment rack.
 - 1. Coordinate required space and Emergency/ UPS power at associated special systems equipment rack, normally located inside a TR (Telecommunications Room).
- E. NCH IP network, PBX and Overhead Paging system, Patient room television and colorized LED headwall lighting shall be fully integrated with the Nurse Call system.
- F. Provide Nurse call stations as required per application to supply full duplex communications, staff emergency and code blue services:
 - 1. Nurse assist stations
 - 2. Staff/ Duty stations
 - 3. Toilet emergency stations
 - 4. Shower emergency stations
 - 5. Code call stations
 - 6. Patient bed stations
 - 7. Corridor/ dome lights
 - 8. Master control stations
 - 9. Staff/ equipment locator stations
 - 10. Master station annunciator/ Vent alarm

1.2 AE Designer Requirements

- A. AE designer shall design and document a fully coordinated and functional Nurse Call system.
- B. Coordinate with NCH and the Nurse Call system manufacturer for all Nurse Call applicable codes and standards, UPS power, system functionality, operator interface details, device details, wired connectivity, required pathways, network connectivity and server/ storage details.
- C. Fully coordinate all required work with all associated project Divisions, NCH and AV contractor.
- D. Identify and coordinate all Nurse Call device and operator interface locations with NCH project manager, NCH-CNS and Nurse Call system manufacturer.
- E. Coordinate and document Nurse Call system integration details with NCH IP network, PBX/ telephone system and Overhead Paging system with emphasis on patient vent alarm integration.

- F. Coordinate TR space design with NCH project manager and NCH-CNS to provide required special systems rack space, preferred power distribution, IP cabling, patching and cable pathways for all equipment and cabling associated with the Nurse Call system at MER/ TR spaces.
- G. Show all device locations on the systems floor plans. Show all associated IP cabling on the telecommunications plans. Show integrated TR rack elevation drawings. Show detailed cable interconnectivity and termination drawings for all Nurse Call equipment and devices. Provide fully coordinated, detailed connectivity drawings for all patient rooms, headwalls, and booms.
- H. Provide construction administration and change support throughout the project.
- I. Identify cables to be provided by Nurse Call contractor vs. Cat6/6a cables and extended warranty to be provided by the Telecom cabling contractor.

PART 2 PRODUCTS

2.1 Approved Manufacturers

A. Intego

- 1. Provide the most current components and fully integrate with existing nurse call system(s).
- 2. Note: all included part numbers are from previous project and are subject to change based on Nurse Call system manufacturer's design and availability, specific project requirements and changes to applicable codes and standards.

2.2 CCA (Central Control Assembly)

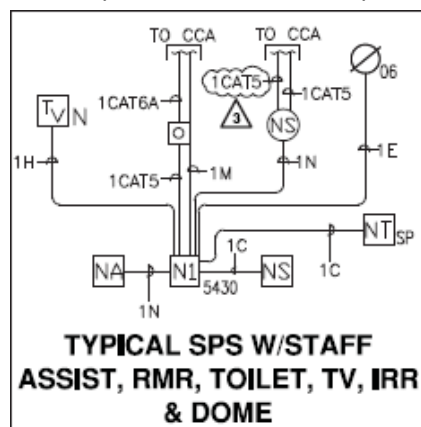
- A. CCA typically locate in dedicated special systems equipment rack(s) in coordinated TRs. (1) CCA can support up to 64 addressable devices. Each CCA requires a minimum of 20 rack spaces plus required associated patch panel and UPS equipment space.
- B. Provide quantity of CCA assemblies as required to support all addressable devices in the Nurse Call system associated with each CCA location.
 - 1. CCA: Intego ProNet.net #CCA-3200 Central Control Assembly including the following devices and required interconnect cabling.
 - a. Central Control Terminal #CCT-3200
 - b. Power Distribution Panel #PDP-3200
 - c. Power Supply #PSA-3200
 - d. Front and rear cable management at the equipment rack location.
 - 2. Emergency/ UPS Power: AE designer to coordinate specific requirements with NCH project manager, NCH-CNS and Division 26 design.
 - 3. PBX gateway: AE designer to coordinate specific requirements with NCH-CNS and Intego
 - 4. Central Paging Interface: AE designer to coordinate specific requirements with NCH-CNS, Intego and central paging system contractor.
 - 5. Coordinate required special systems rack space in the associated TR.

2.3 GCAT (Graphical Central Answer Terminal)

- A. GCATs typically locate at each On-stage or Nurse station location. May also be referred to as Nurse Master.
 - B. Provide quantity of GCAT's as required to support all monitored devices in the associated Nurse Call system GCAT area. Fully coordinate GCAT locations and all associated devices with NCH project manager.
1. GCAT: AE designer to coordinate PC, Monitor, UPS or emergency power and Telephone devices with Intego, NCH project manager, NCH-CNS, and Division 26 design.

2.4 Patient Room Stations

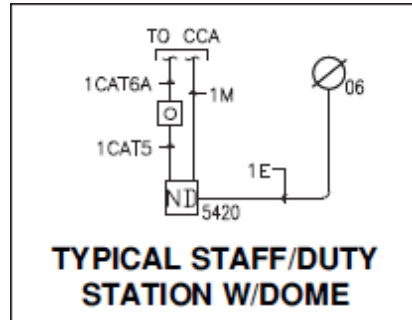
- A. Provide all devices, cabling and integration required for each coordinated Patient Room type. See example below:
 1. [N1] Single Patient Station: 5430 series Intego #SPS-5430
 2. [NA] Remote Monitor Receptacle: Intego #RMR-5004
 3. [NS] Staff assist emergency switch w/ cord: Intego #SAE-5000
 4. Pillow Speaker: Intego #DRPS-9002-A (Verify compatibility with associated TV)
 5. Light Control Isolation Relay: Intego #LIR-1002
 6. [NT] Emergency Pull Switch w/ cord: Intego #EPS-5001
 7. (NS) Infrared locator receiver, ceiling mounted (2). One in room and one in hall positioned to prevent inadvertent staff/ equipment sensing: Intego IRR-5000
 8. Corridor dome light (6) LED: Intego CDL-500
 9. [TV-N] Edutainment Television
 10. "Cat5" = Intego supplied factory terminated violet patch cable(s) from Cat6A module
- B. Provide vent alarm to overhead paging interface: Vent alarms are monitored with a single port auxiliary input jack on the bed docker. Vent alarms are annunciated through the Intego nurse call system and are interfaced to the Overhead paging system.
- C. Provide colorized LED headwall interface: The LED headwall lighting is controlled through the nurse call system pillow speaker control.
- D. Provide Television interface: The nurse call system is interfaced with the television control using a module that mounts in the patient station backbox. Control wire runs across the room to a 1/4" jack in the flat panel box behind the patient television.



2.5 Staff Duty Station

A. Provide all devices, cabling and integration required for each coordinated Staff Duty station.
See connectivity example below:

1. [ND] Staff Duty Station: Intego #SCS-5420
2. Corridor dome light (6) LED: Intego CDL-5006
3. Cat6/ 6A link is by Division 27
4. "1Cat5" = Intego supplied factory terminated violet patch cable from Cat6A module.

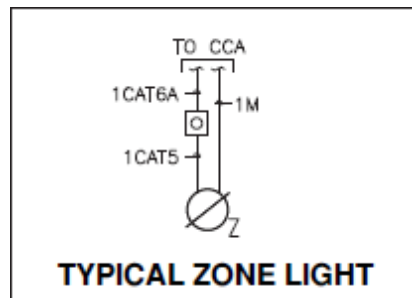


2.6 Zone Light

A. Provide ceiling mounted zone lights to assist responders to specific hallways associated with nurse call device. These Zone lights are provided in addition to the typical corridor dome lights. See connectivity example below:

1. Zone light: Intego ZDL-5000
2. "1Cat5" = Intego supplied factory terminated violet patch cable from Cat6A module

B. See example below:



2.7 Room and Hallway IRR

A. Provide ceiling mounted zone lights to assist responders to specific hallways associated with nurse call device. These Zone lights are provided in addition to the typical corridor dome lights.

1. Room IRR - (NS) Infrared locator receiver: Intego IRR-5000, ceiling mounted (2) Wired to [N1] single patient station. One in room and one in hall positioned to prevent inadvertent staff/ equipment sensing.
2. Hallway IRR - (NS) Infrared locator receiver: Intego IRR-5000, ceiling mounted. Wire first in series with Cat6/ 6A to special systems equipment rack for attachment to CCA.

