102.201 – MEP/FP ENGINEERING DESIGN GUIDELINE

PART 1 - INTRODUCTION

1.01 OVERVIEW

A. The design team shall follow this guideline when engineering a construction project for BJC HealthCare projects.

B. There are architectural design guidelines that contain information that applies to engineering design as well, please review.

C. The design team shall notify the BJC project manager in writing when a project design cannot comply with BJC's design guidelines and/or specifications. The design team and BJC shall resolve through collaboration in a timely manner to avoid impact to the project schedule.

D. The engineers coordinate and document design direction for all of the requirements provided in this document and submit it to the BJC Infrastructure Manager on each project.

E. Engineers are expected to use this document as basis for minimum design expectations and are encouraged to propose enhanced design standards and best practices through coordination with the project team.

F. BJC welcomes feedback on the engineering guidelines and specifications. Please contact the project Infrastructure Manager to provide comments.

PART 2 - GUIDELINE

2.01 GENERAL

A. Design build projects require engineers to sign and seal the design documents.

B. Engineers shall identify and follow all applicable codes and standards.

C. Energy efficiency is an important consideration that shall be part of each project design. Energy efficiency considerations shall be reviewed with the BJC project team.

D. All equipment shall be designed to allow for sufficient access based on code requirements, facility maintenance input, and manufacturer recommendations. This includes ceiling access panels.

E. The engineering design guidelines and specifications apply to all project types. Deviations will be allowed when approved in writing by the BJC Infrastructure Manager.

F. BJC engineering standard specifications are intended to be edited by the design engineer for each project. All revisions are to be tracked and presented to BJC during owner reviews. Revisions changing quality, cost, and similar considerations shall be reviewed with a BJC infrastructure representative.

G. Engineering calculations shall be made available for review upon request.

H. All drawings with floor plans shall include the following information:

1. Room names and numbers
2. Key plans
3. North and True North arrows
4. Column grid lines with labels
5. Scale bar

I. Investigate existing systems sufficiently to confirm available capacities for project requirements. Too often in the past incorrect assumptions have been made.

J. Field investigate and verify existing conditions. Do not rely solely on as-built/design drawings. Ensure routes for distribution systems have sufficient space available above ceilings and in chases.

K. Confirm equipment naming and numbering with facility maintenance representatives during design so information is accurate when controls submittal and installation work begins. No equipment shall have an ID that is a duplicate of equipment already in the field unless the project is to replace that equipment. In that case, the new ID can be the same as the old ID.

L. Review basis of design and allowable alternate manufacturers with the BJC Infrastructure Manager and facility maintenance representative.

M. Select new equipment sizes with spare capacity beyond the expected load to be reviewed with the BJC Infrastructure Manager and facility maintenance representative. A rule of thumb target is 20% spare capacity.

N. Coordinate and clearly identify systems designed with spare capacity for future use (ie plumbing mains for a building expansion).

O. Discuss the need for redundancy with the BJC Infrastructure Manager.

P. Some major infrastructure equipment such as air handlers, chillers, cooling towers, boilers, and generators are commonly purchased directly by BJC, coordinate with the BJC Infrastructure Manager. Similar intent applies to large lighting orders.

Q. Owner Furnished and Contractor Installed (OFCI) major equipment/products for BJC will be applied when possible to maintain and promote the economic buyer relationship with the vendor post warranty period. BJC will solicit and select the applicable vendor/preliminary product, issue PO and directly pay invoices for the applicable OCFI equipment/product. The engineer of record (EOR) and contractor will be responsible for all activities associated with such equipment/product typical to as if they procured (with the exception of stated Owner duties). This EOR and/or contractor responsibilities includes, but is not limited to: Design, engineering calculations, submittal approval, logistical coordination, storage, warranty coordination, startup labor/coordination and any other specifically assigned project responsibility directly with equipment/product suppliers identified. This direct responsibility assignment with the vendor specifically removes the Owner from the overall project related communication between EOR/contractor and vendors.

R. Coordinate the project commissioning requirements with the Infrastructure Manager during design.

S. It is the EOR's responsibility to include contractor's equipment commissioning/start-up requirements in the equipment specifications.

T. Project manuals are required for all projects. Specifications on drawings only is prohibited without permission from the Infrastructure Manager.

U. Rooms that are intended to function 24/7 shall not be served by air handling equipment that is intended to function part of the time in a set-back mode. (ie air handler with night setback serving a pharmacy that needs to maintain specific temperature and pressure 24/7).

