

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 DIVISION 15 - MECHANICAL

2
3
4 SECTION 15000 -- GENERAL MECHANICAL PROVISIONS

5
6
7 GENERAL

8
9 The General Conditions, Special Conditions, Supplemental Conditions,
10 Instructions to Bidders, and other Contract Documents apply to this
11 branch of the work as well as to the other branches.
12

13 Provide the materials (piping, wiring, conduit, equipment, equipment
14 accessories, etc.) and labor necessary for complete and functioning
15 mechanical systems. The Drawings and Specifications are intended to
16 indicate complete working systems. Provide complete and properly
17 working systems, even if all materials and labor necessary to
18 achieve this are not specifically shown on the Drawings or
19 specified.
20

21 The Contractor shall familiarize himself with the work of all other
22 trades, general type construction, and the relationship of his work
23 to other sections. He shall examine all working drawings,
24 specifications and conditions affecting his work. The Contractor
25 shall visit the premises and thoroughly familiarize himself with all
26 details of the work and working conditions, verify all dimensions in
27 the field and advise the Engineer of any discrepancy before
28 fabricating or performing any work.
29

30 The work shall include complete testing of all equipment, piping and
31 ductwork at the completion of the work and making any minor
32 connection changes or adjustments necessary for the proper
33 functioning of the system and equipment.
34

35 Perform any necessary temporary work during construction.
36

37 Work under this section shall conform to governing codes, ordinances
38 and regulations of the City, County and State.
39

40 The Contractor shall be responsible for any errors in fabrication,
41 for the correct fitting, installation and erection of the various
42 mechanical systems.
43

44
45 ALLOWANCES

46
47 See "Special Conditions" to see if for any applicable Allowances.
48
49

50 YEAR 2000 COMPLIANCE

51
52 Contractor represents and warrants that all computer-controlled
53 facility (CCF) components, as herein defined and supplied by
54 contractor or otherwise incorporated into the work (whether as new
55 construction or as modifications, repairs or upgrades to/of existing

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 CCF components) are or will be four-digit year 2000 compliant, as
2 defined. Contractor must verify compliance by physical testing or
3 written confirmation from the component or systems manufacturer and
4 provide test copies or confirmations to the owner prior to
5 substantial completion.
6

7 "Computer-controlled facility component" shall mean all systems
8 components, products or modules utilizing software-driven or
9 embedded microchip technology. This shall include, but not be
10 limited to, programmable thermostats, heating, ventilation and air-
11 conditioning controllers, auxiliary elevator controllers, utility
12 monitoring and control systems, fire-detection and suppression
13 systems, alarms security systems and any other facilities control
14 systems utilizing microcomputer, minicomputer or programmable logic
15 controllers.
16

17 "Year 2000 component" or "four-digit year 2000 compliant" shall mean
18 that each CCF component—both individually and when working with
19 other parts of a system—must, at a minimum, meet the following when
20 use before, on or after Jan. 1, 2000:
21

22
23 Accurately interpret, recognize, calculate, compare, sequence,
24 store, retrieve, display, transmit and otherwise accurately
25 process and act on all date information.
26

27 Experience no crash, interruption, degradation of performance
28 or requirement for human intervention as a result of
29 processing or acting on date information.
30

31 Correctly recognize and handle all leap years and calendar
32 logic.
33

34 Structure and store date data in a format to accommodate the
35 four-digit range.
36

37 Provide all necessary interfaces or other appropriate means
38 for assuring that non-compliant date data are automatically
39 corrected before entering or leaving the system.
40

41 If an owner discovers that any CCF component is not compliant, then
42 at that time, or at any later time, the owner may require the
43 contractor to provide all labor, materials and equipment necessary
44 to bring any non-compliant CCF component into compliance, at no cost
45 to the owner, within 60 days of notice of the noncompliance. A
46 contractor's warranty regarding year 2000 compliance for any and all
47 CCF components supplied by the contractor, or for which the owner is
48 not specifically responsible under the terms of this contract, shall
49 survive termination of this contract and shall remain in full force
50 and effect during the useful life of that portion of the work
51 containing or affected by such CCF components.
52

53 The contractor shall be liable to the owner for any and all direct
54 or consequential damages incurred as a result of any breach of this
55 warranty. The remedies provided in this section shall be available

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 to the owner notwithstanding any contrary provision in any other
2 part of this contract. No limitation shall apply to this section
3 unless the limitation or change is made directly to this section.
4 The remedies provided in this section are in addition to all other
5 remedies provided by law or elsewhere in this contract.
6
7

8 COORDINATION BETWEEN TRADES

9
10 Demand and examine all Drawings and Specifications pertaining to the
11 construction before installing the work described and shown under
12 these Drawings and Specifications. Cooperate with all other
13 Contractors in locating piping, ductwork, conduit, openings, chases
14 and equipment in order to avoid conflict with any other Contractor's
15 work. Give special attention to points where ducts or piping must
16 cross other ducts or piping and where ducts, piping and conduit must
17 fur into the walls and columns. All work installed above a lay-in
18 ceiling must be coordinated and installed so there is a minimum of 4
19 inches between the top of the ceiling grid and the bottom of the
20 installation.
21

22 Make known to other trades intended positioning of materials and
23 intended order of work. Determine intended position of work of
24 other trades and intended order of installation.
25

26
27 DISCREPANCIES

28
29 If any discrepancies occur between the accompanying Drawings and
30 these Specifications and Drawings and Specifications covering other
31 Contracts, report such discrepancies to the Architect/Engineer far
32 enough in advance so that a workable solution can be presented. No
33 extra payment will be allowed for relocation of piping, ductwork,
34 conduit and equipment not installed in accordance with the above
35 instructions, and which interferes with work and equipment of other
36 Contractors.
37

38
39 EXISTING PIPE AND SERVICES

40
41 Existing piping and services are located as accurately as possible
42 from available information, but it shall be the Contractor's
43 responsibility to locate, determine exact elevations and make
44 required connections to such lines and services in manner approved
45 by the Architect/Engineer.
46

47 Maintain in operating condition active utilities encountered in the
48 utility installation. Repair to the satisfaction of the Architect/
49 Engineer and the Owner any surface or subsurface improvements
50 damaged during the course of the work, unless such improvement is
51 shown to be abandoned or removed.
52
53

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 CONTINUOUS OPERATION AND CUTOVER

2
3 To facilitate the continuous operation of the existing utilities, no
4 utility service shall be tapped into without prior notification of
5 48 hours to and approval received from the designated authority of
6 the utility company.
7

8
9 ASBESTOS

10
11 See "Special Conditions" for details on this subject.
12
13

14 ACCESSIBILITY

15
16 Install equipment and materials to provide required access for
17 servicing and maintenance. Coordinate the final location of
18 concealed equipment and devices requiring access with final location
19 of required access panels and doors. Allow ample space for removal
20 of all parts that require replacement or servicing.
21

22 Extend all grease fittings to an accessible location.
23
24

25 ROUGH-IN

26
27 Verify final locations for rough-ins with field measurements and
28 with the requirements of the actual equipment to be connected.
29
30

31 MECHANICAL INSTALLATIONS

32
33 Coordinate mechanical equipment and materials installation with
34 other building components.
35

36 Verify all dimensions by field measurements. Field verify existing
37 conditions and all required measurements before fabricating any
38 piping, ductwork or equipment.
39

40 Arrange for chases, slots, and openings in other building components
41 to allow for mechanical installations.
42

43 Coordinate the installation of required supporting devices and
44 sleeves to be set in poured in place concrete and other structural
45 components, as they are constructed.
46

47 Sequence, coordinate, and integrate installations of mechanical
48 materials and equipment to allow for no more that an one fan is
49 shutdown at any time.
50

51 Coordinate the cutting and patching of building components to
52 accommodate the installation of mechanical equipment and materials.
53

54 Where mounting heights are not detailed or dimensioned, install
55 mechanical services and overhead equipment to provide the maximum

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

- 1 headroom possible.
2
3 Install mechanical equipment to facilitate maintenance and repair or
4 replacement of equipment components. As much as practical, connect
5 equipment for ease of disconnecting, with minimum of interference
6 with other installations.
7
8 Coordinate the installation of mechanical materials and equipment
9 above ceilings with suspension system, light fixtures, and other
10 installations.
11
12 Coordinate connection of mechanical systems with exterior
13 underground and overhead utilities and services. Comply with
14 requirements of governing regulations, franchised service companies,
15 and controlling agencies. Provide required connection for each
16 service.
17
18 Do not install mechanical work where it will interfere with work of
19 other trades.
20
21 Do not install mechanical work under HVAC terminal units above
22 suspended ceilings, such as heat pump units, air handling units,
23 variable volume units, coils, etc.
24
25 Do not install mechanical work where it will interfere with access
26 doors in ductwork.
27
28 Do not install mechanical work where it will interfere with access
29 to control panels on mechanical and/or electrical equipment.
30
31 Do not install mechanical work where it will interfere with access
32 space around mechanical and electrical equipment. Do not install
33 piping where it will interfere with removal of HVAC coils, filters
34 or fan shafts.
35
36 Do not install mechanical work over the top of electrical equipment.
37 Maintain minimum distances away from electrical equipment as
38 required by the Electric Code.
39
40

41 WORKING DRAWINGS

- 42
43 Scale of drawings is approximate. Do not scale the drawings to
44 determine locations of mechanical work. Exact locations, dimensions
45 and elevations shall be governed by field conditions. Make field
46 measurements of building before fabricating or installing equipment
47 or materials.
48
49 Drawings are based on physical dimensions of one or more
50 manufacturer's equipment. Other approved equipment shall be of such
51 dimensions that it can be readily installed in available space,
52 leaving ample clearance for proper maintenance.
53
54 Intent of drawings is to show systems and sizes. Drawings do not
55 necessarily show all required offsets. Work shall be installed to

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 conform with space limitations. Offsets, transitions, fittings,
2 etc., shall be provided as part of the Contract where required to
3 attain this objective.

4
5
6 PAINTING

7
8 Painting shall be done under the "Painting" section of the
9 specifications and unless otherwise specifically specified under
10 other sections of the specifications, the following items shall be
11 painted.

12
13 Mechanical equipment, piping, valve bodies and fittings - bare and
14 insulated, including hangers, platforms, etc.

15
16 Aluminum and stainless steel equipment shall not be painted and
17 motor and identification plates, tags, etc., shall not be painted.

18
19 Exposed ductwork, whether or not insulated, and any grilles,
20 diffusers, etc., not factory finished.