Daisy chain remaining IRRs in series to extent as permitted by manufacturer. Cat6/ 6A is by Division 27

2.8 Cable Reference

- A. See table below for cable reference to Part 2 diagrams above. All IP cabling shall be Cat6 or Cat6A, by the project telecom contractor providing the 20-year manufacturer's extended warranty and shall be included in the project IP termination hardware manufacturer's extended warranty program. Other cabling shall be by nurse call contractor:

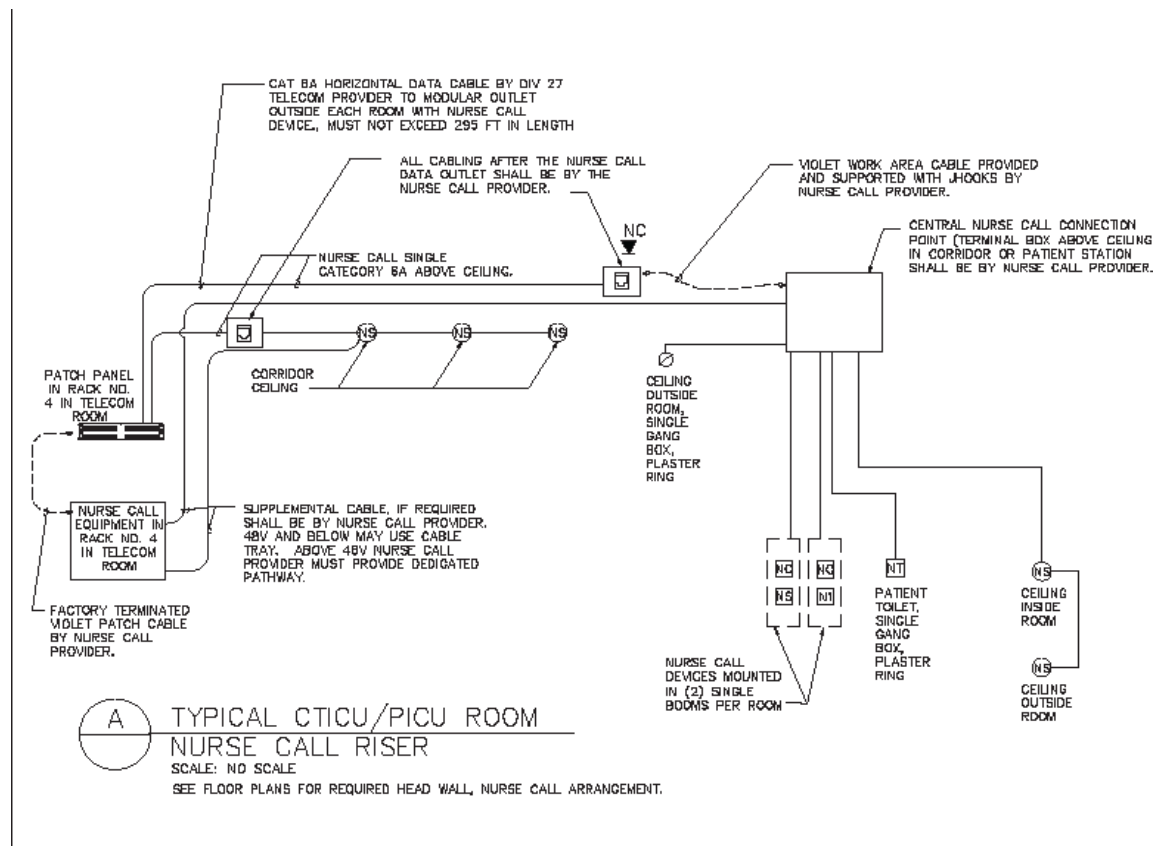
INTEGO WIRE AND CABLE SCHEDULE		
TYPE	DESCRIPTION	PART NUMBER
A	4 COND, 2 TWISTED SHIELDED PAIR 22AWG	047-00011
B	15 COND 22AWG	047-00006
C	5 COND 22AWG	047-00008
D	12 COND 22AWG	047-00013
E	8 COND 22AWG	047-00004
F	4 COND 22AWG	047-00009
G	2 COND 22AWG	047-00005
H	3 COND 22AWG	047-00007
M	2 COND 18AWG	047-00001
N	6 COND 22AWG	047-00014
R	16 COND COMPOSITE, 2 TSP, + 10 SINGLE 22AWG, 2-18AWG	047-00015
X	30 COND 22AWG	047-00026
CAT 5	CAT 5 ETHERNET CABLE	047-00044

PART 3 EXECUTION

3.1 Installation

- A. Provide complete CCAs and associated cabling in coordinated equipment rack space, pathway requirements, UPS power and associated TR design for CCAs required for Nurse Call systems with NCH- CNS. Mount CCAs in coordinated TR equipment rack spaces.
- B. Provide Nurse Call system server/ storage device per approved coordination with NCH-CNS for approved location.
- C. Coordinate all Nurse Call system control, power and lighting requirements and closed pathway requirements with Division 26 design.
- D. Coordinate all IP cabling requirements and associated open pathways with Division 27 design.
- E. Provide factory trained system programming and integration services.
- F. Provide factory trained commissioning services.
- G. Provide minimum 2-year system warranty.
- H. Provide comprehensive as-built documentation.
- I. Provide factory certified owner training for as many groups as are required by the owner.
- J. Call cords in toilet rooms should be specified terminating at 4" to 6" AFF. Cords shall be dangle free & not wrapped around grab bars.

K. See below for examples of patient room cabling diagrams:



DIVISION 28: ELECTRONIC SAFETY AND SECURITY

28.05.53 – Identification for Electronic Safety & Security:

Inpatient Main Campus Area (X* = REVIEW WITH NCH PROJECT MANAGER)

Nationwide Children's Tech Security Standards In Patient Central Campus Areas		Card Reader	IP Camera	Keylocked Door	Door Contacts to ECC	Panic Button to ECC	Lock Down Button	Combination Lock	Door Release Button	Registration Desk Safety Measures	Phone
Med Rooms (Type1) Med Rooms containing controlled substances and/or a Pyxis machine.		X	X	X	X						
Med Rooms (Type 2) Med Rooms containing lighter medications such as vaccines.		X		X*			X*				
Building Perimeter Door - Leading To Outside Doors leading to the exterior of a building is a perimeter door.		X*	X*	X*	X						
Building Perimeter Door - Internal - Between Buildings		X*	X*	X*	X*						
Delayed Egress Doors Alarmed delayed egress doors are to alert into the ECC through Pegasys with camera view from nearest camera.		X*	X*								
Telecom Rooms Any room containing telecom / networking hardware managed by the IS department.		X	X*	X							
Clinic The main entrance to any clinic/registration area		X	X*	X		X					
Clinic Side/Rear Doors Side or rear doors situated in a clinic or unit.		X*		X	X*						
Unit Entrances The main entrance to a unit		X	X*	X							
Lab Doors Doors leading into and out of lab areas.		X*	X*	X							
Doors Between Clinics and/or Units Doors adjoining two or more clinics or units.		X*		X*							
Doors Between Registration Desk and Patient Care Area Doors used by staff and patients to enter and exit between registration and clinical areas. AREA MUST BE REVIEWED FOR LIFE SAFETY		X	X*	X*				X*			
Registration Desk Nurse stations found in clinical areas.			X		X	X*		X*	X*		X
Nurses Station Nurse stations found in clinical areas.			X		X						
Waiting Room Areas Any location reserved for the waiting of patients, parents and visitors.			X								
Patient Care Hallways Hallways within patient care areas of clinics and units.			X*								
Volatile Areas Consult rooms, select meeting rooms, or any area with a possible stressful environment.					X*						
Doors With High Volume Usage Doors leading to rooms or hallways with high volume usage.		X*	X*	X							
Lunch Room Areas Area reserved as a lunch or snack area on units and clinics.		X*		X			X*				
PHI Areas Any room or location reserved for the use of storing patient information.		X*	X*	X							
Med Drawers		X*		X*							
Code Silver Safe Room Must Be Designated				X	X*						X*
Clean Utility Rooms		X*		X							
Soiled Utility Rooms		X*		X							
Knox Boxes - Knox boxes should have contacts so they will alarm into the ECC when opened.					X						
Rooms Containing Expensive Equipment Any location housing a larger number of PCs, A/V Equipment or other hardware of high value.		X*	X*	X							
Ballard / Planters in front of building to prevent ramming where applicable											
X* = Case By Case Review											
08/19/22 - Version 3.8											

Outpatient Off Site Areas (X* = REVIEW WITH NCH PROJECT MANAGER)

Nationwide Children's Tech Security Standards OutPatient Off Site Areas		Card Reader	IP Camera	Keylocked Door	Door Contacts to ECC	Panic Button to ECC	Lock Down Capabilities / Button	Combination Lock	Panel Relay Alerting Power Outage	Door release button	Registration Desk Safety Measures	Phone
Med Rooms (Type1) Med Rooms containing controlled substances and/or a Pyxis machine.		X	X	X	X							
Med Rooms (Type 2) Med Rooms containing lighter medications such as vaccines.		X		X	X							
Building Perimeter Door - Leading To Outside Doors leading to the exterior of a building is a perimeter door.		X*	X*	X	X							X*
Building Perimeter Door - Internal - Between Buildings		X*	X*	X	X							
Delayed Egress Doors Alarmed delayed egress doors are to alert into the ECC through Pegasys with camera view from nearest camera.		X*	X*	X*	X*							
Telecom Rooms Any room containing telecom / networking hardware managed by the IS department. Mixed use TRs must employ camera coverage.		X	X*	X								
Clinic The main entrance to any clinic / registration area		X	X	X*	X		X					
Clinic Side/Rear Doors Side or rear doors situated in a clinic or unit.		X*	X*	X*	X*							
Lab Doors Doors leading into and out of lab areas.		X*	X*	X								
Doors Between Clinics and/or Units Doors adjoining two or more clinics or units.		X*		X*								
Doors Between Registration Desk and Patient Care Area Doors used by staff and patients to enter and exit between registration and clinical areas. AREA MUST BE REVIEWED FOR LIFE SAFETY		X	X*	X*					X*			
Overhead Doors			X*	X*	X*							
Registration Desk Nurse stations found in clinical areas.			X			X	X			X*	X*	
Nurses Station Nurse stations found in clinical areas.			X			X						
Waiting Room Areas Any location reserved for the waiting of patients, parents and visitors.			X								X	
Patient Care Hallways Hallways within patient care areas of clinics and units.			X*									
Volatile Areas Consult rooms, selected meeting rooms, or any area with a possible stressful environment.						X*						
Doors With High Volume Usage Doors leading to rooms and hallways with high volume usage.		X*	X*	X								
Lunch Room Areas Area reserved as a lunch or snack area on units and clinics.		X*		X			X*					
PHI Areas Any room or location reserved for the use of storing patient information.		X*	X*	X								
Rooms Containing Expensive Equipment Any location housing a larger number of PCs, A/V Equipment or other hardware of high value.		X*	X*	X								
Off Site Locations with Access Control In Use In case of power outage relay notifies ECC/Security								X				
Med Drawers		X*		X*								
Clean Utility Rooms		X*		X								
Soiled Utility Rooms		X*		X								

