SECTION 23 37 11
REAR DOOR HEAT EXCHANGERS (CHILL DOORS)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and deliver materials, tools, equipment, and services for Chill Doors Units, as indicated in project schedules on attached drawings, in accordance with provisions of Contract Documents, deliver to Brookhaven National Lab (BNL) storage facility and place into storage.

B. Prepare submittals.

C. Field services including assisting BSA with installation, start-up, testing, commissioning, and train Brookhaven Science Association (BSA) staff.

D. Installing contractor (BSA) to coordinate with work of other trades.

1.2 OWNER FURNISHED/OWNER INSTALLED (OF/OI) EQUIPMENT

A. Equipment specified in this section under Part 2 PRODUCTS shall be furnished by Brookhaven Science Association (BSA) and installed by BSA.

B. BSA shall procure, review and approve submittals, review and/or witness factory testing, and receive shipment and place the equipment either into a temporary storage facility on BNL's campus. BSA shall take equipment out of storage, deliver to project site, and place directly to its final permanent location on a server rack.

C. The equipment supplier shall prepare submittals for BSA review, manufacture and assemble, factory test, deliver to BSA's storage facility, assist BSA with placement into storage and assist BSA with installation, start-up, testing, commissioning, and train BSA staff.

D. BSA shall provide Contractor with a copy of the approved submittals.

E. BSA shall coordinate installation on server rack and set level for equipment anchoring.

F. BSA shall obtain equipment from BSA's storage location, deliver to site and install.

G. BSA shall protect equipment while in BSA's storage location until placement of chill doors into the Data Hall.

H. BSA shall provide fasteners, supports, or other miscellaneous items, not provided by BSA's procurement, necessary for a complete installation.

I. BSA and/or factory authorized representative shall inspect and/or field test equipment and confirm that the equipment is suitable for connection.

J. BSA, with equipment supplier support, shall connect and place the equipment into operation.

K. BSA, with equipment supplier support, shall provide acceptance testing.

L. BSA, with equipment supplier shall support commissioning.

M. Contractor shall also provide support of the infrastructure in terms of supporting chill door acceptance testing and commissioning.

N. Contractor shall protect equipment from time of equipment placement to permanent location until building occupancy.

O. Contractor shall label equipment.

1.3 SECTION INCLUDES

A. Chill doors for mounting on computer racks with hinges to allow for access.

1.4 DESIGN AND PERFORMANCE CRITERIA

A. Rear Door Heat Exchangers (Chill Doors):
   1. This specification describes an active door cooling system for standard or custom data processing server racks, suitable for connection to a closed loop chilled water.
   2. The chill door system shall not require containment, hot or cold aisles, or require any additional space air conditioning to perform its function of removing 100% of the server-generated sensible heat.
   3. The cooling shall be achieved by 100% sensible heat exchange between the hot air leaving the servers and chilled water flowing through an extended surface heat exchanger mounted in the door.
   4. The chill door shall include a finned coil, low noise fans with EC (Electronically Commutated) motors, hinged stainless steel access door to all components, and a provision for a local HMI screen or plug for a remote monitor and provide remote monitoring and control functionality thru an Ethernet connection on each door.
   5. The temperature or pressure based controls shall sense the leaving room or server discharge air temperature and shall adjust the fan speed in direct proportion to the load, thereby saving energy on any partial load condition, while maintaining the room air temperature.
   6. The chilled water control valve shall be reset to maintain a room temperature based on a setpoint of 75 deg F (adjustable).
   7. The chill door shall not require a minimum load. Room neutral air shall be drawn through the servers and through the coil where it is cooled to room temperature. The neutral air is then discharged back to the room to the aisle in a manner that is not disruptive or uncomfortable to operators.
   8. The door controls shall control a 2-way valve fitted in the chilled water supply line supplied by the door manufacturer. The standard control band shall be adjustable to maintain close control of the data center room temperature while cooling the servers.
   9. The chill door shall be complete in all respects, including all components, wiring and controls. The chill door shall be contained in high-quality sheet metal housing, with stainless steel removable fan access panel and finished in baked epoxy powder paint.
   10. The complete assembly shall be tested & approved by ETL, in accordance with UL 1995 and CSA C22.2 236-06 safety standards, and shall be CE certified in accordance with EN ISO 17050-1:2004
   11. The chill door shall meet these specified performance requirements without deviation, and shall be manufactured in the USA or 'Buy American Act-Construction Materials under Trade agreements FAR 52-225-11." Spare parts shall be readily available for shipment in North America.