21
22
23 FIRE BARRIER PENETRATION SEALS:

24
25 Provide seals for any opening through any walls, floors, or ceilings
26 used as passage for mechanical components such as piping or
27 ductwork.

28 General: Provide manufacturer's standard fire-stopping sealant,
29 with accessory materials, having fire-resistance ratings as
30 established by testing identical assemblies per ASTM E 814 by
31 Underwriters' Laboratories, Inc. or other testing and inspecting
32 agency acceptable to authorities having jurisdiction. Sealant shall
33 provide protection equal or exceeding the fire resistance rating of
34 fire rated walls, partitions, ceilings or floors. Use two-part or
35 one part sealants as required to meet required fire resistance
36 ratings.

37
38 Foamed-In-Place Fire-Stopping Sealant: Two-part, foamed-in-place,
39 silicone sealant formulated for use in a through-penetration
40 fire-stop system for filling openings around cables, conduit, pipes
41 and similar penetrations through walls and floors.

42
43 One-Part Fire-Stopping Sealant: One part elastomeric sealant
44 formulated for use in a through-penetration fire-stop system for
45 sealing openings around cables, conduit, pipes and similar
46 penetrations through walls and floors.

47
48 Intumescent Fire-Stopping Sealant: A one-part, acrylic sealant that
49 expands when exposed to heat.

50
51 Firestop Compound: Trowelable compound for large openings

52
53 Available Products: Subject to compliance with requirements,
54 products which may be incorporated in the Work include, but are not
55 limited to, the following:

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1
2 Products: Subject to compliance with requirements, provide one of
3 the following:

4
5 Foamed-in-Place Fire-Stopping Sealant:

6
7 "Dow Corning Fire Stop Foam"; Dow Corning Corp.
8 "Pensil 851"; General Electric Co.

9
10 One-Part Fire-Stopping Sealant:

11
12 "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
13 "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
14 "RTV 7403"; General Electric Co.
15 "Fyre Putty"; Standard Oil Engineered Materials Co.
16 "FS 601"; Hilti Inc.
17 "FS 611A"; Intumescent Sealant; Hilti Inc.
18 "FS 635"; Hilti Inc.

19
20 Installation of Fire-Stopping Sealant: Install sealant, including
21 forming, packing, and other accessory materials to fill openings
22 around mechanical and electrical services penetrating floors and
23 walls to provide fire-stops with fire resistance ratings indicated
24 for floor or wall assembly in which penetration occurs. Comply with
25 installation requirements established by testing and inspecting
26 agency.

27
28
29 DEBRIS

30
31 Remove from the site any debris and dirt caused by the work.
32 Maintain the premises in a clean and orderly condition.

33
34
35 PROTECTION OF EQUIPMENT AND MATERIALS

36
37 Provide suitable protection from dampness damage, dirt, etc., for
38 equipment and materials during construction and until final
39 acceptance by the Owner. Keep ends of piping and ductwork capped
40 off when work on them is not in progress. Such protection shall be
41 by a means acceptable to the Architect/Engineer.

42
43
44 CLEANING UP

45
46 After completion of the work and before final acceptance of the
47 work, thoroughly clean equipment and materials and remove foreign
48 matter such as grease, dirt, labels, stickers, etc., from the
49 exterior of piping, equipment and associated fabrications.

50
51
52 EQUIPMENT CONNECTIONS

53
54 Make connections to equipment furnished by others whenever such
55 equipment is shown on any part of the drawings or mentioned in any

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 section of the specifications.

2

3 Verify equipment locations and the sizes, number, locations, and
4 types of connections to be made before installation of any such
5 equipment.

6

7

8 EQUIPMENT INSTALLATION INSTRUCTIONS

9

10 Install mechanical piping, ductwork and equipment in strict
11 accordance with manufacturer's recommendations. Provide equipment
12 accessories necessary for proper operation or recommended by the
13 manufacturer, even if such accessories are not shown on the drawings
14 or mentioned in the specifications.

15

16

17 PERMITS, CODES AND APPROVALS

18

19 Permits. Obtain and pay for the permits and licenses necessary for
20 the complete mechanical systems from the authorities governing such
21 work.

22

23 Codes. Installation shall be in accordance with applicable codes
24 and regulations, including but not limited to the following:

25

26 City or County Building Inspector
27 National and Local Electric Codes
28 Kentucky State Plumbing Code
29 Kentucky Building Code
30 Kentucky Energy Code
31 Kentucky State Fire Marshal
32 Local Fire Codes

33

34 Approvals. All work must be approved by the Architect/Engineer
35 before final payment is made.

36

37 Obtain a final certificate of approval for the entire plumbing
38 installation from the Department of Housing, Building and
39 Construction, Division of Plumbing. Submit to the
40 Architect/Engineer after completion of the work and before final
41 payment is made.

42

43

44 SUBSTITUTION OF MATERIALS AND EQUIPMENT

45

46 When making a shop drawing submittal for materials and/or equipment
47 of a different manufacturer than that specified, it shall be
48 understood and agreed that such substitution if approved will be
49 made without cost to the Owner, regardless of changes in
50 connections, spacing, electrical service, etc.

51

52

53 WORKMANSHIP

54

55 Work shall be performed by mechanics skilled in their respective

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 trades and shall present appearance typical of best trade practice.
2 Work not installed in this manner shall be repaired, removed or
3 replaced, or otherwise remedied as directed by the
4 Architect/Engineer.
5
6

7 RECORD DRAWINGS

8
9 Keep accurate record of deviations from drawings, particularly where
10 work is concealed. Submit one (1) set of drawings marked to show
11 changes when work is completed.
12
13

14 SUPERVISION

15
16 The Contractor shall personally supervise the work or have a
17 competent superintendent, satisfactory to the Architect/Engineer and
18 Owner on the work at all times during progress with full authority
19 to act.
20

21 The Contractor shall lay out his work and be responsible for any
22 necessary lines, levels, elevations and measurements. He must
23 verify the figures shown on the drawings before laying out the work
24 and will be held responsible for any error resulting from his
25 failure to do so. Work at the site of the project shall be observed
26 by the Architect/Engineer or his representative.
27

28 Final Inspection. At the time of final inspection of the work
29 performed under this Contract, systems shall be complete in every
30 respect and in perfect operating condition. Surplus materials of
31 every character resulting from work of this section shall have been
32 removed. Sanitary sewers shall be free from sand, silt or other
33 obstructions. Any defect discovered in the utilities subsequent to
34 this inspection shall have been corrected.
35
36

37 STRUCTURAL RESPONSIBILITY

38
39 The Contractor shall be responsible for properly shoring, bracing,
40 supporting, etc., any existing and/or new construction to guard
41 against cracking, settling, collapsing, displacing, or weakening. No
42 structural member shall be cut or otherwise weakened in any manner
43 without the written consent of the Architect/Engineer.
44

45 Any damage occurring to the existing and/or new structures, due to
46 failure to exercise proper precautions or due to action of the
47 elements, shall be promptly and properly made good to the
48 satisfaction of the Owner or Architect/Engineer, without cost to
49 either the Owner or the Architect/Engineer.
50
51

52 OPENINGS

53
54 This Contractor shall be responsible for the openings he may require
55 in floors, walls, roof or ceilings of any type of new or existing

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 construction whether or not shown on the Architectural, Structural
2 or Mechanical Drawings.

3
4 Openings that have been shown on the Architectural and/or Structural
5 Drawings will be provided under other Divisions; however, the
6 responsibility for the correct size and location of such openings
7 shall be that of this Contractor.

8
9 Openings that have not been shown on the Architectural and/or
10 Structural Drawings shall be provided by this Contractor.

11
12
13 CUTTING, FITTING AND PATCHING

14
15 Before doing any cutting or drilling, Contractor shall obtain
16 permission from the Architect/Engineer and shall follow his
17 instructions as to how proposed cutting or drilling is to be done.

18
19
20 Each respective Contractor shall do any cutting, patching, drilling
21 of masonry, steel, wood or iron work and any fitting necessary for
22 the proper installation of apparatus and materials included in these
23 specifications or governed thereby.

24
25 General: Employ skilled workmen to perform cutting and patching.
26 Proceed with cutting and patching at the earliest feasible time and
27 complete without delay.

28
29 Cut existing construction to provide for installation of other
30 components or performance of other construction activities and the
31 subsequent fitting and patching required to restore surfaces to
32 their original condition.

33
34 Coordinate with the Structural Engineer BEFORE drilling, cutting,
35 notching, etc., any new or existing structural members. Obtain
36 written permission from Structural Engineer before doing such work.
37 Locations and sizes of openings and methods of cutting or drilling
38 such openings must be approved in advance by the Structural
39 Engineer. Positively identify exact locations of reinforcing bars or
40 tension cables in structural members by X-raying or other methods
41 approved by the Structural Engineer if required by the Structural
42 Engineer.

43
44 Cutting: Cut existing construction using methods least likely to
45 damage elements to be retained or adjoining construction. Where
46 possible review proposed procedures with the original installer;
47 comply with the original installer's recommendations.

48
49 In general, where cutting is required use hand or small power tools
50 designed for sawing or grinding, not hammering and chopping. Cut
51 holes and slots neatly to size required with minimum disturbance of
52 adjacent surfaces. Temporarily cover openings when not in use.

53
54 To avoid marring existing finished surfaces, cut or drill from the
55 exposed or finished side into concealed surfaces.

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1
2 Cut through concrete and masonry using a cutting machine such as a
3 carborundum saw or diamond core drill.

4
5 Comply with requirements of applicable Sections of Division 15 where
6 cutting and patching requires excavating and backfilling.

7
8 The patching and finishing shall be done in a workmanlike manner to
9 the satisfaction of the Architect/Engineer.

10
11 Patch any openings in existing floors, walls, ceilings or roof, left
12 by removal of existing mechanical work.

13
14
15 RESTORATION OF SURFACES

16
17 Each Contractor shall restore to their original conditions all
18 paving, curbing, surfaces, drainage ditches, structures, fences,
19 shrubs, and other items damaged or removed by his operations that
20 are outside of the Limit of Site boundaries. Replacement and
21 repairs shall be in accordance with good construction practice and
22 shall match material employed in the original construction of the
23 item to be replaced.

24
25
26 SHOP DRAWINGS AND OTHER REQUIRED SUBMITTALS

27
28 Prepare and submit to the Architect/Engineer for approval, shop
29 drawings, certified equipment drawings, installation, operating and
30 maintenance instructions, samples, wiring diagrams, etc., and any
31 other data required.