Outpatient Off Site Areas (Continued) (X* = REVIEW WITH NCH PROJECT MANAGER)

Nationwide Children's Tech Security Standards OutPatient Off Site Areas											
	Card Reader	IP Camera	Keylocked Door	Door Contacts to ECC	Panic Button to ECC	Lock Down Capabilities / Button	Combination Lock	Panel Relay Alerting Power Outage	Door release button	Registration Desk Safety Measures	Phone
Code Silver Safe Rooms Must Be Designated			X		X*						X*
Knox Boxes - Knox boxes should have contacts so they will alarm into the ECC when opened.				X							
Code Blue Emergency Phones - If not covered by other security cameras		X*									
Motion detectors shall be placed in areas defined by NCH Security to detect intrusion when security system is armed.											
Off site locations will be evaluated for the placement of desk / phone / PC for use by a security officer assigned to the clinic on a case by case basis.											
Ballard / Planters in front of building to prevent ramming where applicable											
X* = Case By Case Review											
08/19/22 - Version 3.8											

Business Occupancy Areas (X* = REVIEW WITH NCH PROJECT MANAGER)

Nationwide Children's Tech Security Standards Business Occupancy Areas In All Locations		Card Reader	IP Camera	Keylocked Door	Door Contacts to ECC	Panic Button to ECC	Lock Down Capabilities / Button	Combination Lock	Panel Relay Alerting Power Outage
Building Perimeter Door - Leading To Outside Doors leading to the exterior of a building is a perimeter door.		X*	X*	X	X				
Building Perimeter Door - Internal - Between Buildings Doors leading to the exterior of a building is a perimeter door.		X*	X*	X	X*				
Delayed Egress Doors Alarmed delayed egress doors are to alert into the ECC through Pegasys with camera view from nearest camera.		X*	X*		X				
Telecom Rooms Any room containing telecom / networking hardware managed by the IS department.		X	X*						
Overhead Doors			X*	X*	X*				
Volatile Areas Consult rooms, selected meeting rooms, or any area with a possible stressful environment.						X*			
Safes			X						
Doors With High Volume Usage Doors leading to rooms and hallways with high volume usage.		X*	X*	X					
Lunch Room Areas - Case by Case Area reserved as a lunch or snack area on units and clinic		X*		X			X*		
Rooms Containing Expensive Equipment		X*	X*	X					
Code Silver Safe Rooms Must Be Designated				X		X*			X*
Knox Boxes - Knox boxes should have contacts so they will alarm into the ECC when opened.					X				
Off Site Locations with Access Control In Use In case of power outage relay notifies ECC/Security								X	
Ballard / Planters in front of building to prevent ramming where applicable									
X* = Case By Case Review									
08/19/22 - Version 3.8									

Offsite Labs (X* = REVIEW WITH NCH PROJECT MANAGER)

Nationwide Children's Tech Security Standards Offsite Labs									
	Card Reader	IP Camera	Keylocked Door	Door Contacts to ECC	Panic Button to ECC	Lock Down Button	Combination Lock	Door Release Button	Call / Notify ECC
Building Perimeter Door - Leading To Outside Doors leading to the exterior of a building is a perimeter door.	X*	X*	X*	X					X
Building Perimeter Door - Internal - Between Buildings	X*	X*	X*	X*					X
Delayed Egress Doors Alarmed delayed egress doors are to alert into the ECC through Pegasys with camera view from nearest camera.	X*	X*	X*						X*
Telecom Rooms Any room containing telecom / networking hardware managed by the IS department.	X	X*	X						
Clinic The main entrance to any clinic/registration area	X	X*	X*			X*			
Clinic Side/Rear Doors Side or rear doors situated in a clinic or unit.	X*		X	X*					
Doors Between Registration Desk and Patient Care Area Doors used by staff and patients to enter and exit between registration and clinical areas. AREA MUST BE REVIEWED FOR LIFE SAFETY	X	X*	X*					X*	
Registration Desk Nurse stations found in clinical areas.		X*			X	X*		X*	X
Waiting Room Areas Any location reserved for the waiting of patients, parents and visitors.		X*							
Patient Care Hallways Hallways within patient care areas of clinics and units.		X*							
Lunch Room Areas Area reserved as a lunch or snack area on units and clinics.	X*		X				X*		
PHI Areas Any room or location reserved for the use of storing patient information.	X*	X*	X						
Code Silver Safe Rooms Must Be Designated			X		X*				X*
Knox Boxes - Knox boxes should have contacts so they will alarm into the ECC when opened.				X					
Code Blue Emergency Phones									X*
Rooms Containing Expensive Equipment Any location housing a larger number of PCs, A/V Equipment or other hardware of high value.	X*	X*	X						
Ballard / Planters in front of building to prevent ramming where applicable									
X* = Case By Case Review									
08/19/22 - Version 3.8									

Private Practice Offsite Areas (X* = REVIEW WITH NCH PROJECT MANAGER)

Nationwide Children's Tech Security Standards Private Practice Off Site Areas						
	IP Camera	Keylocked Door	Combination Lock	Door Release Button	Panic Button to Local Auth or ECC	Phone
Building External Perimeter Door - Leading To Outside Doors leading to the exterior of a building is a perimeter door.	X*					X*
Clinic Perimeter Door - Internal - Between Clinic and Building Corridors / Hallways Main entry to clinic from building corridors.	X*	X				
Internal Doors- Between clinic and other entities in building.		X*				
Delayed Egress Doors Alarmed delayed egress doors are to alert into the ECC						
Doors Between Waiting Area and Patient Care Area Doors used by staff and patients to enter and exit between registration and clinical areas.	X*	X		X*		
Overhead Doors		X				
Registration Desk	X	X		X*	X*	
Waiting Room Areas Any location reserved for the waiting of patients, parents and visitors.	X	X				
Office Hallways	X*					
Volatile Areas Consult rooms, selected meeting rooms, or any area with a possible stressful environment.					X*	
Lunch Room Areas Area reserved as a lunch or snack area on units and clinics.		X	X*			
Code Silver Safe Rooms Must Be Designated						X*
PHI Areas Any room or location reserved for the use of storing patient information.	X*	X*			X	
Med Drawers	X*				X	
Knox Boxes - Knox boxes should have contacts so they will alarm into the ECC when opened.						
Clean Utility Rooms	X*					
X! = Deadbolted door between entities. Door to Remain locked. If possible door should be walled off with drywall.						
Ballard / Planters in front of building to prevent ramming where applicable						
X* = Case By Case Review						
Requirement: ALL door locks be replaced at the opening of new private practice.						
08/19/22 - Version 3.8						

Pharmacy (X* = REVIEW WITH NCH PROJECT MANAGER)

Nationwide Children's Tech Security Standards Pharmacy													
	Card Reader	IP Camera	Keylocked Door	Door Contacts	Panic Button to ECC	Lock Down Capabilities / Button	Combination Lock	Door Release Button	Call/Notify ECC	Card Reader With Pin Pad	Phone	Registration Desk Safety Measures	Securable Windows
Pharmacy Perimeter Door	X	X		X					X	X			
IP CAMERA Inside and outside perimeter doors													
Delayed Egress Doors	X*	X*	X*						X				
Alarmed delayed egress doors are to alert into the ECC through Pegasys with camera													
Transaction Counter		X			X	X*		X*	X			X*	X
Doors used by staff and patients to enter and exit between registration and clinical areas.													
Doors Between Registration Desk and Patient Care Area													
Doors used by staff and patients to enter and exit between registration and clinical areas.	X	X	X										
AREA MUST BE REVIEWED FOR LIFE SAFETY													
Code Silver Safe Rooms Must Be Designated			X		X*						X*		
Cash Handling		X											
Safes		X											
Controlled Narcotic Storage / Dispensing Systems		X											
Pharmacy Entrance Doors										X			
Exterior Walls - must extend to solid floor to solid roof	X*		X										

02/09/21 - Version 3.6

28.06.00 Safe Room Standards:

PART 1 GENERAL

- 1.1 Engineering PM to meet with Protective Services during project initiation to determine applicable design requirements for safe rooms.
- 1.2 Room Particulars
 - A. Scale and number of rooms to be aligned with size of clinic and location of department.
 - 1. Desire is to have 75-100% of typical occupancy accounted for.
 - 2. Can split up into multiple rooms, as needed, spread through the department.
 - B. No interior glass walls
 - C. Room should contain either a panic button -OR- telephone (see additional information below.)
 - D. Safe rooms should not have signage designating safe room locations.
 - 1. Internal training to be done so staff knows locations.
 - a. Example: some departments place colored stickers above doors to designate safe rooms.
- 1.3 Doors
 - A. Should be accessible to all occupants.
 - B. Locks should allow occupants to lock and unlock the doors manually from within the safe room.
 - C. Preferably no card reader or keypad locks.
 - 1. Exception for doors with card reader: Sargent 8200 series NAC electrified lockset.
 - D. Hardware:
 - 1. Ability to lock yourself in the room
 - 2. Office lock set with key override (push lock functionality)
 - 3. No indicator on lock
 - E. Normal Panic Room (See Door Hardware Section)
 - F. Clinical Panic Room (See Door Hardware Section)
 - G. Preferably no windows
 - 1. Exception: install blinds or frosting
 - H. Engineering room number designation should be labeled on the inside above the doorway of the safe room.
- 1.4 Windows
 - A. Prefer room to not have externally facing windows unless they are on the second floor or above.
- 1.5 Panic (Duress) Button
 - A. Panic buttons go to Protective Services dispatchers in ECC, or local authorities if at an off-site location.
- 1.6 Telephone
 - A. Wall phone on regular network
 - B. Direct dial capabilities (do not need to dial '9' first.)

