**Appendix A: CHD Exam Blueprint**

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| ***HVAC Designer Certification Exam Blueprint***  **HVAC Design: Level I HVAC Design: Level II** | | Complexity Level and Number of Items | | | |
| Recall | Application | Analysis | *TOTALS* |
| ***1. SYSTEM DESIGN*** | | **8** | **24** | **8** | **40** |
| A. Size supply, return, and exhaust ducts. | |  |  |  |  |
| B. Prepare HVAC zoning plans and sensor locations in accordance with building design. | |  |  |  |  |
| C. Prepare control sequences and schematics. | |  |  |  |  |
| D. Design ductwork and piping including shaft and ceiling space requirements. | |  |  |  |  |
| E. Differentiate and design HVAC system types (e.g., variable air volume, VRF, radiant, thermal storage, underfloor systems, perimeter and process systems). | |  |  |  |  |
| F. | Design HVAC flow diagrams. |  |  |  |  |
| G. Design duct and fluid systems to minimize pressure loss and resultant power requirements. | |  |  |  |  |
| H. Select HVAC system based on calculations (e.g., AHUs, fans, pumps, chillers, cooling towers). | |  |  |  |  |
| I. Design proper air diffusion and devices following codes and standards. | |  |  |  |  |
| J. Develop a detailed HVAC design based on the approved preliminary building design concept and site information. | |  |  |  |  |
| K. Prepare HVAC schematics, plan drawings, elevation views, section views, and installation details. | |  |  |  |  |
| L. Select diffusers and grilles to meet thermal comfort and ventilation needs and coordinate with architectural plans (e.g., ceiling grid, under floor systems, sidewalls, architectural specialties, transfers). | |  |  |  |  |
| M. Evaluate proposed building design concept modifications for HVAC implications. | |  |  |  |  |
| N. Integrate new system technologies into HVAC design (e.g., VRF, ECM motor control, integrated automation). | |  |  |  |  |
| O. Research and confirm capacities of existing equipment and obtain shop drawings of existing equipment (e.g., air handling systems, chillers, cooling towers). | |  |  |  |  |
| P. | Prepare HVAC demolition drawings of the equipment and systems that must be moved or relocated to accomplish retrofit. |  |  |  |  |
| Q. Recommend system design options to minimize machine or system down time (e.g., N+1, 2N, fan array, direct drive fans, VRF). | |  |  |  |  |
| R. Recommend system configurations to facilitate future maintenance (e.g., system access, coil pull space, motor replacement, safety concerns). | |  |  |  |  |
| S. Design for balancing air and fluid systems (e.g., balancing dampers, balance valves, self-balancing control valves). | |  |  |  |  |
| T. | Prepare ductwork and piping flow diagrams to convey the design intent  (e.g., primary/secondary systems, pumping and isolation systems, duct loops,  exhaust risers with sub-ducts). |  |  |  |  |

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| U. Design piping and ductwork layout based on calculated sizing and required routing. |  |  |  |  |
| V. Select expansion tanks. |  |  |  |  |
| W. Select major airside units. |  |  |  |  |
| X. Size major heating plant components. |  |  |  |  |
| Y. Design leak detection systems. |  |  |  |  |
| Z. Select major cooling plant components: |  |  |  |  |
| 1. fans. |  |  |  |  |
| 2. coils |  |  |  |  |
| 3. piping. |  |  |  |  |
| 4. pumps. |  |  |  |  |
| ***2. DESIGN CALCULATIONS*** | **6** | **6** | **18** | **30** |
| A. Calculate HVAC system requirements (e.g., water flows, airflows, pump heads, suction heads, expansion compensation). |  |  |  |  |
| B. Assist in the preparation of project estimates for comparative system selection (e.g., installed cost, operating cost, space limitations, water availability, power requirements). |  |  |  |  |
| C. Calculate all piping and ductwork sizing based on flow rates received from the project engineer and adapted in size and route to comply with the existing physical constraints. |  |  |  |  |
| D. Adjust thermal load or HVAC requirement estimates based on modifications to building. |  |  |  |  |
| E. Calculate head loss through the critical path. |  |  |  |  |
| F. Calculate heat loads for each assigned space in the building. |  |  |  |  |
| G. Calculate the building load heat loss and gain. |  |  |  |  |
| H. Calculate external static and total pressures for air distribution units and specify in the equipment schedule. |  |  |  |  |
| I. Calculate ventilation rate requirements by space use, thermal comfort parameters, and air quality per applicable codes and standards. |  |  |  |  |
| J. Design piping system to account for various fluid properties (e.g., freeze protection, fluid expansion compensation, fluid density, transfer capacity). |  |  |  |  |