V. Coordinate infrastructure equipment that require dedicated rooms such as emergency power, medical gas equipment, etc.

W. Coordinate the need for detailed construction phasing drawings with the Infrastructure Manager.

X. Coordinate seismic anchorage and restraint code requirements for all MEP systems.

Y. Coordinate and clearly identify space intended for the installation of future equipment.

Z. Coordinate methods and pathways for getting equipment into final locations.

AA. Design drawings are not allowed to be submitted with copyright restrictions. Refer to BJC's contracts for specific limitations.

BB. Provide riser/schematic/one-line type diagrams within drawings to summarize distribution systems and major equipment.

CC. All demolished equipment and systems shall be removed as part of the project scope. These items are not allowed to be abandoned in place unless BJC provides permission in writing.

DD. Coordinate all building wall, floor, etc. penetration requirements regarding fire protections and sealing requirements.

EE. Include capacity information for existing equipment and mains for tie-in and re-use purposes within the design drawings.

FF. Coordinate with other design team members for areas requiring careful special coordination (ie sloped waste piping above ceilings with large ductwork nearby, similar for banks of electrical conduit).

GG. Ensure all materials to be installed in return plenums meeting code requirements for material type and flame/smoke spread limits.

2.02 HVAC

A. Include an air balance diagram within the HVAC drawings. The diagram should include a high level analysis of supply, return, outside and exhaust air for the area of work and the HVAC equipment serving the area of work. The intent is to understand the building pressure impact each project may have.

B. Provide an air balance table in the drawing schedule sheets that includes each unique room type associated with a project that have air change, pressure, temperature and humidity requirements in the current version of the Missouri Hospital Code and FGI Guidelines (using the more stringent requirements). The table shall indicate required and design values for parameters including air changes, CFMs, room pressure, temperature and humidity.

C. Locate building ventilation intakes away from sources of contamination such as generator exhaust, building exhaust, plumbing vents, automobile exhaust, other sources of odor, etc. Separation distances shall follow code requirements as well as good practice where distances should be increased.

D. Coordinate controls design with JCI during design phase. Engineer is responsible for designing the controls sequences and schematics with JCI providing coordination input and assistance.

E. Confirm the equipment selected can achieve the desired design sequence and that the points listed can be viewed and controlled as needed in the Metasys system. Being able to view or change points at the specific equipment controller only is not acceptable unless coordinated with the BJC Infrastructure Manager during design.

F. Points lists shall be included on the design drawings and shall clearly identify whether the points are controllable or read-only. The table shall clearly identify points that are controllable or viewable only from the equipment controller.

G. UV lights are often desirable at new air handler cooling coils, review the need for these with the project Infrastructure Manager.

H. Typical chilled water coils shall be selected for 45°F entering water temperature, even if chiller plant is delivering slightly cooler water.

I. Select cooling coil sizes for a maximum of 450 feet per minute air velocity.

J. Select all coils with the number of rows and fins per inch to provide the ability for proper cleaning access.

K. Provide stainless steel drain pans and cooling coil casings in air handlers.

L. Typical heating hot water coils shall be selected for 140°F entering water temperature, even if boiler plant is delivering warmer water. The intent is to have the ability to utilize heat recovery equipment or high efficiency boilers as applicable.

M. Design distribution systems to optimize for low pressure drop and sizing.

N. Cooling tower capacities shall be designed with an 80°F wet bulb ambient temperature.

O. Coordinate the space sound criteria with the Infrastructure Manager and design team.

P. Coordinate room pressure monitor requirements with the Infrastructure Manager.

Q. Coordinate testing and balancing requirements with the Infrastructure Manager.

R. Design code compliant combustion air sources for spaces with fuel burning equipment.

S. Design emergency exhaust systems where code required (ie chiller mechanical rooms with refrigerant monitoring, MRI’s, etc)

T. Coordinate exhaust systems required to be dedicated (ie isolation rooms, hoods, etc.) versus combined (restroom and general exhaust).

U. Internal ductwork liner is not allowed unless approved by the Infrastructure Manager.

V. Coordinate distribution isolation locations with the project Infrastructure Manager and facility maintenance representatives.

W. Coordinate outside air measuring and control requirements for air handling equipment with the Infrastructure Manager. Ventilation air quantities need to be delivered during all occupied periods during both peak heating and cooling seasons.

X. BJC's preference is to utilize air handling equipment with draw-thru fan configurations. Consideration will be given to blow-thru air handlers when desaturation coils are specified. Coordinate equipment configurations with the Infrastructure Manager.

Y. Coordinate and document low temperature applications and design temperatures (ie operating room temperatures and resulting cooling coil demands).