- C. When 911 is dialed, pop-up will appear on ECC screens notifying them of the call, address of location, floor, and room. ECC can listen into the call with 911.

28.07.00 Protective Services Parking Requirements:

PART 1 GENERAL

General Surface / Garage Parking Areas Requirements
Parking areas located on or off NCH Central Campus will follow the following security tech standards
Visitor parking areas employee gate hardware must also include card reader for use by employees.
Parking areas must meet minimum illumination standards as set by Illuminating Engineering Society of America as described in Appendix A.
Surface lots including entry/exit gates will be evaluated for video surveillance by Protective Services department
Light levels in parking structures will be evaluated in conjunction with Protective Services department.
High visibility traffic control signage will be evaluated with Protective Services to use LED border lighting on a case by case basis.
New and replacement call boxes / intercoms etc are to be CODE BLUE adhering to standards listed below in Appendix B.

Garage Parking Requirements
All entry / exit lanes including pedestrian doors must be under video surveillance
Cashier booths should be under video surveillance
Booths should be secureable
Panic buttons in booths
Elevator lobbies video surveillance
Stairwells video surveillance
Code Blue call boxes spaced throughout floors
Code Blue call boxes at each stair well / elevator lobby
Code Blue call boxes - in view of cameras
Entry / exit gates require two way communication to Protective Services Communication Center
Interior garages should be painted white - especially ceilings
Parking revenue equipment at entry and exits at visitor garages accompanied with two way com
Stairwells should be glass exterior walls to provide additional security from city streets.
Garages should be planned with a pedestrian circulation safety plan
Pedestrian and vehicle doors secured by access control system
AVI system employed Case by Case
Mixed use garages must be secured from each other (Employee / Visitor)
Fencing on exterior walls for all levels to prevent unwanted incidents / casualties.
Mixed use garages must employ elevator control to segregate employee and visitor areas
Mixed use garages must use access control at stairwells to segregate employee and visitor areas where applicable
Ballard must be placed in front of parking equipment
Ballard / Planters in front of buildings to prevent ramming
Digital signs displaying count of free spaces and directions to overflow lots must be included in visitor lots
Avoid dead end parking in pedestrian areas, and areas of concealment.
Anti Graffiti coating should be considered to enable quick and easy cleaning
Potential hiding spaces below stairs should closed off.
08/19/22 - Version 3.8

28.08.00 Protective Services Suggested Illumination Standards:

PART 1 GENERAL

(To be confirmed by Project Engineer)

Application	Average Horizontal Illuminance (footcandles)	Sense of Security (1=poor, 5=best)
Office Park		
Typical	0.43	2
Upgrade	2.00	4
Redesign	3.80	5
Parking Structure		
Typical	0.93	2
Upgrade	1.90	3
Redesign 1	3.00	3
Redesign 2	4.10	4
Redesign 3	5.20	5
Loading Dock (Exterior)		
Typical	0.99	2
Upgrade	0.65	3
Redesign	1.30	4
Gate House		
Typical	0.33	2
Upgrade	0.61	3
Redesign	4.30	5
Campus Green (Three-Story)		
Typical	0.33	2
Upgrade	0.61	3
Redesign	1.50	4

Application	Minimum Lighting Levels (footcandles)
Perimeter fence	0.50
Outer perimeter	0.50 - 2.00
Open Area	2.00
Open Parking Lot	.20 - .90
Covered parking structure	5.00
Pedestrian walkway	0.20
Pedestrian entrance	5.00
Vehicle entrance	10.00
Building façade	0.50 - 2.00
Loading dock elevator	0.20 - 5.00
Loading bay	15.00
Office - general	30.00-50.00
Office - task	50.00 - 70.00
Interior public area	10.00-20.00
Retail store	50.00

Code Blue Devices

Features:

ToolVox® compatible with Blue Alert® EMS software integration

IP connectivity

Operates in extreme weather (-40 to 158 F/-40 to 70 C

Vandal resistant hardware

5000 Model Code blue Speakerphones

28.09.00 Registration Desk Safety Measures:

PART 1 GENERAL

- 1.1 There should be a clear distinction and control between general public waiting areas and clinic treatment areas.
- 1.2 Use systems, furniture or barriers to reduce the opportunity to intentionally or accidentally overhear interactions or see registration information adhering to HIPPA standards.
- 1.3 There should be a clear distinction between registration / admitting desks and waiting areas
- 1.4 Work areas should be protected to prevent unwanted access and be of sufficient height and strength to make it difficult for someone to jump over a barrier or assault a staff member.

28.13.00– Access Control Hardware Devices:

PART 1 GENERAL

- 1.1 Security Management System - Project Design Meeting
 - A. Protective Services and Access Control vendor should be invited to provide details to ensure Security Standards are incorporated in the design.
- 1.2 Access Control Equipment
 - A. Card Readers
 1. Access Control door Reference (Standard): HID #Signo 40NKS-00-00000.
 2. Access Control door Reference (Mullion): HID #Signo 20NKS-00-00000
 3. Access Control door Reference (Keypad): HID #Signo 40KNKS-00-00000 Reader with Keypad.
 4. Gate Control Reference: HID MaxiProx Reader #5375 with buffer plate
- 1.3 Card Reader Naming Convention
 - A. When entering new card reader into access control software use the following naming convention
 1. Building designation – floor number – room number
 - a. Example: BHP-3-BH3301
- 1.4 Duress/Panic Switches
 - A. Provide and install panic switches at indicated locations.
- 1.5 Under work surface Reference: Honeywell # 270R
 - A. Install in a concealed manner under worksurface unless noted otherwise. Provide plastic wire loom to secure cables and attach to undercounter surface to secure cables/cable loom. Only access control cabling can be inside the cable loom. Worksurface should have its own pathway and grommet for each device.
- 1.6 Wall mount Reference: Honeywell #270R- Duress Button

- A. Provide tamper resistant polycarbonate cover where installed in patient areas. Coordinate cover details with NCH Security prior to purchase. Reference STI #STI-1400NC or #STI-1300NC or owner approved equal.
- B. Interface with the Access Control system as an alarm input point.
- C. Provide unique permanent machine printed self-adhesive label to identify intended operation to user. Coordinate text with owner.

1.7 Door Release Switches

- A. Provide and install remote Door Release (DR) switches at indicated locations.
- B. Reference: United Security Products #HUB2SA
- C. Install in a concealed manner under worksurface unless noted otherwise. Provide plastic wire loom to secure cables and attach to undercounter surface to secure cables/cable loom. Only access control cabling can be inside the cable loom. Worksurface should have its own pathway and grommet for each device.
- D. The local operator must be able to view the individual they are letting in the door. A video intercom must be installed at the door and operator desk if the operator cannot see the individual.
- E. Interface with the Access Control system.
- F. Provide unique permanent machine printed self-adhesive label to identify intended operation to user. Coordinate text with owner.

1.8 Lockdown Switches

- A. Provide and install lockdown switches at indicated locations. Mount to vertical wall above work surface, within view of local staff unless owner directed otherwise.
- B. Reference: Assa Abloy #RP44
- C. Install in view of the local operators unless noted otherwise.
- D. Interface with the Access Control system as an alarm input point.
- E. Provide unique permanent machine printed self-adhesive label to identify intended operation to user. Coordinate text with owner.
- F. Install in a concealed manner under worksurface unless noted otherwise. Provide plastic wire loom to secure cables and attach to undercounter surface to secure cables/cable loom. Only access control cabling can be inside the cable loom. Worksurface should have its own pathway and grommet for each device.

1.9 Video Intercom

- A. If a door release button is required, Security Standards require that the staff can see the person at the door to identify the individual. If the individual cannot be seen, perhaps the door does not have a window, or if the door does not have a line of site to the staff, then a video intercom will be required. The video intercom will have a button for the individual to push. Once the button is pushed, the intercom will ring at the master station or sub master station (sub master stations will be used at alternate staff desks). The audio and video from the door station will be displayed at the Master and/or the sub master station(s). The staff can communicate with the individual at the door and determine if they can be allowed access. If access can be granted, the staff can use the door release on the master or sub master stations to release the door.
- B. Each video intercom master station and sub-master station shall provide necessary system output tied to the Access Control systems "input" to provide for remote door release

functionality. This will require a card reader at the door. A card reader is required so the “input” on the access control system can be used to release the door via the door release button on the master or sub master station(s).