32
33 Submittal data shall have the stamp of approval of the General
34 Contractor to show that the drawings have been checked by the
35 Contractor. Any drawings submitted without this stamp of approval
36 will be returned to the Contractor for proper resubmission.

37
38 Submittal data shall include specification data including metal
39 gauges, finishes, accessories, etc. Also, the submittal data shall
40 include certified performance data, wiring diagrams, dimensional
41 data and a spare parts list. Submittal data shall be approved by
42 the Architect/Engineer before any equipment or material is ordered
43 or any work is begun.

44
45 No roughing-in, connections, etc., shall be done until approved shop
46 drawings are in the hands of the Contractors. It shall be the
47 responsibility of the Contractor to obtain approved shop drawings
48 and to make connections, etc., in the neatest and most workmanlike
49 manner possible.

50
51 Submittal data must be complete for each piece of equipment. Partial
52 or incomplete data will not be processed.

53
54 Approval of shop drawings by the Architect/Engineer applies only to
55 general design, arrangement, type, capacity and quality. Such

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 approval does not apply to quantities, dimensions, connection
2 locations, etc. In these cases, the Contractor alone shall be
3 responsible for furnishing the proper quantity of the equipment
4 and/or materials required for seeing that the equipment fits the
5 available space in a satisfactory manner and that piping, electrical
6 and other connections are suitably located.
7

8 The Architect's/Engineer's approval of shop drawings, schedules or
9 other required submittal data shall not relieve the Contractor from
10 responsibility for deviations from drawings or specifications unless
11 he has, in writing, called the Architect's/Engineer's attention to
12 such deviation at the time of submission and secured his written
13 approval nor shall it relieve him from responsibility for error in
14 shop drawings or schedules.
15

16 Submittal data must be complete and approved before project is
17 accepted.
18
19

20 OPERATING AND MAINTENANCE INSTRUCTIONS

21

22 This Contractor shall prepare three loose-leaf, bound brochures,
23 entitled "Mechanical Equipment Operation and Maintenance Data."
24 Mark identification on both front and spine of each binder. Each
25 binder shall be a heavy duty 3-ring, vinyl-covered binder with
26 pocket folders for folded sheet information. Binders shall be
27 properly indexed (thumb- tabbed). Information shall be filed under
28 applicable specification section number.
29

30 Each brochure shall contain the following information:

31 Name and address of Consulting Engineer, Contractor, and index
32 of equipment, including vendor (name and address).
33
34

35 Complete brochures, descriptive data and parts list, etc., on
36 each piece of equipment, including all approved shop drawings.
37
38

39 Complete maintenance and operating instructions, prepared by
40 the manufacturer, on each major piece of equipment.
41

42 Complete shop drawing submittal on temperature controls
43 including control diagrams updated to reflect "as-built"
44 conditions.
45

46 Final testing and balancing report.
47

48 All brochures shall be submitted to the Architect/Engineer or his
49 representative prior to final inspection of the building.
50
51

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 OWNER INSTRUCTION

2
3 Conduct a minimum of a full-day walk-through instruction seminar
4 for the Owner's personnel to be involved in the continued operation
5 and maintenance of mechanical equipment and systems.

6
7 Train Owner's maintenance personnel on procedures and schedules
8 related to startup and shutdown, troubleshooting, servicing, and
9 preventive maintenance. Review data in the operation and maintenance
10 manuals.

11
12 Explain the identification system, operational diagrams, emergency
13 and alarm provisions, sequencing requirements, seasonal provisions,
14 security, safety, efficiency and similar features of the systems.

15
16 Provide separate, training for the automatic control systems (see
17 temperature control specification for training time).

18
19 Video tape all instruction sessions and turn over video tapes to the
20 Owner. Tapes shall in a format so that they can be played on a VHS
21 player.

22
23
24 ACCESS UNITS

25
26 General. The work of this article is limited to the provisions for
27 access through other work for access to mechanical work, and does
28 not include internal access provisions (within the mechanical work).

29 In general and where possible, furnish or furnish-and-mount
30 required access units in other trades' work prior to their work, so
31 that cutting and patching for the subsequent installation of such
32 access units will not be required. In occupied spaces, provide
33 finished access units of the maximum concealment type, including
34 locks where appropriate, and matching access units provided in the
35 same expanse of finish (for non-mechanical access, if any).

36
37 The scope of access units to be furnished or provided as mechanical
38 work includes those units indicated on the mechanical drawings or
39 specified in Division 15 sections, and those additional units
40 required for adequate access to mechanical work and not shown or
41 specified individually.

42
43 Access Doors. Standard welded-steel construction, 16-gage frames
44 and 14 gage door panels, 175 degree concealed spring hinges,
45 rust-inhibitive prime coat, flush cam lock (for screw-driver
46 operation where keyed lock is not required), recessed to receive
47 applied finish where applicable (such as in concealed spline
48 ceilings).

49
50 Removable Access Plates. Where only hand access is sufficient,
51 provide removable plate-type access unit, or minimum size which will
52 facilitate the required access. Provide units of the type, style,
53 design, material and finish appropriate for the location and
54 exposure in each instance. In exposed surfaces of occupied spaces
55 provide round plate units, flush floor units and frameless

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 low-profile wall units, primed-for-paint in painted surfaces and
2 polished chrome or stainless steel finish in other surfaces.

3
4 Access Thru Fire Rated Walls or Ceilings. Where access doors or
5 plates are required in fire rated partitions or ceilings, provide
6 U.L. listed "B" Label doors or plates rated for 1-1/2 hours.
7 Furnish doors with automatic closers and key operated latches that
8 latch automatically when door closes.

9
10
11 FLASHING:

12
13 General: Provide flashings from the following listing for each
14 penetration of mechanical systems through roofs or waterproof
15 membranes. Select appropriate flashing method for the type of roof
16 used. Flashing shall be in accordance with roofing manufacturer's
17 recommendations.

18
19 Copper Flashing: Provide cold-rolled sheet copper, complying with
20 ANSI/ASTM B 370, weighing 16 oz. per sq. ft. (0.0216" thick), except
21 as otherwise indicated.

22
23 Lead Flashing: Provide sheet lead complying with FS QQ-L-2201,
24 Grade B; formed from common desilverized pig lead, complying with
25 ANSI/ASTM B 29; weighing 4.0 lbs. per sq. ft., except as otherwise
26 indicated.

27
28 Bituminous Coating: FS TT-C-494, or MIL-C-18480, or SSPC-paint 12,
29 cold-applied solvent-type bituminous mastic coating for application
30 in dry film thickness of 15 mils per coat.

31
32 Laminated Sheet Flashing: Bottom laminate of heavy-duty
33 nonplasticized chlorinated polyethylene (CPE) synthetic elastomer,
34 with top laminate of built-up roofing (BUR) sheet material; weighing
35 8 oz. per sq. ft.

36
37 Manufacturer's Recommendations: Except as otherwise shown or
38 specified, comply with recommendations and instructions of
39 manufacturer of sheet metal being installed.

40
41 Coat back side of lead flashings where in contact with concrete and
42 other cementitious substrates, by painting surface in area of
43 contact with heavy application of bituminous coating, or by other
44 permanent separation as recommended by manufacturer of metal.

45
46 On vertical surfaces, lap flashings minimum of 3".

47
48 On vertical surfaces, for slopes of not less than 6" in 12", lap
49 unsealed flashings minimum of 6".

50
51 For embedment of metal flashing flanges in roofing or composition
52 flashing or stripping, extend flanges minimum of 6" for embedment.

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 LINTELS:

2
3 General: Provide lintels for penetration of mechanical systems
4 through masonry walls if not provided elsewhere in these
5 specifications. Lintels shall be type and size required to span the
6 required openings.

7
8 Lintels will not be required for openings 16 inches length or less.
9

10
11 MAINTAINING EXISTING SERVICES

12
13 Properly make all temporary connections that may be necessary to
14 continue these services in a safe and substantial manner until the
15 permanent services are activated. Upon completion, remove all
16 temporary work, and completely restore all areas that may be
17 affected.
18

19
20 INTERRUPTION OF EXISTING MECHANICAL SERVICES

21
22 In general, do not interrupt mechanical services (such as plumbing,
23 fire protection and water) to occupied building (both inside and
24 outside construction area). If services must be interrupted (for
25 making temporary connections, for changing over from existing to
26 new, or for making new connections to existing systems, for example)
27 then do such work at the times designated by the Owner.
28

29 Schedule this work in advance with the Owner. Perform work on
30 premium time if required to do so by the Owner.
31

32 At any time the existing building services are interrupted, the
33 Contractor shall work continuously until the permanent services are
34 restored.
35

36
37 OWNER OCCUPANCY

38
39 Full Owner Occupancy: The Owner will occupy the site and building
40 surrounding construction area during the entire construction period.
41 Cooperate with the Owner during construction operations to minimize
42 conflicts and facilitate Owner usage. Perform the Work to minimize
43 interference with the Owner's operations. Perform portions of work
44 on premium time if required to do so by the Owner.
45

46
47 LICENSE REQUIRED

48
49 Contractors installing HVAC work must be licensed by the Kentucky
50 Board of Heating, Cooling and Ventilation Contractors. Submit proof
51 of licensing.
52

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 REQUIRED SUBMITTALS:

2

3 The following chart is supplied for the benefit of the Owner,
4 Architect, Engineer and contractor to assure a complete submission
5 of required information. It is a reference listing of documents
6 required by the Specifications under this Section. Refer to
7 Specifications Section - General Provisions for the general
8 requirements of submittals.