Z. Coordinate security measures on HVAC systems with the project team (ie air devices in special rooms, security bars in ductwork to pharmacies, etc.)

AA. Coordinate special shielding measures and design requirements in shielded rooms such as MRI's and similar.

BB. Document equipment heat loads to rooms with specialty equipment and design HVAC equipment accordingly. Ensure equipment temperature and humidity requirements are achieved.

CC. Design systems with appropriate freeze protection measures such as heat tracing, coil pumps, etc.

DD. Ensure air handling equipment is selected to allow ventilation air to properly mix with return air to avoid air stratification in the air handler and resulting in nuisance trips on coil freeze-stats.

EE. Provide flexible connections and similar design elements for all rotating/vibrating equipment.

FF. Flexible ductwork serving air devices shall not exceed 6 feet in length or be kinked or compressed when installed.

GG. Coordinate HVAC zone sizes and configuration with the project team.

HH. Design for applicable water treatment measures, coordinate requirements with project team.

II. Design building entrances and vestibules with sufficient heating/cooling and pressurization measures to avoid excessively cold or hot building entrances.

JJ. Coordinate if building smoke control or stair pressurization is required.

KK. Coordinate steam sources for humidification with the project team. Ensure the steam source is suitable for the humidification application.

LL. Provide stainless steel ductwork near duct mounted humidifiers to avoid duct corrosion issues. Provide a piped drain from this ductwork to a suitable drain location.

MM. Coordinate and document means for drain pan overflow protections.

NN. Coordinate drain pan trap heights required are achievable with the installed equipment heights. Design equipment supports and housekeeping pads accordingly.

OO. Ensure all motor selections are based on non-overloading operational curves.

PP. Coordinate pipe and duct routing to avoid certain types of rooms, ie electrical rooms, IT rooms, etc.)

QQ. Provide code required fan shutdown and damper isolation upon detection of smoke.

RR. Coordinate the location of fire and smoke dampers for different partition/barrier types with project team.

SS. Provide code required emergency shutdown measures for equipment such as boilers.

TT. Coordinate with project architect regarding rooms that have special pressurization requirements. These types of rooms should be designed to have full height walls with drywall running up to the underside of the floor or roof above. Seal walls to deck in a code approved manner.

UU. Provide air valve type air volume control for rooms with critical pressurization requirements such as compounding pharmacies, negative isolation rooms, OR rooms, etc.

VV. Provide exhaust discharge heights and velocities required for specialized types of exhaust.

WW. Coordinate and identify special operations or failure positions upon loss of equipment or building automation power within the design documents.

XX. Piping system design must address thermal expansion control.

YY. Ductwork designs must prevent the transmission of audible speech between rooms through ductwork and ceiling plenums (ie duct takeoffs 180° apart serving different rooms).

ZZ. Bottom and top duct taps should be avoided when possible.

AAA. Duct taps shall not be installed on elbows or within one duct diameter of a elbow or reheat coil.

BBB. VAV boxes shall be selected in standard sizes, maximum of 16” round inlet.

CCC. Where multiple medium pressure taps occur on a branch line manual balance dampers shall be installed at the tap.

DDD. Medium pressure ducts serving multiple VAV boxes shall not terminate directly into the last VAV box. All taps shall be off the side of the duct.

EEE. Do not use spin in taps for duct takeoff’s. Use Shoe taps.

FFF. Ductwork shall be larger than the largest tap off of it such that the lip on the tap is within the depth of the duct.

GGG. Air handlers with fan array designs shall have VFDs provided for each fan and designed to be controlled through the building automation system, not through a factory provided controller. Each fan shall have a non-motorized backdraft damper to prevent airflow when not in operation.

HHH. Check for air change reduction variance when evaluating operating room existing operating conditions and airflows. Project design shall be based on code required airflows, not based on variance airflows.

2.03 PLUMBING AND MEDICAL GASES

A. Include a table in the construction drawings that indicates the medical gases and number of outlets provided for the typical room types, comparing to code minimum requirements.

B. Coordinate plumbing fixture selections and associated trim with the design team and Infrastructure Manager. Identify low flow applications intended for the project.

C. Coordinate distribution isolation locations with the project Infrastructure Manager and facility maintenance representatives.

D. Coordinate domestic hot water recirculation design and expected time to temperature for fixtures with the project team.

E. Coordinate emergency wash fixture locations, type, drains and methods of temperature control with the project team.

F. Provide drain clean outs at code required distances, coordinate cover locations with the design team, Infrastructure Manager, and facility maintenance representatives.