C. A kit (JPS-4AEDV) is available from Aiphone via the access control vendor that includes:

1. (1) video door station (JPDV)
 - a. This can be surface or flush mounted
2. (1) video master station (JP4MED) which can have (3) sub master stations
 - a. These will go on the desk like a Cisco phone
3. (1) power supply (PS-2420UL) which is located at the desk where the video master/sub master stations are located. This will require (1) open 120VAC outlet at the desk.
 - a. The below part(s) are not in the kit (JPS-4AEDV), however they shall be included:
 - b. (1) Desk stand (MCW-S/B) will mount to the master/sub master station to provide a “tilt” for easy viewing of the master/sub master station(s).

D. Intercom cabling

1. (1) 18/4 from the door station to the TR where the access control cabinet is located
2. (1) 18/4 from the TR where the access control cabinet is located to the Master station

E. If a sub master station is being installed (1) CAT6A from the master station to each Sub Master station is required.

F. All cabling will be enclosed in a plastic cable loom (in the desk area) and secured.

28.14.00 Cable Specification:

PART 1 GENERAL

- 1.1 All Security Access Control cable shall be listed for the intended environment; cable jacket shall be green. Access Control cabling by Division 27.
- 1.2 All indoor cables shall be listed minimum CMR in non-plenum spaces and CMP in plenum spaces in compliance with the NEC and local AHJ. All cables placed in or routed through damp, wet or outdoor spaces shall be listed CMR in addition to listings for water penetration resistance and UV resistance.
- 1.3 Indoor, CMP
 - A. 18-04 UNS STR CMP Grn Jkt, Windy City #0023860
 - B. 22-06 OAS STR CMP Grn Jkt, Windy City #444351-60
- 1.4 Indoor/ Outdoor, CMR, not submerged
 - A. 22-04 OAS STR CMR Blk + WBT, Windy City # 416310WBT
 - B. 22-06 OAS STR CMR WBT Gry Jkt, Windy City #416400WBT
 - C. 16/4 shielded, OSP, Windy City #1604SDB-WBT-BLK
- 1.5 Listed Cat5e UTP
 - A. 24-4P UNS SOL CMP C5E Grn Jkt, Windy City #5556160

- B. 24-4P UNS SOL CMR C5E Grn Jkt, Windy City #86656160
 - C. 24-4P UNS SOL PE C5E Blk DB, Windy City #665610-110DB
 - D. EZ-RJ45 Cat5e Connector 100pk. w/ tool, Windy City #PTM-100003B
- 1.6 Outdoor, in conduit, direct burial.
- A. 16/4 shielded, OSP, West Penn #AQ3245
 - B. 22-06 shielded, West Penn #AQC3274
 - C. 18-04 shielded, West Penn #AQC3244
- 1.7 Category 6UTP, The Siemon Company #9C6O4-E2-01-R1A or equal (Field Term Patch Cables)
- A. EZ-RJ45 Cat6 Connector 50pk. (requires PTM-100054C) tool, Windy City #PTM100010C

28.15.00 Access Control Cabinets:

PART 1 GENERAL

- 1.1 Demarcation junction box by access control vendor
- 1.2 Reference part number – Altronix BC200-24T
- A. This unit has a 24 terminal strip for low voltage terminations
 - B. Provided by access control vendor and installed by division 26
 - C. This junction box serves as a demarcation point between access control cabling and door hardware cabling. The access control vendor will terminate cabling to the right side of the terminal strip. The door hardware vendor will terminate door hardware cabling to the left side of the terminal strip.
 - D. Door hardware installation and terminations for access control doors shall be by an authorized door hardware vendor.
- 1.3 Access control cabinets
- A. PSX-FPO250-NCH01 – 32 door panel
 - B. PSX-FPO250-NCH02 – 32 door secondary
 - C. PSX-FPO250-NCH03 – 16 door panel
 - D. PSX-FPO250-NCH04 – 16 door secondary
 - E. PSX-FPO150-NCH05 – 8 door panel
 - F. PSX-FPO150-NCH06 – 8 door secondary
 - G. PSX-ISG2-E2SN – 2-4 reader enclosure
 - H. GSTAR004-MB – 2-4 reader board
 - I. GSTAR-ACM – 8 reader board
 - J. iStar Ultra G2 (equivalent to the CK721A)
- 1.4 Surge protector for outdoor devices by access control vendor
- A. See 28 11 13 for complete list

- B. Reference: Ditek #DTK-4LVLP-CR (12/24v powered Card Readers)
 - C. Reference: Ditek #DTK-3LVLPX (Wiegand Card Reader)
 - D. Reference: Ditek #DTK-ESS (Magnetic Locks)
- 1.5 Data Drops per cabinet
 - A. Data drops are required per access control cabinet
- 1.6 IP reservations
 - A. Access Control vendor to submit MAC address for each device requiring an IP address to NCH Protective Services
- 1.7 Motion Detectors
 - A. Some facilities (Remote sites) may require motions detectors by Protective Services. Access control vendor to coordinate with Protective Services on the number needed for coverage.
 - B. A single card reader with numeric keypad will be used to arm/disarm the motions.
 - C. Reference (Keypad): HID #Signo 40KNKS-00-00000 Reader with Keypad.
- 1.8 Graphical Maps
 - A. Access Control vendor to coordinate with Protective Services to see if Graphical Maps are needed for the project
 - B. Provide quote as requested
- 1.9 Submittals
 - A. Material submittal
 - 1. List all parts with data sheets
 - 2. No shop drawings (all devices are on the Technology sheets)
 - B. Close out
 - 1. Warranty
 - a. 1 year labor + Manufacturer warranty
 - 2. As Built document
 - 3. No O&M - Manuals
 - 4. No Training for hardware or software

28.23.00 – CCTV Video Surveillance:

PART 1 GENERAL

1.1 System Description

- A. Project Design Meeting
 - 1. Protective Services and CCTV vendor should be invited to provide details to ensure Security Standards are incorporated in the design.
- B. Cabling and patch cables

1. General Note: All low voltage wiring shall be supported independently by bridal rings or j-hooks (if structured cabling is used), at distances no greater than 5' apart, utilize approved manufacture raceways (ex. EZ-Path) or electrical conduit with bushed ends when penetrating walls and/or floors, is labeled on both ends of cable and/or at every termination point. Attaching low voltage cabling to all thread or ceiling grid support wires is prohibited. Independent ceiling wires can be used if a unique identifier is used to distinguish low voltage supports from ceiling system support wires.
2. Indoor and outdoor cabling for cameras by Division 27
3. Indoor and outdoor patch cables for cameras by Division 27

C. Camera License

1. CCTV vendor shall coordinate with Protective Services on license requirements

D. This section describes typical infrastructure required for IP-CCTV cameras which include IP cabled links and associated equipment. The Division 28 scope is often contracted directly by NCH outside of the base project however the base project Division 27 contractor will be required to provide IP cabled links to support the IP-CCTV and other Division 28 devices as required.

E. This section describes NCH-CNS approved typical outdoor pole mounted camera assemblies. IP-CCTV locations must be coordinated with NCH project manager, NCH security and NCH-CNS during the Systems design and Document design phase.

1.2 AE Designer Requirements

- A. AE designer shall coordinate all CCTV locations with NCH project manager, NCH security and NCH-CNS during the SD and DD project phases and include final coordinated locations in the CD phase.
- B. Coordinate all outdoor pole locations with the Architect, NCH project manager and associated integration of Civil, Electrical and Communications design requirements. Coordinate TR space design with NCH project manager and NCH-CNS for wall space, rack space, grounding, power, open and conduit pathways, and other systems required for code and standards compliant distribution of IP cabling for CCTV locations.
- C. Show all CCTV device locations on the systems site and floor plans, Pole mount detail for CCTV camera including base conduit routing, TR rack elevation drawings and detailed cable interconnectivity and termination drawings. Provide construction administration and change support throughout the project. Show all scaled MER/ TR elevations in project drawings with required support services. Show coordinated services on corresponding sheets including but limited to the electrical power plans. Coordinate and maintain minimum clearances to all access panels for adjacent systems equipment. Coordinate new and existing, intrabuilding and interbuilding CCTV pathways with NCH project manager and NCH-CNS NCH.
- D. Show all new and existing pathway details including conduit sizes and quantities, duct banks, manholes, required UL listed firestop system locations, cable tray and open pathways on project site plan sheets and floor plan sheets.
- E. Provide construction administration and change support throughout the project

PART 2 PRODUCTS

2.1 Approved Manufacturers

A. Outdoor Pole Mounted CCTV Camera assemblies:

1. Sony exterior PTZ camera 36x zoom and exterior dome assembly, #SNC-RS86N
2. Sony gooseneck for exterior dome, #UNI-WMB1
3. Sony exterior Power Block Unit, #UNI-PBU1 Alternate MOOG/ Videolarm PB24
 - a. Include pole mount adapter for power block as needed.
4. Optical fiber media convertors (1) inside pole or building mounted power block, (1) at coordinated MER/ TR space, MOOG/ Videolarm #E0F2N (1-pair per multimode fiber link)

B. IP cabled link for exterior CCTV camera location:

1. Cabled links over 295' termination to termination

- a. Multimode optical fiber link per division 27 specifications. Indoor Outdoor, 6-strand, OM3 Corning link listed for the environment it is placed in. Provide spider kits at both ends. match optical fiber connector type at CCTV camera to media convertor for direct connect. Match connector type to project standard at MER/ TR space.
- b. Optical fiber media convertors (1) inside pole or building mounted power block, (1) at coordinated MER/ TR space, MOOG/ Videolarm #E0F2N (1-pair per multimode fiber link). Include manufacturer suggested wall mount kits for the wall mount solution. Provide 19" 1U vented equipment rack shelves for rack mount solution.
- c. Copper patch cable at CCTV camera. Provide (1) Cat6/ 6A copper patch cable and pathway from each media convertor to NCH-CNS network switch. Patch cable shall match project extended warranty solution and additional requirements included in the Division 27 design documents.
- d. Copper patch cable at MER/ TR space. Provide (1) Cat6/ 6A copper patch cable and pathway from each media convertor to CCTV camera at exterior enclosure. Patch cable shall match project extended warranty solution and additional requirements included in the Division 27 design documents.
- e. Optical fiber patch cable at MER/ TR space. Provide (1) optical fiber patch cable and pathway from shelf terminated optical fiber to each media convertor to CCTV camera. Patch cable shall match project extended warranty solution and additional requirements included in the Division 27 design documents.