9

10

ITEM	SHOP DRAWING	M & O MANUAL	PARTS LIST	CERTIFICATE
Fire barrier penetration seals	X			
Access units	X			

11

12 END OF SECTION 15000

1 **SECTION 15001 - REFERENCE STANDARDS AND DEFINITIONS**

2
3
4 **PART 1 - GENERAL**

5
6
7 RELATED DOCUMENTS

8
9 Drawings and general provisions of Contract, including General and
10 Supplementary Conditions, General Mechanical Provisions and other
11 Division 1 Specification Sections, apply to this Section.
12

13
14 DEFINITIONS

15
16 General: Basic Contract definitions are included in the General
17 Conditions.
18

19 Indicated: The term "indicated" refers to graphic representations,
20 notes, or schedules on the Drawings, other paragraphs or schedules
21 in the Specifications, and similar requirements in the Contract
22 Documents. Where terms such as "shown," "noted," "scheduled," and
23 "specified" are used, it is to help the reader locate the reference;
24 no limitation on location is intended.
25

26 Directed: Terms such as "directed," "requested," "authorized,"
27 "selected," "approved," "required," and "permitted" mean "directed
28 by the Architect," "requested by the Architect," and similar
29 phrases.
30

31 Approve: The term "approved," where used in conjunction with the
32 Architect's action on the Contractor's submittals, applications, and
33 requests, is limited to the Architect's duties and responsibilities
34 as stated in General and Supplementary Conditions.
35

36 Regulation: The term "Regulations" includes laws, ordinances,
37 statutes, and lawful orders issued by authorities having
38 jurisdiction, as well as rules, conventions, and agreements within
39 the construction industry that control performance of the Work.
40

41 Furnish: The term "furnish" is used to mean "supply and deliver to
42 the Project site, ready for unloading, unpacking, assembly,
43 installation, and similar operations."
44

45 Install: The term "install" is used to describe operations at
46 project site including the actual "unloading, unpacking, assembly,
47 erection, placing, anchoring, applying, working to dimension,
48 finishing, curing, protecting, cleaning, and similar operations."
49

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 Provide: The term "provide" means "to furnish and install, complete
2 and ready for the intended use."
3

4 Installer: An "Installer" is the Contractor or an entity engaged by
5 the Contractor, either as an employee, subcontractor, or
6 sub-subcontractor, for performance of a particular construction
7 activity, including installation, erection, application, and similar
8 operations. Installers are required to be experienced in the
9 operations they are engaged to perform.
10

11 The term "experienced" when used with the term "Installer"
12 means having a minimum of 5 previous Projects similar in size
13 and scope to this Project, being familiar with the precautions
14 required, and having complied with requirements of the
15 authority having jurisdiction.
16

17 Trades: Use of titles such as "carpentry" is not intended to
18 imply that certain construction activities must be performed
19 by accredited or unionized individuals of a corresponding
20 generic name, such as "carpenter." It also does not imply
21 that requirements specified apply exclusively to tradespersons
22 of the corresponding generic name.
23

24 Project Site is the space available to the Contractor for
25 performance of construction activities, either exclusively or in
26 conjunction with others performing other work as part of the
27 Project. The extent of the Project Site is shown on the Drawings
28 and may or may not be identical with the description of the land
29 upon which the Project is to be built.
30

31 Testing Laboratories: A "testing laboratory" is an independent
32 entity engaged to perform specific inspections or tests, either at
33 the Project Site or elsewhere, and to report on and, if required, to
34 interpret results of those inspections or tests.
35
36

37 SPECIFICATION FORMAT AND CONTENT EXPLANATION

38
39 Specification Format: These Specifications are organized into
40 Divisions and Sections based on the Construction Specifications
41 Institute's 16-Division format and MASTERFORMAT numbering system.
42

43 Specification Content: This Specification uses certain conventions
44 in the use of language and the intended meaning of certain terms,
45 words, and phrases when used in particular situations or
46 circumstances. These conventions are explained as follows:
47

48 Abbreviated Language: Language used in Specifications and
49 other Contract Documents is the abbreviated type. Implied
50 words and meanings will be appropriately interpreted.

1 Singular words will be interpreted as plural and plural words
2 interpreted as singular where applicable and the full context
3 of the Contract Documents so indicates.
4

5 Imperative and streamlined language is used generally in the
6 Specifications. Requirements expressed in the imperative mood
7 are to be performed by the Contractor. At certain locations
8 in the text, for clarity, subjective language is used to
9 describe responsibilities that must be fulfilled indirectly by
10 the Contractor, or by others when so noted.

11
12 The words "shall be" shall be included by inference
13 wherever a colon (:) is used within a sentence or
14 phrase.
15

16
17 INDUSTRY STANDARDS
18

19 Applicability of Standards: Except where the Contract Documents
20 include more stringent requirements, applicable construction
21 industry standards have the same force and effect as if bound or
22 copied directly into the Contract Documents. Such standards are
23 made a part of the Contract Documents by reference.
24

25 Publication Dates: Where the date of issue of a referenced standard
26 is not specified, comply with the standard in effect as of date of
27 Contract Documents.
28

29 Conflicting Requirements: Where compliance with two or more
30 standards is specified, and the standards establish different or
31 conflicting requirements for minimum quantities or quality levels,
32 refer requirements that are different, but apparently equal, and
33 uncertainties to the Architect for a decision before proceeding.
34

35 Minimum Quantity or Quality Levels: The quantity or quality
36 level shown or specified shall be the minimum provided or
37 performed. The actual installation may comply exactly with
38 the minimum quantity or quality specified, or it may exceed
39 the minimum within reasonable limits. In complying with these
40 requirements, indicated numeric values are minimum or maximum,
41 as appropriate for the context of the requirements. Refer
42 uncertainties to the Architect for a decision before
43 proceeding.
44

45 Copies of Standards: Each entity engaged in construction on the
46 Project is required to be familiar with industry standards
47 applicable to that entity's construction activity. Copies of
48 applicable standards are not bound with the Contract Documents.
49

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 Where copies of standards are needed for performance of a
2 required construction activity, the Contractor shall obtain
3 copies directly from the publication source.

4
5 Although copies of standards needed for enforcement of
6 requirements may be included as part of required submittals,
7 the Architect reserves the right to require the Contractor to
8 submit additional copies as necessary for enforcement of
9 requirements.

10
11 Abbreviations and Names: Trade association names and titles of
12 general standards are frequently abbreviated. Where such acronyms
13 or abbreviations are used in the Specifications or other Contract
14 Documents, they mean the recognized name of the trade association,
15 standards generating organization, authority having jurisdiction, or
16 other entity applicable to the context of the text provision. Refer
17 to the "Encyclopedia of Associations," published by Gale Research
18 Co., available in most libraries.

19
20 Abbreviations and Names: Trade association names and titles of
21 general standards are frequently abbreviated. The following
22 acronyms or abbreviations as referenced in Contract Documents are
23 defined to mean the associated names. Names and addresses are
24 subject to change and are believed to be but are not assured to be
25 accurate and up to date as of date of Contract Documents.

26
27 AA Aluminum Association
28 900 19th St., NW, Suite 300
29 Washington, DC 20002 (202) 862-5100
30
31 AABC Associated Air Balance Council
32 1518 K St., NW, Suite 503
33 Washington, DC 20005 (202) 737-0202
34
35 AAMA American Architectural Manufacturer's Association
36 2700 River Rd., Suite 118
37 Des Plaines, IL 60018 (312) 699-7310
38
39 ACI American Concrete Institute
40 P.O. Box 19150
41 Detroit, MI 48219 (313) 532-2600
42
43 ACIL American Council of Independent Laboratories
44 1725 K St., NW
45 Washington, DC 20006 (202) 887-5872
46
47 ACPA American Concrete Pipe Association
48 8320 Old Courthouse Rd.
49 Vienna, VA 22180 (703) 821-1990
50

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1	ADC	Air Diffusion Council	
2		230 N. Michigan Ave., Suite 1200	
3		Chicago, IL 60601	(312) 372-9800
4			
5	AFBMA	Anti-Friction Bearing Manufacturers Association	
6		1101 Connecticut Ave., NW, Suite 700	
7		Washington, DC 20036	(202) 429-5155
8			
9	AGA	American Gas Association	
10		1515 Wilson Blvd.	
11		Arlington, VA 22209	(703) 841-8400
12			
13			
14	AI	Asphalt Institute	
15		Research Park Drive	
16		P.O. Box 14052	
17		Lexington, KY 40512-4052	(606) 288-4960
18			
19	AIA	American Institute of Architects	
20		1735 New York Ave., NW	
21		Washington, DC 20006	(202) 626-7300
22			
23	AISC	American Institute of Steel Construction	
24		400 N. Michigan Ave., 8th Floor	
25		Chicago, IL 60611	(312) 670-2400
26			
27	AISI	American Iron and Steel Institute	
28		1133 Fifteenth St., NW	
29		Washington, DC 20005	(202) 452-7100
30			
31	ALI	Associated Laboratories	
32		641 S. Vermont St.	
33		Palatine, IL 60067	(312) 358-7400
34			
35	AMCA	Air Movement and Control Association	
36		30 W. University Drive	
37		Arlington Heights, IL 60004	(312) 394-0150
38			
39	ANSI	American National Standards Institute	
40		1430 Broadway	
41		New York, NY 10018	(212) 354-3300
42			
43	ARI	Air Conditioning and Refrigeration Institute	
44		1501 Wilson Blvd., 6th Floor	
45		Arlington, VA 22209	(703) 524-8800
46			
47	ASA	Acoustical Society of America	
48		500 Sunnyside Blvd.	
49		Woodbury, NY 11797	(516) 349-7800
50			

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 ASC Adhesive and Sealant Council
2 1627 K Street, NW., Suite 1000
3 Washington, DC 20006 (202) 452-1500
4
5 ASHRAE American Society of Heating, Refrigerating
6 and Air-Conditioning Engineers
7 1791 Tullie Circle, NE
8 Atlanta, GA 30329 (404) 636-8400
9
10 ASME American Society of Mechanical Engineers
11 345 East 47th St.
12 New York, NY 10017 (212) 705-7722
13
14 ASPE American Society of Plumbing Engineers
15 3617 Thousand Oaks Blvd., Suite 210
16 Westlake, CA 91362 (805) 495-7120
17
18 ASSE American Society of Sanitary Engineering
19 P.O. Box 40362
20 Bay Village, OH 44140 (216) 835-3040
21
22 ASTM American Society for Testing and Materials
23 1916 Race St.
24 Philadelphia, PA 19103 (215) 299-5400
25
26 AWS American Welding Society
27 P.O. Box 351040
28 550 LeJeune Road, NW
29 Miami, FL 33135 (305) 443-9353
30
31 AWWA American Water Works Association
32 6666 W. Quincy Ave.
33 Denver, CO 80235 (303) 794-7711
34
35 CAGI Compressed Air and Gas Institute
36 c/o Thomas Associates, Inc.
37 1230 Keith Building
38 Cleveland, OH 44115 (216) 241-7333
39
40 CBM Certified Ballast Manufacturers Association
41 1422 Euclid Ave.
42 Hanna Building, Suite 772
43 Cleveland, OH 44115 (216) 241-0711
44
45 CDA Copper Development Association
46 Box 1840, Greenwich Office Park 2
47 Greenwich, CT 06836 (203) 625-8210
48
49 CGA Compressed Gas Association
50 Crystal Gateway #1, Suite 501