1.5 SUBMITTALS

A. Follow Section 01 33 00.

B. Product Data:
   1. Manufacturer's catalog sheets, specifications, including the following:
      a. Operating weights and dimensions of all unit assemblies.
      b. Performance data including sensible cooling capacities, total supply airflow rates, chilled water flow rates, noise levels in octave bands, air and water side pressure losses.
      c. Chill Doors Performance requirements:
         1) Rated cooling capacity
         2) Design cfm
         3) Entering chilled water temperature
         4) Leaving chilled water temperature
         5) Data Hall design temperature
         6) Estimated power draw for active chill door
         7) Electrical service (v/phase/Hz)

d. Construction details including manufacturer's recommendations for installation, mounting, and connection.
    1) Chill Door:
        a) Powder coated metal enclosure and local LED status indicator with 3 color codes.
        b) Chilled water aluminum or powder coated steel frame coil
        c) 2-way control valve
        d) EC fans & motors
        e) Local microprocessor controls and instrumentation
        f) Flex hose and screwed female connection fittings
        g) Leak prevention system leveraging 2-way valve isolation and leak tape

C. Informational Submittals:
    1. Manufacturer's Installation Instructions.
    2. Operation and Maintenance Data: Include assembly views, lubrication instructions and replacement parts list.

1.6 QUALITY ASSURANCE

A. Test and certify units in accordance with European standard EN 15116 for active chilled doors.

1.7 DELIVERY, STORAGE AND HANDLING

A. Protect and clean units before, during, and after installation. Damaged material due to improper site protection shall be cause for rejection.

1.8 WARRANTY

A. Provide full parts and labor manufacturer warranty to include all parts, labor, travel time, and incurred expenses. Warranty to cover from date of start up to date of substantial completion, plus an additional 24 month full parts and labor manufacturer warranty from date of substantial completion.

B. Provide optional 3-year extended warranty from date of delivery.

C. Provide any software updates within either of the warranties listed above.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Chill Doors
    1. Motivair
    2. USystems - Qcooling/Coldlogik
    3. Vertiv

2.2 BASIC COMPONENTS

A. Coils:
    1. Factory leak test coils with air under water.

B. Valving: Each chill door shall have a shut-off valve and configured for pressure independent control with flow sensor prior to connection to door.

2.3 CHILL DOOR

A. Powder Coated Metal Enclosure:
    1. The chill door shall be enclosed in a structural welded frame capable of supporting all the required components and suitable for attachment to the rear aperture of any industry standard server rack.
    2. The enclosure shall include an internal coil protection grill with 94% minimum open area and external perforated screens for fan discharge.
    3. Enclosure shall contain LED status indicators to alert staff to any alarm.

4. The Owner's current server racks are APC racks and chill door bid should be based on mating with the existing APC racks.
    a. Each chill door shall be supplied with an adapter frame (Interface Frame) with a hinged connection to allow for simple accessibility to all racks by one person.
    b. Adaptor frame shall be supplied to prevent 'racking' of the server racks and to fully support the door in the open position.
5. The door when fully open shall allow unobstructed access inside the rack and shall not hit adjacent doors when open. The active door and frame shall be prepared, primed and finished in a black or white baked epoxy powder.
6. Provide seal between adaptor frame and server rack and chill door and adaptor frame to minimize infiltration airflow to the coil.

B. Chilled Water Coil:
1. The chill door cooler shall be fitted with an extended surface chilled water coil with plain copper tubes and corrugated aluminum fins. The coil shall be designed to remove 100% of the sensible server heat when provided with the specified chilled water flow.
2. The coil in/out headers shall be located at the bottom or top of the coil and shall allow for flexible hose connection with chilled water hoses.
3. The headers shall also contain vents for the purpose of removing accumulated air from the coils.
4. Coil frame shall be manufactured with aluminum to prevent the formation of zinc whiskers.

C. 2-Way Control Valve:
1. Valve shall be a Fail Safe Modulating Control Valve which provides proportional control of chilled water in commercial applications.
2. On a power failure, the valve shall drive the valve to its failsafe position, fully open.
3. The valve shall use a microprocessor-controlled, low voltage stepper motor with a super-capacitor-based power supply that stores sufficient power to drive the valve to its fail safe position when 24V power is removed from the actuator.

D. Fans and Motors:
1. The active rear door shall be complete with up to five (5) low-noise centrifugal fans, each with its own close-coupled 230/1/60 motor requiring no greater than 168 watts of power each.
2. Fan motors shall be EC design and independently powered for variable speed operation and rated for a minimum protection of IP 54 for indoor application.
3. Fan/motor assemblies shall be designed for easy access and shall allow for any fan/motor to be safely isolated & "hot swapped" in service while the others remain operational.
4. Provide input power cord with a type C14 2-pole, 3-wire and grounding plug.

E. Microprocessor Controls and Instrumentation:
1. Electronic, microprocessor based. Provide compatible communication protocol (BACnet, Modbus, etc) to work with Owner supplied Nlyte DCIM software to monitor-report on each chill door.
2. The chill door operation shall be controlled and monitored by a plug-in, fully integrated, re-programmable microprocessor.
3. The microprocessor shall control all functions of the chill door and shall monitor all operating parameters including chilled water inlet & outlet temperature, entering and leaving air temperature.
4. Provide current transformers and voltage taps to monitor input current, voltage, power (kW), apparent power (kva) and energy (kWh) for remote monitoring by the BAS and DCIM systems for PUE calculations.
5. The entire control system shall be accessible and mounted on the door. The controls shall be suitable for connection to a central control system for remote control & alarm access.