2. Cabled links up to 295' from termination to termination:

- a. Cat6 OSP link per division 27 specifications. Listed outdoor Cat6 cabled link from exterior CCTV camera to a transition point within 50' of entering the building or as otherwise required by the NEC, Continue project standard Cat6 indoor link from transition point to assigned MER/ TR space. Cat6 link shall comply with and be included in the project extended warranty solution.
- b. Provide all termination required hardware, pathways and firestop in accordance with project extended manufacturer's warranty and Division 27 design documents.
- c. Where required by code and NCH-CNS design guide the transition point shall be primary protection assembly as permitted in the project Division 27 design

documents. Coordinate approved grounding point with Division 26 design documents.

d. Copper patch cable at exterior IP-CCTV camera enclosure. Provide (1) Cat6 copper patch cable from each cabled link to IP-CCTV camera. Patch cable shall match project extended warranty solution and additional requirements included in the Division 27 design documents.

e. Copper patch cable at MER/ TR space. Provide (1) Cat6 copper patch cable from each cabled link for IP-CCTV camera to NCH-CNS network switch. Patch cable shall match project extended warranty solution and additional requirements included in the Division 27 design documents.

2.2 Indoor fixed camera (stairwells, MEDS room)

A. Acti E93

2.3 Indoor 360 (Waiting areas, elevator lobby, Nurse/Care desk, registration)

A. Acti B511A

2.4 Indoor PTZ (Pharmacy clean room, label printer)

A. Acti B923

2.5 Indoor Covert 360 with Microphone (Security directed areas)

A. Acti Q13-K1

B. Verifact D-V microphone

2.6 Outdoor 360

A. Acti B76A

2.7 Outdoor Fixed

A. Acti A811

2.8 Outdoor PTZ

A. B928

2.9 UL497 Primary protector for outdoor cameras

A. See 28.11.13 for complete list

B. Reference: Cat6A PoE, ITW Linx #CAT6A-75/PoE RJ45, alt. Ditek #DTK-110RJC6APOE & DIN rail mounting kit #DTK-DRK

2.10 IP reservations

A. Access Control vendor to submit MAC address for each device requiring an IP address to NCH Protective Services

PART 3 EXECUTION

3.1 Installation

A. Install pathways for LV camera cabling in separate and dedicated internal raceways.

B. Install pathways in accordance with NCH-CNS Division 27 design guide. Coordinate all pathways at pole bases and exterior building locations with Division 26 to ensure required 120V electrical power.

- C. Division 26 shall provide graduated nylon pull tape to be used by Division 27 for exterior pathways. Division 27 shall provide new graduated nylon pull tape to be left in exterior pathways for future use with installed cables.
- D. Install all IP cabled links in accordance with Division 27 design documents and project standard manufacturer's extended warranty program.
- E. Certify all CCTV IP cabled links in accordance with Division 27 design documents and include all IP-links in the project extended warranty program.
- F. Coordinate actual installation/ termination locations at the MER/ TR spaces with NCH-CNS and Division 28 contractor.
- G. All new cables shall be 100% tested and passed by the criteria as established herein.
- H. Testing shall be performed only after work area faceplates and outlets have been fixed in final position and final closet terminations are complete. Under no circumstances shall testing be performed while work area outlets are hanging loose.
- I. Any cable or component not satisfactorily passing the tests as described or failing to meet quality installation standards as described in this specification, shall be repaired and/or replaced at the Contractor's expense.

3.2 Submittals

A. Material submittal

- 1. List all parts with data sheets
- 2. No shop drawings (all devices are on the Technology sheets)

3.3 Close out

- A. Warranty
- B. 1 year labor + Manufacturer warranty
- C. As Built document
- D. No O&M
- E. No Training for hardware or software

3.3 Labeling

- A. Wire and cable identification shall consist of self-adhesive, self-laminating, permanently applied, machine- printed wrap-around markers. Printed marker area shall be no less than 1-1/4" wide and located within 3 to 6 inches of each cable termination. Labels must withstand the requirements of UL 969 as outlined in the EIA/TIA Standard. Provide separate cable length label adjacent to cable identifier label. Cable length label shall conform to the same criteria as the cable identification label but shall include only the cable length in feet from termination to termination.
- B. The labeling scheme for the Horizontal System shall consist of a seven-character or eight-character sequence for each port. The first three or four alpha-numeric characters, followed by a dash, designate the MER (Main Equipment Room) or TR (Telecommunications Room) from which the cabling originates. The last four numeric characters shall be assigned as a unique sequential cable number starting at X001. Confirm all details of cable labeling with NCH-CNS during design and prior to installation.

3.4 Firestopping

- A. Refer to Section 27.05.00 – Common Work Results for Communications

28.30.00 – Fire Alarm Systems:

PART 1 GENERAL

- 1.1 Design electronic detection and alarm quantities to code minimum. Verify quantity and locations with PM.
- 1.2 BEFORE doing ANY programming discuss with Engineering Electrical Trades or Engineering Operations Manager. MUST use NCH's most current disk.
- 1.3 Acceptable Fire Alarm systems Gamewell FCI (preferred), and Simplex
- 1.4 ALL New Simplex Systems are to Utilize the Simplex ES Panels
- 1.5 Provide a complete inventory in Microsoft Excel that includes each device, type of device, building location, room location, and label (address) information. This is required and shall be provided to the NCH operations Electrical Trades Supervisor prior to the Completion of the Project.
- 1.6 Initial Function & Sensitivity Testing is required and shall be included in a complete report, prior to the Date of Certificate of Completion of Project. Provide a copy of the report to the NCH operations Electrical Trades Supervisor
- 1.7 Fire Alarm Graphics must be updated for every phase of the project that affects the system prior to the completion of the project.
- 1.8 Need to arrange meeting with NCH Project Manager, Operations and vendor to discuss system requirements and functionality.
- 1.9 During Design stage, coordinate with NCH Operations: impact of changes to existing Fire Alarm System Explain scope of work and software program. Test program also needs to be discussed during this meeting.
- 1.10 Supply Hard Copy of all program changes At Time of Installation of Software in System.
- 1.11 Supply to NCH Operations, printed and Disc copy of entire operating program, complete as built drawing set and Certificate of Completion upon Successful completion of Life Safety Witness Test.
- 1.12 First Year Function & Sensitivity Testing shall be included in a complete report, no later than 10 months after Date of Certificate of Completion of Project.
- 1.13 Addressable system required. Where old zones still exist, replace with addressable.
- 1.14 Exposed devices colored red.
- 1.15 All Program changes, new device installs, and device relocations must be programmed and added or changed in graphic by building, location, room number, and floor. Fire Alarm Graphics must be updated for every project that affects the system.
- 1.16 Fire Annunciators- 80" AFF to top per ADA, exposed devices colored red.
- 1.17 All new Construction All Audio Notification to utilize Speakers with recorded voice message.
- 1.18 In renovation areas minimum requirement to pull in wiring for speakers to be added.