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| ***3. PROCEDURAL*** | **4** | **6** | **0** | **10** |
| A. Analyze buildings, building designs or HVAC plans for compliance with applicable codes, standards and regulations. |  |  |  |  |
| B. Apply Building Information Modeling (BIM) standards throughout drawing production. |  |  |  |  |
| C. Review shop drawings and equipment submittals for compliance with contract documents. |  |  |  |  |
| D. Interpret design documents during bidding/tender and construction phases. |  |  |  |  |
| E. Review and comply with HVAC codes and standards. |  |  |  |  |
| F. Verify and document as-built field conditions for existing structures. |  |  |  |  |
| G. Verify and document as-built field conditions for projects in construction. |  |  |  |  |
| H. Perform periodic field investigations to (e.g., punch-lists, quality control, shop drawings). |  |  |  |  |
| I. Perform review of Request For Information (RFI) and incorporate into bidding/tender documents. |  |  |  |  |
| J Prepare HVAC documentation for building permit application and coordinate with Authority Having Jurisdiction (AHJ). |  |  |  |  |
| K. Incorporate field “as-built” documents into final documents. |  |  |  |  |
| ***4. COORDINATION*** | **8** | **12** | **0** | **20** |
| A. Assist in the development of the Basis of Design. |  |  |  |  |
| B. Review HVAC drawings with Commissioning Authority. |  |  |  |  |
| C. Coordinate space requirements for HVAC equipment placement with other design team members. |  |  |  |  |
| D. Modify the HVAC design documents concept based on the outcome of the design team reviews. |  |  |  |  |
| E. Coordinate system expansion compensation design with structural engineer and piping vendor (e.g., thrust blocks, expansion joints, anchor points). |  |  |  |  |
| F. Analyze architectural plans, sections, and elevations for use in HVAC design. |  |  |  |  |
| G. Comply with client specifications and performance requirements to determine mechanical designs. |  |  |  |  |
| H. Collaborate in the development of HVAC systems and design parameters. |  |  |  |  |
| I. Review architectural life safety plan relative to mechanical plan and apply fire and smoke damper requirements. |  |  |  |  |
| J. Coordinate with life and safety engineer to design the smoke management and ventilation system per fire code and regulation. |  |  |  |  |
| K. Coordinate with other design team members during each design phase (e.g., architects, structural designers, plumbing designers, electrical designers). |  |  |  |  |

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| L. Coordinate HVAC implications for the building electrical loads and electrical space mechanical requirements with electrical design team members. |  |  |  |  |
| M. Coordinate with structural engineer for HVAC requirements (e.g., duct and piping runs, anchorage, seismic bracing, sound isolation, support requirements, vibration). |  |  |  |  |
| N. Coordinate with project design and construction schedules. |  |  |  |  |
| O. Coordinate electrical requirements for HVAC equipment. |  |  |  |  |
| P. Coordinate requirements of HVAC system for domestic water and waste with plumbing designer. |  |  |  |  |
| Q. Coordinate with acoustical engineer for selection of ventilation equipment including sizing of ventilation distribution and air handling equipment to meet designated sound pressure levels. |  |  |  |  |
| R. Coordinate with energy modeler for HVAC system input. |  |  |  |  |
| S. Coordinate site piping and utility requirements with civil engineer. |  |  |  |  |
| T. Coordinate with vendors to prepare equipment schedules. |  |  |  |  |
| U. Review drawings and identify potential obstructions that may impact the HVAC system (e.g., structural, fire proofing, lighting, sprinklers, walls). |  |  |  |  |
| ***Totals*** | **26** | **48** | **26** | **100** |