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 1235 Jefferson Davis Highway
2 Arlington, VA 22202 (703) 979-0900
3
4
5
6 CISPI Cast Iron Soil Pipe Institute
7 5959 Shallowford Road, Suite 419
8 Chattanooga, TN 37421 (615) 892-0137
9
10 ETL ETL Testing Laboratories, Inc.
11 P.O. Box 2040
12 Route 11, Industrial Park
13 Cortland, NY 13045 (607) 753-6711
14
15 FM Factory Mutual Engineering and Research Organization
16 1151 Bos - Providence Turnpike
17 Norwood, MA 02062 (617) 762-4300
18
19 HEI Heat Exchange Institute
20 c/o Thomas Associates, Inc.
21 1230 Keith Building
22 Cleveland, OH 44115 (216) 241-7333
23
24 HI Hydronics Institute
25 P.O. Box 218
26 35 Russo Place
27 Berkeley Heights, NJ 07922 (201) 464-8200
28
29 H.I. Hydraulic Institute
30 712 Lakewood Center North
31 14600 Detroit Avenue
32 Cleveland, OH 44107 (216) 226-7700
33
34 IEEE Institute of Electrical and Electronic Engineers
35 345 E. 47th St.
36 New York, NY 10017 (212) 705-7900
37
38 IESNA Illuminating Engineering Society of North America
39 345 E. 47th St.
40 New York, NY 10017 (212) 705-7926
41
42 ISA Instrument Society of America
43 67 Alexander Drive
44 P.O. Box 12277
45 Research Triangle Park, NC 27709 (919) 549-8411
46
47 LPI Lightning Protection Institute
48 P.O. Box 1029
49 Woodstock, IL 60098 (815) 337-0277
50

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1
2 MCAA Mechanical Contractors Association of America
3 5410 Grosvenor Lane, Suite 120
4 Bethesda, MD 20814 (301) 897-0770
5
6 MSS Manufacturers Standardization Society of
7 the Valve and Fittings Industry
8 127 Park St., NE
9 Vienna, VA 22180 (703) 281-6613
10
11 NEC National Electric Code (Now NFPA)
12
13 NECA National Electrical Contractors Association
14 7315 Wisconsin Ave.
15 Bethesda, MD 20814 (301) 657-3110
16
17 NEMA National Electrical Manufacturers Association
18 2101 L St., NW, Suite 300
19 Washington, DC 20037 (202) 457-8400
20
21 NFPA National Fire Protection Association
22 Batterymarch Park
23 Quincy, MA 02169 (617) 770-3000
24
25 NSF National Sanitation Foundation
26 P.O. Box 1468
27 3475 Plymouth Rd.
28 Ann Arbor, MI 48106 (313) 769-8010
29
30 PDI Plumbing and Drainage Institute
31 (c/o Saul Baker)
32 1106 W. 77th St., South Dr.
33 Indianapolis, IN 46260 (317) 251-6970
34
35 SMACNA Sheet Metal and Air Conditioning
36 Contractors National Association
37 P.O. Box 70
38 Merrifield, VA 22116 (703) 790-9890
39
40 SSPMA Sump and Sewage Pump Manufacturers Association
41 560 W. Washington Street, Suite 301
42 Chicago, IL 60606 (312) 332-4146
43
44 SWPA Submersible Wastewater Pump Association
45 600 S. Federal Street, Suite 400
46 Chicago, IL 60605 (312) 922-6222
47
48 TIMA Thermal Insulation Manufacturers Association
49 29 Bank Street
50 Stamford, CT 06901 (203) 324-7533

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1
2 UL Underwriters Laboratories
3 333 Pfingsten Rd.
4 Northbrook, IL 60062 (312) 272-8800
5
6 Federal Government Agencies: Names and titles of federal government
7 standard- or Specification-producing agencies are often abbreviated.
8 The following acronyms or abbreviations referenced in the Contract
9 Documents indicate names of standard- or Specification-producing
10 agencies of the federal government. Names and addresses are subject
11 to change; they are believed to be but are not assured to be
12 accurate and up to date as of the date of the Contract Documents.
13
14 CE Corps of Engineers (U.S. Department of the Army)
15 Chief of Engineers - Referral
16 Washington, DC 20314 (202) 272-0660
17
18 CFR Code of Federal Regulations
19 Available from the Government Printing Office
20 N. Capitol St. between G and H St., NW
21 Washington, DC 20402 (202) 783-3238
22 (Material is usually first published in the
23 Federal Register)
24
25 CPSC Consumer Product Safety Commission
26 5401 Westbard Ave.
27 Bethesda, MD 20816 (800) 638-2772
28
29 CS Commercial Standard
30 (U.S. Department of Commerce)
31 Government Printing Office
32 Washington, DC 20402 (202) 377-2000
33
34 DOC Department of Commerce
35 14th St. and Constitution Ave., NW
36 Washington, DC 20230 (202) 377-2000
37
38 DOT Department of Transportation
39 400 Seventh St., SW
40 Washington, DC 20590 (202) 366-4000
41
42 EPA Environmental Protection Agency
43 401 M St., SW
44 Washington, DC 20460 (202) 382-2090
45 FCC Federal Communications Commission
46 1919 M St., NW
47 Washington, DC 20554 (202) 632-7000
48
49 FS Federal Specification (from GSA)
50 Specifications Unit (WFSIS)

University of Kentucky
 HSRB Exhaust Fans Replacement
 Chandler Medical Center
 UK Project#
 S&F Job No. 90316G

1
 2
 3
 4
 5
 6
 7
 8
 9
 10
 11
 12
 13
 14
 15
 16
 17
 18
 19
 20
 21
 22
 23
 24
 25
 26
 27
 28
 29
 30
 31
 32
 33
 34
 35
 36
 37
 38
 39
 40
 41
 42
 43
 44
 45
 46
 47
 48
 49
 50

7th and D St., SW		
Washington, DC 20406	(202) 472-2205	
	or 472-2140	
MIL	Military Standardization Documents	
	(U.S. Department of Defense)	
	Naval Publications and Forms Center	
	5801 Tabor Ave.	
	Philadelphia, PA 19120	
NIST	National Institute of Standards and Technology	
	(U.S. Department of Commerce)	
	Gaithersburg, MD 20899	(301) 975-2000
OSHA	Occupational Safety and Health Administration	
	(U.S. Department of Labor)	
	Government Printing Office	
	Washington, DC 20402	(202) 523-6091
PS	Product Standard of NBS	
	(U.S. Department of Commerce)	
	Government Printing Office	
	Washington, DC 20402	(202) 783-3238

GOVERNING REGULATIONS/AUTHORITIES

The Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents; that information may or may not be of significance to the Contractor. Contact authorities having jurisdiction directly for information and decisions having a bearing on the Work.

Copies of Regulations: Obtain copies of the following regulations and retain at the Project Site, available for reference by parties who have a reasonable need for such reference.

SUBMITTALS

Permits, Licenses, and Certificates: For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS (Not Applicable)

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1
2
3
4
5
6

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 15001

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 SECTION 15815 - METAL DUCTS

2
3
4 PART 1 - GENERAL

5
6
7 RELATED DOCUMENTS

8
9 Drawings and general provisions of the Contract, including General
10 and Supplementary Conditions, General Mechanical Provisions and
11 Division 1 Specification Sections, apply to this Section.
12

13
14 SUMMARY

15
16 This Section includes rectangular, round, and flat-oval metal ducts
17 and plenums for heating, ventilating, and air-conditioning systems
18 in pressure classes from minus 2- to plus 10-inch wg (minus 500 to
19 plus 2490 Pa).
20

21 Install duct accessories (such as dampers, automatic control
22 dampers, etc.) furnished under other sections of the Specification
23 in duct system.
24

25
26 SUBMITTALS

27
28 Product Data: For duct and sealing materials (medium and high
29 pressure round and/or oval duct).
30

31 Welding Certificates: Copies of certificates indicating welding
32 procedures and personnel comply with requirements in "Quality
33 Assurance" Article.
34

35 Record Drawings: Indicate actual routing, fitting details,
36 reinforcement, support, and installed accessories and devices.
37

38
39 QUALITY ASSURANCE

40
41 Provide round and oval duct and fittings by the same manufacturer.
42

43 Comply with Tables 6-A, 6-B and 6-C in the Uniform Mechanical Code,
44 Chapter 6, "Duct Construction". Comply with requirements for metal
45 thickness, reinforcing types and intervals, hangers and supports,
46 and joint types and intervals.
47

48 Comply with the Kentucky Building Code, except as noted in the
49 paragraph above.
50

51 Compliance with SMACNA Standards is acceptable where there is no
52 conflict with the Contract Documents. Where there are conflicts, the
53 Contract Documents shall prevail.
54

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 Welding Standards: Qualify welding procedures and welding personnel
2 to perform welding processes for this Project according to AWS D1.1,
3 "Structural Welding Code--Steel," for hangers and supports;
4 AWS D1.2, "Structural Welding Code--Aluminum," for aluminum
5 supporting members; and AWS D9.1, "Sheet Metal Welding Code," for
6 duct joint and seam welding.

7
8 Comply with NFPA 90A, "Installation of Air Conditioning and
9 Ventilating Systems," unless otherwise indicated.

10
11 Comply with NFPA 90B, "Installation of Warm Air Heating and Air
12 Conditioning Systems," unless otherwise indicated.

13
14
15 DELIVERY, STORAGE, AND HANDLING

16
17 Deliver sealant and firestopping materials to site in original
18 unopened containers or bundles with labels indicating manufacturer,
19 product name and designation, color, expiration period for use, pot
20 life, curing time, and mixing instructions for multicomponent
21 materials.

22
23 Store and handle sealant and firestopping materials according to
24 manufacturer's written recommendations.

25
26 Deliver and store stainless-steel sheets with mill-applied adhesive
27 protective paper maintained through fabrication and installation.

28
29
30 PART 2 - PRODUCTS

31
32
33 SHEET METAL MATERIALS

34
35 Galvanized, Sheet Steel: Lock-forming quality; ASTM A 653/A 653M,
36 G90 (Z275) coating designation; mill-phosphatized finish for
37 surfaces of ducts exposed to view.

38
39 Stainless Steel: Type 316, sheet form with No. 1 finish unless
40 otherwise specified.

41
42 Reinforcement Shapes and Plates: Galvanized steel reinforcement
43 where installed on galvanized, sheet metal ducts; compatible
44 materials for aluminum and stainless-steel ducts.

45
46
47 SEALANT MATERIALS

48
49 Joint and Seam Sealants, General: The term "sealant" is not limited
50 to materials of adhesive or mastic nature but includes combinations
51 of open-weave fabric strips and mastics.