- 1.19 Renovation areas replace buzzers/bells entire floor with speakers and amplifier system to convert to speakers with recorded message.
- 1.20 All Fire Alarm wiring to be installed in conduit or metal raceway. Flexible metal conduit is acceptable from J-Box to device and should not be greater than 6' in length.
- 1.21 Conduits 2" and smaller are to be Yellow conduit.
- 1.22 All Fire Alarm wiring to be labeled at each termination point. This includes at the main fire alarm panels, NAC panels, and at each device. No "star-taps". Splices inside junction boxes should be kept to a minimum.
- 1.23 Spray paint each F/A J-box yellow and mark address or circuit info on J-box cover.
- 1.24 Smoke Detector Placement and Door Control functions shall comply with NFPA 101 Life Safety Code
- 1.25 Manual Stations (Pull Stations) shall be equipped with Tamper Resistant Non-Alarming Covers STI -1200 Flush Mount and STI 1230 with Spacer
- 1.26 No initiating device shall have "Blind output Capability" (control function capability outside of software program).
- 1.27 All Duct Detectors shall have Remote Test Switch wall mounted, No more than 72 in AFF.
- 1.28 No Markers labels must be made with Brady or P-Touch type labeling machine.
- 1.29 All above ceiling devices, including but not limited to Duct Detectors, Dampers and Control Relays shall be identified by address or circuit info on ceiling grid adjacent to device.
- 1.30 All devices in shafts shall be identified by address or circuit info adjacent to door or hatch opening to shaft.
- 1.31 All devices shall be identified by device address or circuit info on each device including but not limited to Pull Stations, Smoke Detectors, Heat Detectors, all AV devices and all control devices including door controls and security devices.
- 1.32 No initiating, Notification, Control Circuit or Power Supply shall exceed 75% of Rated Capacity
- 1.40 All low voltage wiring shall be supported independently by bridal rings or j-hooks (if structured cabling is used), at distances no greater than 5' apart, utilize approved manufacture raceways (ex. EZ-Path) or electrical conduit with bushed ends when penetrating walls and/or floors, is labeled on both ends of cable and/or at every termination point. Attaching low voltage cabling to all thread or ceiling grid support wires is prohibited. Independent ceiling wires can be used if a unique identifier is used to distinguish low voltage supports from ceiling system support wires.
- 1.41 Design Requirements for Architects, Engineers and Designers
 - A. The AE design team shall coordinate all building mounted fire alarm device locations with NCH during project phases. Provide complete design documents identifying all coordinated fire alarm device locations in the CD phase.
 - B. Design electronic detection and alarm quantities to code minimum. Verify quantity and locations with PM.

- C. Need to arrange meeting with NCH Project Manager, Operations and vendor to discuss system requirements and functionality.
- D. Addressable system required for initiating devices. Where old zones still exist, replace with addressable. Coordinate with NCH for addressable speaker/strobes which shall be decided on a project basis.
- E. Fire Annunciators - Coordinate height with NCH.
- F. Locate the control panel as required by code. The exact location of the control panel and/or annunciator shall be coordinated with NCH Engineering Services.
 - 1. Refer to owner drawings for existing system information.
 - 2. The system shall be capable of voice communication via site microphone from the main fire alarm panel, and from the annunciator panel (if used). The system shall be capable of voice communication from the ECC and the ECC triggering pre-recorded messages.
 - 3. Public Safety Communication System. An ERRS(Emergency Responder Radio System) shall be coordinated with the latest City of Columbus requirements and shall be designed per code minimum.
 - a. ERRS cabling to have label at every 8'-0" minimum
- G. Speakers/Strobes: For new construction all audio notification devices to utilize speakers which shall be capable of utilizing recorded voice message.
 - 1. At a minimum, a separate audio and visual circuit shall be run for each floor.
 - 2. The standard audible shall be a 4" speaker, adjustable from 1/4 Watt to 2 Watts that can be installed by itself or in conjunction with a visual strobe.
 - 3. The high output audible shall be a 4" speaker, adjustable from 2 Watts to 15 Watts that can be installed by itself or in conjunction with a visual strobe
 - 4. Speaker/strobes shall be addressable on a per project basic, coordinate with NCH.
 - 5. Review notification devices outside project area for coverage requirements and show them on project drawings as existing to remain.
 - 6. Wall mount all notification devices except with special permission from NCH.
- H. Exposed devices colored red. (Some buildings may require White Devices– Coordinated with NCH Project Manager.)
- I. Manual Stations (Pull Stations) shall be equipped with Tamper Resistant Non-Alarming Covers in locations coordinated with NCH. Pull stations shall be red in color and shall be push-pull double action, and individually addressable.
- J. Renovation areas replace buzzers/bells entire floor with speakers and amplifier system to convert to speakers with recorded message. Coordinate with NCH. In some renovation areas minimum requirement to pull in wiring for speakers to be added.
- K. Conduits: All Fire Alarm wiring to be protected by enclosure in in conduit or metal raceway. Flexible metal conduit is acceptable from J-Box to ceiling device.
 - 1. All Conduits are to be yellow conduit.
 - 2. All Fire Alarm wiring to be labeled at each termination point this includes at main Panel, in all terminating junction boxes and at each device.
 - 3. Paint each F/A J-box yellow and mark address or circuit info on J-box cover.
- L. Wiring: No splices permitted in all new wiring.

1. Provide wiring per the following requirements and all wiring shall follow this color code:

WIRE LEGEND				
A	SIGNALING LINE CIRCUIT (SLC LOOP)	2 #16 AWG	CLASS A	RED JACKET
CA	STROBE CIRCUIT	2 #12 AWG - THWN	CLASS A	YELLOW (+) BLACK (-)
CB	STROBE CIRCUIT	2 #12 AWG - THWN	CLASS A	RED (+) BLUE (-)
CC	STROBE CIRCUIT	2 #12 AWG - THWN	CLASS A	PURPLE (+) BROWN (-)
CD	STROBE CIRCUIT	2 #12 AWG - THWN	CLASS A	ORANGE (+) PINK (-)
D	24 VDC DOOR HOLDER POWER	2 #14 AWG - THWN	CLASS D	RED (+) BLACK (-)
E	INITIATING DEVICE CIRCUIT	2 #16 AWG - FPL	CLASS A	RED JACKET
G	CONTROL CIRCUIT	2 #14 AWG - THWN	CLASS E	ORANGE (+) BLUE (-)
K	24 VDC POWER	2 #14 AWG - THWN	CLASS A	YELLOW (+) BROWN (-)
N	NETWORK	2 #16 AWG - FPLR	CLASS A	RED JACKET
T	REMOTE TEST STATION CONNECTIONS	4 #14 AWG - THWN	CLASS E	BLACK/RED (LED), GREEN/WHITE (TEST SWITCH)
V	SPEAKER CIRCUIT	2 #16 TWISTED / SHIELDED - FPL	CLASS A	GREY JACKET

- M. Smoke Detector Placement and Door Control functions shall comply with NFPA 101 Life Safety Code.
- N. No initiating device shall have “Blind output Capability” (control function capability outside of software program)
- O. All devices in shafts shall be identified by address or circuit info adjacent to door or hatch opening to shaft.
- P. Fire Alarm devices in areas where there is a high risk of physical damage (mechanical rooms, etc.) shall have a protective wire housing UL listed for the purpose installed over the device.
- Q. Access to all fire alarm equipment must not put personnel at risk and shall not require that personnel bring equipment such as ladders or lifts unless approved by the NCH Engineering Services plan review.
- R. **ELEVATOR RECALL:** Code Minimum. Coordinate with elevator manufacturer and sprinkler designer – preferred method is no sprinkler head at the top of the elevator shaft.
- S. **DUCT SMOKE DETECTION:** Duct smoke detection shall be provided where required by addressable, analog duct smoke detectors connected to the building fire alarm system. Duct smoke detectors shall not be used to replace area smoke detection and are not to be used as life safety devices. Their primary purpose shall be to shut down air handling equipment to prevent or control the spread of smoke through the building when required by code. Duct detectors shall be installed in accordance with NFPA 72 and all other applicable codes. Duct detectors shall be programmed as supervisory devices. All Duct Detectors shall have Remote Test Switch wall mounted, coordinate location with NCH. Verify with NCH for inaccessible areas and consider remote sampling tubes.
- T. Special monitoring not currently installed or integrated through fire alarm system.
- U. **Monitor ZAM** (zone adaptor module) shall be used to monitor a dry contact device, water flow, tamper, etc. and convert the signal to a specific point in the system
- V. **Control ZAM** shall be used to provide a dry contact activation of a function such as AHU shutdown or de-energizing an electrical circuit controlling a fire damper.

- W. No initiating, Notification, Control Circuit or Power Supply shall exceed 75% of Rated Capacity.
- X. Auditoriums or other areas of assembly with an occupancy greater than code minimum will have a separate voice announcement control unit with microphone to serve that area of assembly.
- Y. Design documents shall include the following:
 - 1. Fire Alarm floor plan(s); Identify all fire alarm device locations with unique symbols, text per NCH Labeling requirements and installation heights. Note the Private Operating Mode notification areas or other special areas on the plan.
 - 2. Identify all new and existing pathway details including conduit sizes, required UL listed firestop system locations.
 - 3. Rename any existing devices within an existing construction or renovation zone to remain in accordance with NCH naming standards. Refer to Section 3.04.
 - 4. During Design stage, coordinate with NCH Operations, impact of changes to existing Fire Alarm system. Explain scope of work and software program. Test program also needs to be discussed during this meeting. Test programs need updated as devices are added to or removed from the system. Test programs need to be verified of proper operation prior to occupancy or project completion.
- Z. The A&E team shall provide Closeout Documents in conformance with the NCH Design Requirements section 01.78.00. In addition to those standards, the Closeout documentation shall also include the following:
 - 1. Fire Alarm floor plan(s)
 - a. Identify all fire alarm device locations with unique symbols, text and installed heights as verified as installed during construction.
 - b. Identify all new and existing pathway details including conduit sizes and required UL listed firestop system locations.
- AA. The Fire Alarm Vendor's shall provide Closeout Documents in conformance with the NCH Design Requirements section 01.78.00. In addition to those standards, the Closeout documentation shall also include the following:
 - 1. NCH Fire Alarm one line diagrams to be marked up with the revisions of the job
 - 2. Project inventory of all devices that were deleted or added by label, spread sheet provided by NCH.
 - 3. Provide a copy of the redlined field set to NCH and the A&E team

1.3 Specific Area Design Requirements:

- A. Private Operating Mode Notification Areas. Coordinate with NCH and show on all documents. Patent Sensitive areas including Neonatal ICU bed areas, Pediatric ICU bed areas, MRI procedure rooms, Interventional Radiology Procedure rooms (Angiography), Cardiac Catheterization Laboratories, Operating rooms and adjacent ancillary spaces, and Anesthesia Care spaces.
- B. Residential - motel type overnight accommodations for staff or families
 - 1. Install combination speaker/strobe in sleeping areas. (The codes are requiring wiring for the strobes and in the next few cycles will probably require the strobes.)