6. Built in Ethernet interface allows remote communication through BACnet or Modbus® over TCP/IP and optional addition of SNMP. Integrated fieldbus/BMS connectivity. MicroUSB interface for data backup/load. The active chill door shall provide data remotely up to 330 points within the door and be adjustable when merged with BMS and DCIM systems.
7. An adjustable alarm shall be provided for all critical functions. In the event of any alarm condition, the microprocessor shall display a code for the alarm condition; the alarm conditions as a minimum shall be:
    a. High leaving air temperature.
    b. Low leaving air temperature.
    c. High server discharge air temperature.
    d. High rack entering temperature.
    e. High/Low chilled water supply temperature.
    f. Memory failure.
    g. Electrical line noise.
    h. Input voltage out of range.
    i. High ambient temperature.
    j. Leak detection alarm.
    k. Total fan power monitored and passed to DCIM for continuous PUE calculations.
    l. Common alarm output.

F. Flex Hose Connections:
1. Each chilled door shall be equipped with a pair of flex hose connections as detailed on the drawings and schedule.
2. The hose shall be 1 IN diameter and suitable for the specified flow and pressure drop. Hose construction shall be black nitrile synthetic rubber (Class A - Oil Resistant) with black Chemivc™ synthetic cover.
3. Reinforcement shall be spiral plied synthetic fabric with wire helix. The hose shall be temperature rated at -40 DEGF to 200 DEGF. They shall be rated at 250 psi max and pressure tested twice prior to shipment.
4. The hose shall have a bend radius of 1 IN. The hose shall be fitted with an external stainless steel braided cover for additional protection against accidental damage.
5. The hose shall have a 1 IN female connection socket pre attached for connection to door and manifold system.

G. Leak Prevention System:
1. The chill door shall isolate the door in the event of leak detection.
2. Upon leak detection alarm within the door's controls the 2-Way valve will be driven to a closed position.
3. In the event of 2-Way valve isolation the chill door shall adjust fan speed accordingly up to 100% fan speed.
4. All chill doors shall collectively control the ambient room temperature in any failure scenario maintaining a constant server inlet air temperature.

H. Control Logic:
1. Fans shall be controlled by server leaving air temperature.
2. Two way valve shall be controlled by leaving air temperature.
3. Override control via ambient air temperature or entering rack temperature.
4. Customer shall have option to control via differential pressure if sealed racks will be used.

PART 3 - EXECUTION

3.1 INSTALLATION

A. BSA shall install chill doors in accordance with manufacturer's written instructions and recommendations.

B. Coordinate left or right handed location of doors with drawings.

C. All chill doors shall be protected by a protective film over painted surfaces during construction. Seal pipe ends and ducts connection with plastic covers during installation.

D. Before connecting supply water system to the beams, contractor shall flush the piping system to assure that all debris has been removed.

E. Perform connection of chill doors to the chilled water circuit by hard connection using screwed connections.

3.2 STARTUP SERVICE

A. Provide manufacturer's factory-trained and factory-employed service technician for a minimum of one day to startup, test, check and adjust chill door units.

B. Technician shall perform the following steps as a minimum:
   1. Check unit installation.
   2. Energize the units.
   3. Verify correct voltage, phases and cycles.
   4. Energize motor briefly and verify correct direction of rotation.
   5. Start the units.
   6. Test twenty percent (20%) of chill doors for performance within design rating parameters.
   7. Make adjustments as required.

3.3 OPERATING TRAINING

A. Provide training of the owner's personnel. Cover startup, shutdown, general maintenance and troubleshooting. Review operating and maintenance manual and familiarize personnel with control panel, control communications including its special features and capabilities.

B. Provide a minimum of 12 hours of training for owner's personnel by manufacturer's factory-trained and factory-employed service technician at the BNL campus.

C. Training shall include control panel, hot-swapping of fans, etc., operation and maintenance requirements.

D. Training shall include startup and shutdown procedures as well as regular operation and maintenance requirements.

3.4 DOCUMENTATION

A. Provide Installation, Operation & Maintenance Manual(s) in each unit's control panel door. Provide six additional copies for owner's project system manual.

B. Provide six copies of Spare Parts Manual for owner's project system manual.

3.5 ACCEPTANCE TESTING

A. Support acceptance testing.

3.6 COMMISSIONING

A. Supplier shall provide all levels of support for install, start-up and system commissioning. Time of installation to be coordinated with the Owner.

B. Supplier to provide local preventative maintenance support in US market and offer optional (customer registration required) 24/7/365 emergency support program.

END OF SECTION