52
53 Joint and Seam Sealant: One-part, nonsag, solvent-release-curing,
54 polymerized butyl sealant, formulated with a minimum of 75 percent
55 solids.

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1
2 Flanged Joint Mastics: One-part, acid-curing, silicone, elastomeric
3 joint sealants, complying with ASTM C 920, Type S, Grade NS,
4 Class 25, Use O, unless otherwise specified.
5
6

7 HANGERS AND SUPPORTS
8

9 Building Attachments: Concrete inserts, powder-actuated fasteners,
10 or structural-steel fasteners appropriate for building materials.
11

12 Use powder-actuated concrete fasteners for standard-weight aggregate
13 concrete or for slabs more than 4 inches (100 mm) thick.
14

15 Exception: Do not use powder-actuated concrete fasteners for
16 lightweight-aggregate concrete or for slabs less than 4 inches (100
17 mm) thick.
18

19 Hanger Materials: Galvanized, sheet steel or round, threaded steel
20 rod.
21

22 Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-
23 thread rod or galvanized rods with threads painted after
24 installation.
25

26 Straps and Rod Sizes: Comply with the Uniform Mechanical Code,
27 Chapter 6, "Duct Construction" for sheet steel width and thickness
28 and for steel rod diameters.
29

30 Trapeze and Riser Supports: Steel shapes complying with
31 ASTM A 36/A 36M.
32

33 Supports for Galvanized-Steel Ducts: Galvanized steel shapes and
34 plates.
35

36 Supports for Stainless-Steel Ducts: Stainless-steel support
37 materials.
38
39

40 PART 3 - EXECUTION
41

42 DUCT INSTALLATION, GENERAL
43

44 Electrical Equipment Spaces: Route ductwork to avoid passing
45 through transformer vaults and electrical equipment spaces and
46 enclosures.
47
48

49 HANGING AND SUPPORTING
50

51 Support horizontal ducts within 24 inches (600 mm) of each elbow and
52 within 48 inches (1200 mm) of each branch intersection.
53

54 Install upper attachments to structures with an allowable load not
55 exceeding one-fourth of failure (proof-test) load.

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

- 1
- 2 Install concrete inserts before placing concrete.
- 3
- 4 Install powder-actuated concrete fasteners after concrete is placed
- 5 and completely cured.
- 6
- 7 Connect equipment with flexible connectors according to Division 15
- 8 Section "Duct Accessories."
- 9
- 10
- 11 FIELD QUALITY CONTROL
- 12
- 13 CLEANING
- 14
- 15 After completing system installation, including outlet fittings and
- 16 devices, inspect the system. Vacuum systems before final acceptance
- 17 to remove dust and debris.

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 SECTION 15831 - MIXED FLOW, INDUCED DILUTION EXHAUST FANS

2
3
4 PART 1 - GENERAL

5
6
7 RELATED DOCUMENTS

8
9 Drawings and general provisions of the Contract, including
10 General and Supplementary Conditions, General Mechanical
11 Provisions and Division 1 Specification Sections, apply to this
12 Section.

13
14
15 SUMMARY

16
17 This Section includes mixed flow, induced dilution fans.

18
19
20 PERFORMANCE REQUIREMENTS

21
22 Project Altitude: Base air ratings on sea-level conditions.

23
24 REFERENCES

25
26 Fans shall have been tested under AMCA 210-85, "Laboratory
27 Methods of Testing Fans for Rating, or British Standard 848,
28 Part I, "Methods of Testing Performance", 1980, and shall
29 have been witnessed by an independent agency.

30
31 Documented aspiration tests shall have been performed in
32 conjunction with the fan performance test.

33
34 Sound testing shall be in accordance with AMCA 300.

35
36 Fans shall be UL and CUL listed per UL 705 safety standard.

37
38 Fans shall meet the criteria of NFPA-45.

39
40 SUBMITTALS

41
42 Submit shop drawings and product data sheets including
43 performance data, fan curves, and sound power levels.

44
45 Fan manufacturer shall furnish a certificate of guarantee
46 stating that the fan assembly "as installed" (mixing plenum,
47 outlet nozzle, stack extension if any, and all related
48 accessories specified herein) have been pre-tested at the
49 factory and that the fan curves supplied have been de-rated for
50 any and all system effects created by the accessories and
51 plenum inlet conditions.

52
53 Shop Drawings: Detail equipment assemblies and indicate
54 dimensions, weights, loads, required clearances, method of

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 field assembly, components, and location and size of each field
2 connection.

3
4 Wiring Diagrams: Power, signal, and control wiring.
5 Differentiate between manufacturer-installed and field-
6 installed wiring.

7
8 Design Calculations: Calculate requirements for selecting
9 vibration isolators and seismic restraints and for
10 designing vibration isolation bases.

11
12 Vibration Isolation Base Details: Detail fabrication,
13 including anchorages and attachments to structure and to
14 supported equipment. Include auxiliary motor slides and
15 rails, and base weights.

16
17 Maintenance Data and Part List: For fans to be included in
18 maintenance manuals.

19
20
21 DELIVERY, STORAGE, AND HANDLING

22
23 Deliver fans as factory-assembled units, to the extent
24 allowable by shipping limitations, with protective crating and
25 covering.

26
27 Disassemble and reassemble units, as required for moving to the
28 final location, according to manufacturer's written
29 instructions.

30
31 Lift and support units with manufacturer's designated lifting
32 or supporting points.

33
34
35 COORDINATION

36
37 Coordinate size and location of structural-steel support
38 members.

39
40 Coordinate size and location of concrete bases. Cast anchor-
41 bolt inserts into bases.

42
43 Coordinate installation of roof curbs, equipment supports, and
44 roof penetrations.

45
46 If the specified manufacturer is not used, it shall be the
47 manufacturer's responsibility to coordinate with the design
48 team and all other contractors and make all necessary changes
49 to allow for the installation and operation of their equipment.
50 The manufacturer shall be responsible for the cost of all
51 required changes and all work shall be done at no change in
52 contract cost.

53
54
55 EXTRA MATERIALS

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1
2 Furnish extra materials described below that match products
3 installed and that are packaged with protective covering for
4 storage and identified with labels describing contents.

5
6 Belts: **One** set for each belt-driven unit.
7

8
9 PART 2 - PRODUCTS

10
11
12 MANUFACTURERS

13
14 Manufacturers: Subject to compliance with requirements, provide
15 products by one of the following:

16
17 Strobic Air Corp./Metpro Corp.
18 M.K. Plastics
19

20
21 MANUFACTURED UNITS

22
23 Description: Factory-fabricated, -assembled, -tested, and -
24 finished, belt-driven centrifugal fans consisting of housing,
25 wheel, fan shaft, bearings, motor and disconnect switch, drive
26 assembly, and support structure.
27

28 Mixed-flow induced dilution fans

29
30 Impellers shall be mounted directly to the motor shaft to
31 provide a direct drive arrangement 4 type fan. Motors shall
32 be isolated from the primary exhaust air stream and shall
33 be visible and accessible from the fan exterior for
34 inspection and service.
35

36 Mixed flow impellers shall consist of combination
37 axial/backward curved blades and shall be of welded steel
38 construction. The impellers shall have non-stall and non-
39 overloading performance characteristics with stable
40 operation at any point on the fan curves.
41

42 Stationary discharge guide vane sections shall be provided
43 to increase fan efficiencies.
44

45 Fan dynamic balance not to exceed 0.5 mil, peak to peak, at
46 the blade pass area when operating at fan frequency.
47 Vibration isolation shall be limited to rubber-in-shear pad
48 type isolators.
49

50 Fan assemblies shall be designed for mounting on
51 conventional roof curb without the need for guy wire
52 supports.
53

1 Discharges shall include twin FRP nozzles with passive third
2 central stacks that are capable of generating aspiration.
3 The FRP shall be chemically and UV resistant.
4
5 Steel entrainment wind bands shall provide secondary
6 induction of outside air. Induction shall take place
7 downstream of the fan impeller and shall not influence BHP
8 or static pressure requirements. Wind bands shall discharge
9 up to 270% of the design flow rates. The manufacturer shall
10 publish discharge volumes for all fans at specified primary
11 exhaust flow.
12
13 A non-ferrous inlet bell shall be provided in order to
14 reduce sparking in the event of a motor bearing failure.
15
16 Fans shall be modular construction and capable of being
17 assembled on the roof.
18
19 PTFE gaskets shall be provided at all companion flanged
20 joints.
21
22 Fasteners shall be 316 stainless steel.
23
24 A bolted access door shall be provided for impeller
25 inspection on each fan.
26
27 Fans and accessories shall have internal drain systems to
28 prevent rain water from entering building duct system.
29
30 Electric motors shall be TEFC Mill & Chemical duty with a
31 1.15 service factor and an L-50 bearing life of 200,000
32 hours. Motors shall have sealed bearings up through a 256T
33 NEMA frame. Motors on BS-1 and larger fans shall be C-Face
34 and foot mounted. Motors shall comply with efficiencies
35 listed in U.S. Energy Policy Act of 1992.
36
37 A NEMA 3R non-fused disconnect switch shall be provided,
38 mounted and wired to the motor.
39
40 Coatings-All steel and aluminum surfaces shall be prepared
41 for coating by blasting or chemical etching. Coating will be
42 Epoxy (8-10 mils) for protection against weather, chemical
43 vapors and splashes.
44

45 Accessories

46
47 Stainless safety screens shall be supplied over bottom
48 primary air inlets, or under isolation dampers.
49
50 Low leakage isolation dampers shall be constructed of
51 aluminum air foil extrusions and coated with epoxy.
52 Operators shall be 2 position, spring return and shall be
53 24V electric. The electric operator shall be factory wired
54 (via a transformer when required) to the fan disconnect
55 switch to open when the fan is energized and close via a

1 spring return when de-energized. When the fan ships separate
2 from the plenum, all wiring and conduit shall be factory
3 supplied for easy connection in the field.
4
5

6 SPECIALTY OPTION:
7

8 A 14 gauge galvanized steel roof curb shall be provided to
9 support the fans/plenums. The curb shall be minimum 14
10 gauge and canted for rigidity in wind loads. The curb shall
11 be 36" high. The curb shall include a rigid fiberglass
12 liner and a wood nailer.
13

14 Silencer Tri-stack Nozzle shall be provided. See drawings
15 for sound performance levels.
16

17 Disconnect Switch, nonfusible type, with thermal-overload
18 protection mounted on fan housing, factory wired.
19

20 Jib Crane, shall be provide on units with more than one
21 fan. The crane shall be sized and positioned to allow the
22 removal of the motor and discharge cone.
23
24

25 PART 3 - EXECUTION
26

27
28 INSTALLATION
29

30 Install roof-mounting units on roof curbs. Coordinate
31 installation with the roofing contractor.
32

33 Install units with clearances for service and maintenance.
34

35 Label fans according to requirements specified in Division 15
36 Section "Mechanical Identification."
37
38

39 CONNECTIONS
40

41 Duct installation and connection requirements are specified in
42 other Division 15 Sections. Drawings indicate general
43 arrangement of ducts and duct accessories.
44

45 Install ducts adjacent to fans to allow service and
46 maintenance.
47

48 Ground equipment.
49

50 Tighten electrical connectors and terminals according to
51 manufacturer's published torque-tightening values. If
52 manufacturer's torque values are not indicated, use those
53 specified in UL 486A and UL 486B.
54
55

1 FIELD QUALITY CONTROL

2
3 Equipment Startup Checks:

4
5 Verify that shipping, blocking, and bracing are removed.