- C. Impairment Process - Coordinate with NCH Project Manager and NCH Impairment Manager. Provide 155 degree linear heat detection for areas under construction connected to fire alarm panel, clearly labeled with location (building & floor), upgrade graphic and labeled as Construction area. The linear heat detection shall be removed at end of construction period. Protectowire or Safe Fire Detection system or approved equal are approved linear heat detectors manufacturers.
- D. In exterior or damp locations, no top entry allowed on devices, cabinets or junctions.

PART 2 PRODUCTS

2.1 System Requirements

- A. Control unit shall be installed in a suitable steel cabinet with hinged cover, secured with lock and key. Spare parts shall be provided to the NCH as coordinated with NCH.

2.2 Approved Manufacturers

A. Fire Alarm Systems

1. Honeywell Gamewell FCI and SimplexGrinnell panels.

PART 3 EXECUTION

3.1 Coordination

- A. Coordinate all fire alarm device locations and accessories, required IP cabling, power and grounding, site hardware, fiber connections, ECC Monitoring, DAS First Responder Radio System, and required cabling with NCH project manager and architect.

3.2 Installation

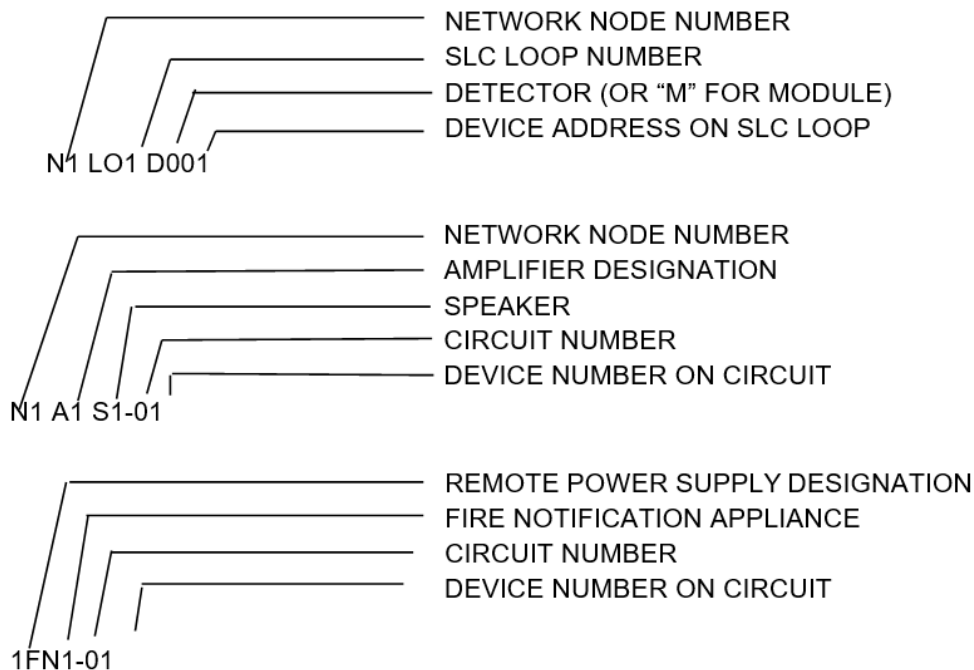
- A. BEFORE doing ANY programming discuss with NCH Project Team to validate programming requirements. MUST use NCH's most current programming disk.
- B. Fire Alarm Graphics and computers must be updated for every project that affects the system prior to completion of the project.
- C. Supply Hard Copy and digital CAD and PDF of all program changes At Time of Installation of Software in System.
- D. Duct smoke detectors shall be programmed as Supervisory points and generate a supervisory signal at both the building control panel and at the ECC.
- E. Coordinate the following with Close Out Documentation.
 1. Supply to NCH Project Manager and Operations, printed and Digital copy of entire operating program, complete as built drawing set and Certificate of Completion upon Successful completion of Life Safety Witness Test.
 2. First Year Function & Sensitivity Testing shall be included in a complete report, no later than 10 months after Date of Certificate of Completion of Project.
 3. A single line drawing showing the physical location of each device, it's system address, and the type of device. Floor plan drawings showing all device locations, including all room numbers and room descriptions. A single line riser diagram of the system. Complete list of points on system, and all programming data for panel. Shop drawings

shall include Fire Alarm Sequence of Operation Matrix, Battery Calculations and Voltage Drop Calculations. Digital copy.

3.3 Labeling

- A. Provide a complete inventory in per owner supplied spread sheet that includes each device, type of device, building location, room location, and label (address) information. This is required and shall be provided to NCH Team prior to the Completion of the Project.
- B. All Program changes, new device installs, and device relocations must be programmed and added or changed in graphic by building, location, room number, and floor. Devices added to or removed from the system may also affect test programs. Fire Alarm Graphics much be updated for every project that affects the system. Coordinate with NCH Project Manager or Construction Manager the programming abbreviations for the building name and correct nomenclature.
- C. Label each fire alarm device with Brady or P-Touch type labeling machine printed self-adhesive laminated label stock to match the owner's spreadsheet. Labels to be of a permanent type, 24 point height black letter on white tape, with clear laminate overlay. Hand lettering is specifically not acceptable. All devices shall be identified by device address or circuit info on each device including but not limited to Pull Stations, Smoke Detectors, Heat Detectors, all AV devices and all control devices including door controls and security devices and named per NCH naming conventions. Coordinate with NCH on naming prior to start of labeling.
- D. Label each wire at every termination point.
- E. All ow voltage cabling shall be labeled in compliance with NCH standards. Refer to 3.03 D.

3.4 Address Label Clarification



DIVISION 31: EARTHWORK

31.23.00 – Excavation and Fill:

PART 1 GENERAL

- 1.1 Backfill material should be clay/soil generally and not grits or similar unless desirable for drainage, etc. All backfill is to be compacted.

DIVISION 32: EXTERIOR IMPROVEMENTS

32.17.23 – Pavement Markings:

PART 1 GENERAL

- 1.1 Thermoplastic traffic markings on streets / roads.
- 1.2 Parking stall markings to be white paint, 4" wide (typ.)
- 1.3 Traffic signs, painted or vinyl applied letters, standard green steel perforated hat stakes

32.33.13 – Site Bicycle Racks:

PART 1 GENERAL

- 1.1 Bicycle racks shall be of a standard type, serpentine style, galvanized or stainless steel, surface mounted.
- 1.2 Quantities of loops as needed and suitable for normal use. Locks to be user provided.
- 1.3 Any exceptions to be approved by NCH PM

32.33.14 – Planting Irrigation:

PART 1 GENERAL

- 1.1 Irrigation required for all new / freestanding buildings
- 1.2 System shall include deduct meters, and easily accessible exterior controllers.
- 1.3 Rainbird IQ System preferred.
- 1.4 Installation contractor responsible for winterization and initial spring startup the following season
- 1.5 Provide network jack at building controller for future network connectivity
- 1.6 Provide spec section for review by owner
- 1.7 Project Close out Documents shall include locations of all major gear & irrigation zoning drawings

32.39.00 – Electric Vehicle Charging Stations:

PART 2 PRODUCTS

- 2.1 ChargePoint shall be standard manufacturer. Acceptable models include:
- 2.2 CT4000 Dual Port Level 2 EV Charging Station.
- 2.3 Express 250 DC Fast Charging Station
- 2.4 Any exceptions to be approved by NCH PM

- 2.5 Contractor to coordinate with PM & NCH Operations team for monitoring hardware & system set up including Cloud Plan integration & Assure Plan Purchase

32.90.00 — Planting:

PART 1 GENERAL

- 1.1 Sod/seed mix should be 90/10 Turf-type Tall Fescue and Bluegrass – to be used to repair all new and disturbed turf areas. Topsoil is required for finish grade of seed bed, and shall be free of any debris. Grass seed shall be covered with Penn Mulch or equivalent – No straw.

Please see below the “Do Not Plant List” - Do not specify or accept these as substitutions

Trees (Do Not Plant)

- 1.1 American Sycamore-*Platanus occidentalis*
1.2 London Planetree- *Platanus x acerifolia*
1.3 Callery Pear- *Pyrus calleryana* Sdadads
1.4 Sweetgum- *Liquidambar styraciflua*
1.5 Black Locust- *Robinia pseudoacacia*
1.6 Hawthorn- *Crataegus sp.*

Shrubs (Do Not Plant)

- 1.1 “Gro-Low Sumac-*Rhus aromatica* ‘Gro-Low’
1.2 Roses- *Rosa sp.*
1.3 Ninebark-*Physocarpus sp*
1.4 Dwarf Burning Bush- *Euonymus altatus* ‘Compactus’

Perennials/Grasses (Do Not Plant)

- 1.1 Fountain Grass- *Pennisetum sp.*
1.2 Blue Lyme Grass- *Leymus arenarius.*