G. Coordinate fixture drain locations with structural components and architectural design (ie water closet waste landing on a beam underneath floor).

H. Coordinate design intent for drain trap seal protection measures (ie trap primers, deep seal traps, etc).

I. Size floor drains and piping to appropriately handle the potential water discharge into them (ie backflow preventers, linear accelerator city water cooling configurations, laundry, equipment blowdown, etc).

J. Coordinate all plumbing wall thicknesses and chase sizes with architect.

K. Provide flexible connections and similar design elements for all rotating/vibrating equipment.

L. Coordinate wall hung versus floor support fixtures with the project team.

M. Provide hose bibbs and connections at building exterior walls and roofs. Coordinate locations with the project team.

N. Ensure all motor selections are based on non-overloading operational curves.

O. Coordinate rooms that require floor drains for code and project team requirements.

P. Coordinate pipe routing to avoid certain types of rooms, ie electrical rooms, IT rooms, etc.)

Q. Coordinate and identify mixing valve design intent for locations, temperatures and recirculation considerations.

R. Coordinate and identify locations and type of backflow preventers and vacuum breakers required for the project.

S. Coordinate design intent when a project requires the use of special waste systems such as grease interceptors in kitchens and other specialty type spaces.

T. Design documents shall require all plumbing piping dead legs to be removed as part of the construction scope. All piping systems being demolished should be taken back to the next active branch or main.

U. Coordinate appropriate piping materials with the project team for special applications such purified water distribution, laboratory waste piping, etc.

V. Coordinate measures necessary for protecting waste systems from concerns such as high temperature drainage (ie boiler blowdown), corrosive waste, etc.

2.04 ELECTRICAL AND LOW VOLTAGE

A. Lighting Design – Request the latest version of BJC's Lighting Design Standard prior to design.

B. Follow life safety code requirements for separation of emergency power branches.

C. Power for controls system shall match the power branch to the equipment each controller serves (ie normal vs. emergency).

D. Coordinate motor starters, disconnects and VFDs for all powered equipment. Provide a table in the design drawings summarizing design intent.

E. Coordinate generator exhaust locations so that ventilation intakes will not draw in exhaust air.

F. Coordinate equipment and systems that are to be connected to an emergency power or UPS source, review with the project team.

G. Coordinate design with the WU/BJC Low Voltage and Spaces Standard. Refer to 102.204 Low Voltage Electrical Guideline.

H. Coordinate electrical scope responsibilities for equipment that is to be assembled on site, such as air modular handlers that are assembled on site that have power and lighting that require field connections.

I. MC Cable shall be allowed in MOB's for branch wiring but must be run in an organized manor and supported properly.

J. MC Cable used in I2 occupancy shall have a separate shielded ground within the MC (hospital grade). It will only be allowed as whips to light fixtures from junction boxes not greater than 5 feet in length.

K. Aluminum conductors are acceptable on feeders greater than 200Amps.

L. Power for BAS controls are to be at the same level of reliability as the power for the equipment they serve. If the equipment is on Generator the controls serving it are to be on generator.

2.05 FIRE PROTECTION

A. Coordinate fire sprinkler design intent with the project team, especially regarding applications requiring special systems such as dry-type systems, kitchen hood systems, waterless systems for areas with sensitive equipment, etc.

B. Coordinate integration with existing fire protection systems and address the possibility of new work requiring un-intended full building upgrades.

C. Sprinkler piping must not rest on or touch any other system except where sprinkler heads are mounted.

PART 3 - DOCUMENTATION

3.01 GENERAL

A. Provide a documented response addressing the design intent for all items in this design guide. Provide sources and excerpts of codes as verification for a response if applicable.

PART 4 - SUPPORTING INFORMATION

4.01 GENERAL

A. Not used.

END OF DOCUMENT

RESPONSIBILITY MATRIX

The following matrix identifies those individuals, roles or departments responsible for maintaining the accuracy of the information and those responsible for providing input. Refer to Preface for detailed explanation.

	BJC HealthCare													Hospital/Entity				
	PD&C																	
	Corporate Architect	Corporate Engineer	Director of Planning	Director of Design	Director of Construction	Other:	Clinical Asset Management (CAM)	Risk Management	Real Estate	Ergonomics	Infection Prevention (IP)	Info Systems, Data, Telecom (IS)	Other:	Standards Review Committee	Facilities Engineering	Housekeeping	Security	Other:
Primary Authorship	☐	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Secondary Authorship	☒	☐	☒	☒	☒	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

DOCUMENT REVISION HISTORY

The following able indicates the date the document originated and any subsequent revisions.

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