6
7 Verify that unit is secure on mountings and supporting
8 devices and that connections to ducts and electrical
9 components are complete. Verify that proper thermal-
10 overload protection is installed in motors, starters, and
11 disconnect switches.

12
13 Verify that cleaning and adjusting are complete.

14
15 Disconnect fan drive from motor, verify proper motor
16 rotation direction, and verify fan wheel free rotation and
17 smooth bearing operation. Reconnect fan drive system,
18 align and adjust belts, and install belt guards.

19
20 Verify lubrication for bearings and other moving parts.

21
22 Verify that manual and automatic volume control dampers in
23 connected ductwork systems are in fully open position.

24
25 Starting Procedures:

26
27 Energize motor and adjust fan to indicated rpm.
28 Measure and record motor voltage and amperage.

29
30 Operational Test: After electrical circuitry has been
31 energized, start units to confirm proper motor rotation and
32 unit operation. Remove malfunctioning units, replace with new
33 units, and retest.

34
35 Test and adjust controls and safeties. Replace damaged and
36 malfunctioning controls and equipment.

37
38 Shut unit down and reconnect automatic temperature-control
39 operators.

40
41 Replace fan and motor pulleys as required to achieve design
42 airflow.

43
44 Repair or replace malfunctioning units. Retest as specified
45 above after repairs or replacements are made.

46
47
48 ADJUSTING

49
50 Adjust damper linkages for proper damper operation.

51
52 Adjust belt tension.

53
54 Lubricate bearings.
55

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37

CLEANING

On completion of installation, internally clean fans according to manufacturer's written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.

DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.

Review data in maintenance manuals.

Schedule training with Owner, through Architect, with at least seven days' advance notice.

REQUIRED SUBMITTALS:

The following chart is supplied for the benefit of the Owner, Architect, Engineer and contractor to assure a complete submission of required information. It is a reference listing of documents required by the Specifications under this Section. Refer to Specifications Section - General Provisions for the general requirements of submittals.

ITEM	SHOP DRAWING	M & O MANUAL	PARTS LIST	WIRING DIAGRAM
Induced dilution exhaust fans	X	X	X	

38
39
40

END OF SECTION 15837

1 SECTION 15973 - AUTOMATIC TEMPERATURE CONTROLS

2
3
4 PART 1 - GENERAL

5
6
7 RELATED DOCUMENTS:

8
9 Drawings and general provisions of the Contract, including General
10 and Supplementary Conditions, General Mechanical Provisions and
11 General Requirements, Division 1 Specification Sections apply to
12 the work specified in this section.
13

14
15 DESCRIPTION OF WORK:

16
17 Furnish and install and fit-up in complete working order, with all
18 accessories required, the automatic temperature control and
19 monitoring systems shown on the Drawings and specified herein.
20 The systems shall be properly connected, piped and wired in a
21 manner conforming to the laws, ordinances and codes now in force
22 in the Commonwealth of Kentucky.
23

24 The controls, graphics and all listed I/O points from this project
25 shall communicate with the Medical Center's BACNET head-in
26 station using BACNET over ethernet with IP or connect to a
27 previously installed controls network in the Medical Center with
28 Graphics on the "Signal" System.
29

30 Provide control equipment, including any associated hardware and
31 software, that is Year 2000 compliant.
32

33 Provide Pneumatic operators for dampers.
34

35 The control equipment shall be complete and shall include, but not
36 be limited to, all necessary valves, damper operators, pipe,
37 fittings, etc.
38

39 **Electronic Control System: Installer must physically demonstrate**
40 **to Owner and Owner's representatives before approval of shop**
41 **drawings that proposed building automation system will function as**
42 **outlined above.**
43

44 The control and monitoring system for this project shall be made
45 up using standard materials, equipment and components regularly
46 manufactured for systems of this type. The system shall be
47 complete in every respect and shall be a functioning system.
48

49 Electrical power wiring and interlock wiring for all controls,
50 signal devices, equipment, alarms, etc., shall be in accordance
51 with diagrams and instructions from the supplier of the systems.
52 All power and control wiring, conduit and wiring connections
53 required for the complete installation, shall be provided by this
54 Contractor in accordance Electrical 16 specification requirements.
55 Controls shall be on emergency power.
56

57 QUALITY ASSURANCE:

1
2 Available Manufacturers: Subject to compliance with requirements,
3 manufacturers offering controls that may be incorporated into the
4 Work include, but are not limited to, the following:

5
6 Siebe Network 8000
7 Johnson Controls, Inc. Metasys
8 Automated Logic
9 Siemens

10
11 **Manufacturer shall be responsible for the installation and**
12 **checkout of control systems. The installation is to be by the**
13 **manufacturer or an authorized agent of the manufacturer. The**
14 **manufacturer is to be ultimately responsible for the installation**
15 **and the warranty and shall be listed as the installing sub-**
16 **contractor on bid documents and must sign all contracts or**
17 **warranties.**

18
19 Codes and Standards:

20
21 Electrical Standards: Provide electrical components of pneumatic
22 control systems which have been UL-listed and labeled, and comply
23 with NEMA standards.

24
25 NFPA Compliance: Comply with NFPA 90A "Standard for the
26 installation of Air Conditioning and Ventilating Systems" where
27 applicable of controls and control sequences.

28
29 Kentucky Building Code: Comply with requirements where applicable
30 for controls.

31
32 Product literature provided by the Temperature Control System
33 Manufacturer shall contain the ISO-9001 Certificate Mark from the
34 applicable registrant.

35
36 Provide products of the temperature control system with the
37 following agency approvals:

38
39 **UL-916;** Energy Management Systems
40 **UL-873;** Temperature Indication and Regulating Equipment
41 **UL-864;** Subcategories UUKL, OUXX, UDTZ; Fire Signaling and
42 Smoke Control Systems
43 **CSA;** Canadian Standards Association
44 **FCC,** Part 15, Subpart J., Class A Computing Devices

45
46 All products shall be labeled with the appropriate approval
47 markings. System installation shall comply with NFPA, NEMA, NEC,
48 Local and National Codes.

1 SUBMITTALS:
2

3 Product Data: Submit manufacturer's technical product data for
4 each control device and compressed air station furnished,
5 indicating dimensions, capacities, performance and electrical
6 characteristics, and material finishes, also include installation
7 and start-up instructions.

8 A. Shop Drawings, Product Data, and Samples
9

- 10 1. Each submittal shall have a cover sheet with
11 the following information provided: submittal
12 ID number; date; project name, address, and
13 title; FMS Contractor name, address and phone
14 number; FMS Contractor project manager,
15 quality control manager, and project engineer
16 names and phone numbers.
- 17 2. Each submittal shall include the following
18 information.
- 19 a. FMS riser diagram showing all DDC
20 controllers, operator workstations,
21 network repeaters, and network wiring.
- 22 b. One-line schematics and system flow
23 diagrams showing the location of all
24 control devices.
- 25 c. Points list for each DDC controller,
26 including: Tag, Point Type, System
27 Name, Object Name, Expanded ID, Display
28 Units, Controller Type, Address, Cable
29 Destination, Module Type, Terminal ID,
30 Panel, Slot Number, Reference Drawing,
31 and Cable Number. **All objects names**
32 **shall comply with the Medical Centers**
33 **naming convention. The contractor must**
34 **schedule a meeting with the Engineer**
35 **and Owner to discuss this before the**
36 **shop drawings are submitted.**
- 37 d. Vendor's own written description for
38 each sequence of operations, to include
39 the following:
- 40 ☐☐ Sequences shall reference
41 input/output and software
42 parameters by name and
43 description.
- 44 ☐☐ The sequences of operations
45 provided in the submittal by the
46 FMS Contractor shall represent
47 the detailed analysis needed to
48 create actual programming code
49 from the design documents.
- 50 ☐☐ Points shall be referenced by
51 name, including all software
52 points such as programmable
53 setpoints, range limits, time
54 delays, and so forth.

- 1 □□ The sequence of operations shall
2 cover normal operation and
3 operation under the various
4 alarm conditions applicable to
5 that system.
6 e. Detailed Bill of Material list for each
7 panel, identifying: quantity, part
8 number, description, and associated
9 options.
10 f. Control Damper Schedules. This
11 spreadsheet type schedule shall include
12 a separate line for each damper and a
13 column for each of the damper
14 attributes, including: Code Number,
15 Fail Position, Damper Type, Damper
16 Operator, Blade Type, Bearing Type,
17 Seals, Duct Size, Damper Size,
18 Mounting, and Actuator Type.
19 g. Control Valve Schedules. This
20 spreadsheet type schedule shall include
21 a separate line for each valve and a
22 column for each of the valve
23 attributes, including: Code Number,
24 Configuration, Fail Position, Pipe
25 Size, Valve Size, Body Configuration,
26 Close off Pressure, Capacity, Valve CV,
27 Calc CV, Design Pressure, Actual
28 Pressure, and Actuator Type.
29 h. Cataloged cut sheets of all equipment
30 used. This includes, but is not limited
31 to, the following: DDC panels,
32 peripherals, sensors, actuators,
33 dampers, control air system components,
34 and so forth.
35 i. Range and scale information for all
36 transmitters and sensors. This sheet
37 shall clearly indicate one device and
38 any applicable options. Where more than
39 one device to be used is on a single
40 sheet, submit two sheets, individually
41 marked.
42 j. Hardware data sheets for all operator
43 workstations, local access panels, and
44 portable operator terminals.
45 k. Software manuals for all applications
46 programs to be provided as a part of
47 the operator workstations, portable
48 operator terminals, programming
49 devices, and so forth for evaluation
50 for compliance with the performance
51 requirements of this Specification.

- 1 3. FMS Contractor shall not order material or
2 begin fabrication or field installation until
3 receiving authorization to proceed in the
4 form of an approved submittal. FMS Contractor
5 shall be solely responsible for the removal
6 and replacement of any item not approved by
7 submittal at no cost to the Owner.
8
- 9 Maintenance Data: Submit maintenance instructions and spare parts
10 lists for each type of control device, and compressed air
11 stations. Include that type data, product and shop drawings in
12 maintenance manual.
13
- 14 Operation and Maintenance Instructions:
15
- 16 This contractor shall prepare three (3) loose-leaf, bound
17 brochures, entitled "Automatic Temperature Control and Monitoring
18 Systems Operation and Maintenance Data." Mark identification on
19 both front and spine of each binder. Each binder shall be a heavy
20 duty 3-ring, vinyl-covered binder with pocket folders for folded
21 sheet information. Binders shall be properly indexed
22 (thumb-tabbed).
23
- 24 Each brochure shall contain the following information:
25
- 26 Name and address of Consulting Engineer, Contractor, and
27 index of equipment, including vendor (name and address).
28
- 29 Complete brochures, descriptive data and parts list, etc., on
30 each piece of equipment, including all approved shop
31 drawings.
32
- 33 Complete maintenance and operating instructions, prepared by
34 the manufacturer, on each major piece of equipment.
35
- 36 Complete shop drawing submittal on temperature and monitoring
37 controls including control diagrams updated to reflect
38 "as-built" conditions.
39
- 40 All wiring and component schematics necessary for Owner to
41 troubleshoot, repair and expand the system.
42
- 43 All brochures shall be submitted to the Architect prior to
44 final inspection of the building.
45
- 46 Provide a framed set of schematic drawings and sequence of
47 operation to be hung at each local panel and at the central
48 computer as directed by the Engineer.
49
50

1 DELIVERY, STORAGE AND HANDLING:
2

3 Provide factory shipping cartons for each piece of equipment and
4 control device. Maintain cartons while shipping, storage and
5 handling as required to prevent equipment damage and to eliminate
6 dirt and moisture from equipment. Store equipment and materials
7 inside and protect from weather.
8
9

10 PART 2 - PRODUCTS
11

12
13 DIRECT DIGITAL CONTROL SYSTEM
14

15 General: This specification defines the minimum hardware and
16 performance requirements for a computer-based building automation
17 system to be furnished and installed.
18
19

20 SCOPE OF WORK:
21

22 System Requirements:
23

24 Contractor shall provide all equipment, engineering and technical
25 specialist time to check the installation required for a complete
26 and functioning system. The contractor shall furnish and install
27 all interconnecting system components. Components to include, but
28 not be limited to: printers, power line conditioners, field
29 panels, sensors, motor starter interfaces, and any other hardware
30 items not mentioned above but required to provide the Owner with a
31 complete workable system.
32

33 Any feature or item necessary for complete operation,
34 trouble-shooting, and maintenance of the system in accordance with
35 the requirements of this specification shall be incorporated, even
36 though that feature or item may not be specifically described
37 herein. This shall include hardware and software.
38

39 All materials and equipment used shall be standard components,
40 regularly manufactured for this and/or other systems and not
41 custom designed especially for this project. All systems and
42 components shall be thoroughly tested and proven in actual use.
43

44 Input/Output Summary:
45

46 The system as specified shall monitor, control and calculate all
47 of the points and functions as listed in the Input/Output Summary.
48

49 The system as installed shall have sufficient computer memory and
50 application software for 5000 point capacity of the same type and
51 combination as the points listed in the Input/Output Summary.
52

1 System Start-Up and Acceptance:
2

3 Upon completion of the installation, the Energy Management System
4 Contractor shall start-up the system and perform all necessary
5 testing and debugging operations. An acceptance test in the
6 presence of the Owner's representative shall be performed. The
7 vendor shall check all sensors that exhibit any problems or faulty
8 reading. When the system performance is deemed satisfactory in
9 whole, the system parts will be accepted for beneficial use and
10 placed under warranty.

11
12 The Energy Management System (EMS) Contractor is responsible for
13 the generation of the graphics. An acceptance test shall be
14 performed for the Owner's representative.
15

16 Owner's Instruction:
17

18 The EMS Contractor shall provide three copies of an operator's
19 manual describing all operating and routine procedures to be used
20 with the system. This user's manual should contain subjects such
21 as: standard operation, error message explanations, software
22 usage, commands, system troubleshooting, etc. The Contractor
23 shall also provide wiring schematics for all system components.
24

25 The EMS Contractor shall instruct the Owner's designated
26 representatives in these procedures during the start-up and test
27 period. The duration of the instruction period shall be no less
28 than forty (16) hours. These instructions are to be conducted
29 during normal working hours at the Owner's convenience and are to
30 be prearranged with the Owner.
31

32 The instructions shall consist of both hands-on and classroom
33 training at the job site.
34
35

36 The EMS Contractor shall also provide additional training for the
37 Owner's chief operators. This training shall be an additional 16
38 hours at the Owner's location three months after installation
39 acceptance. Upon completion, the attendees shall be able to
40 operate the system and implement system changes including
41 start-up, boot load, color graphic generation, add point to the
42 data base, enter messages, and down line load field units.
43

44 Warranty:
45

46 The system including all hardware and software components, shall
47 be warranted for a period of one year following the date of final
48 acceptance. Any defects in materials and workmanship arising
49 during this warranty period shall be corrected without cost to the
50 Owner.
51

52 All applicable software as detailed in this specification shall be
53 updated by the EMS Contractor free of charge during the warranty
54 period. This will ensure that all system software will be the
55 most up-to-date software available from the EMS Contractor.
56
57

1
2 DIRECT DIGITAL CONTROL (DDC) EQUIPMENT

3
4 Hand Held Operator Terminal (HHOT)

5
6 Provide one Hand Held Operators Terminal. Terminal shall allow
7 connection to a network controller within the network, to allow
8 review and modification of all control points. In addition, all
9 points shall be accessible for review and modification through a
10 connection to the room sensor or controller.
11

12 CENTRALIZED HOST STATION (CHS) SOFTWARE

13
14 Graphics shall be developed on the Medical Center's front-end
15 software. The Medical Center's graphic standards must be followed.
16 A meeting with the Engineer and Owner shall be scheduled before
17 the graphics are developed. Graphics shall provide the
18 functionality described below and as specified in the I/O
19 Schedule.
20

21 Dynamic Graphics

22
23 The Graphic shall allow the operator to access any system
24 information via a "system penetration" method. "System
25 penetration" shall allow the operator to begin at an entire site
26 plan and then zoom in to a particular area for closer inspection
27 and then further zoom in on this area and so on until the detailed
28 color graphic display of a desired portion of the facility is
29 represented. The operator shall be able in this manner to
30 "penetrate" to any desired system information without being
31 required to enter any commands via the keyboard.
32

33 As a minimum, a Graphic screen shall be designed showing the
34 entire facility, each building within the facility, each major
35 piece of mechanical equipment within each building, each
36 temperature control zone, all of which will display the data for
37 each area dynamically.
38
39

40 Global Digital Controllers (GDC)

41
42 General

43
44 Standalone Digital Controllers (GDC) shall be minimum 16 bit
45 microcomputer based, utilizing a multi-tasking, multi-user
46 operating system.
47

48 The GDC controllers shall permit the simultaneous operation of all
49 control, communication facilities management and operator
50 interface software, as programmed by the Contractor or User.
51 Modification of the on-board GDC controller database shall be
52 performed on-line using the built-in or HHOT interface. Systems
53 which require the GDC to be removed from service while DDC control
54 sequences are modified shall not be acceptable.
55

56 SDC controllers shall utilize true floating point arithmetic
57 capabilities.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50

Database and Memory Back-Up

All programming defining the functions to be performed by the GDC, including but not limited to application programs and point database within each GDC, shall be protected from loss due to power failure for a minimum of 72 hours.

Service Ports

GDC controllers shall be equipped with a minimum of one operator service port for the connection of a HHOT. The service port shall be either a built-in RS-232 data terminal port or an RJ-11 type jack which connects to the manufacturer's standard HHOT.

Connection of a service device, to a service port, shall not cause the GDC controller to lose communications with its peers or other networked device controllers.

Display and Readout Capability

The GDC controller shall additionally provide diagnostic LED indication of device transmit and receive data communications for all communication port and peripheral ports, normal operation, abnormal operation and control relay operation indication.

Manual/Auto Control and Notification

The GDC controller shall provide commanded override capability from the HHOT or the built-in operator interface. Such overrides shall be annunciated to the CHS's. Such overrides shall be valid as long as power is applied to the controller.

Adjustments

Every control panel shall provide adjustments for the functions specified. In general, adjustments shall be provided for all setpoints used by controllers within each control panel. In addition, adjustments shall be provided for throttling ranges, mixed air damper minimum positions, or other items as specified. Adjustments shall be integral to each individual GDC. The built-in operator interfaces shall allow the easy execution of the adjustment through named identifiers within the GDC. From a single GDC user interface, any other GDC shall be accessible and full adjustment capabilities shall be provided.

Standalone Digital Controller (SDC)

General

1 Controls shall be microprocessor based, Standalone Handler Digital
2 Controllers (SDC's). SDC's shall be provided for Air Handling
3 Units, packaged Rooftops, primary and secondary pumping loop
4 systems and other applications as shown on the drawings. SDC's
5 shall be based on a minimum 16 bit microprocessor working from
6 software program memory which is physically located in the SDC.
7 The application control program shall be resident within the same
8 enclosure as the input/output circuitry which translates the
9 sensor signals. All input/output signal conversion shall be
10 performed through a minimum of a 10 bit A to D converter. All
11 input points shall be universal in nature allowing their
12 individual function definition to be assigned through the
13 application software. All unused input points must be available
14 as universally definable at the discretion of the owner. If the
15 input points are not fully universal in nature, unused points must
16 be equal in quantity between Analog Inputs and Digital Inputs.

17
18 Contractor shall provide a minimum of one SDC controller per air
19 handling or mechanical system as shown on the drawings.

20
21 The BAS contractor shall provide and field install all SDC's
22 specified under this section. Mechanical equipment manufacturers
23 desiring to provide SDC type controls as factory mounted
24 equipment, shall provide a separate bid for their products less
25 all controls, actuators, valve assemblies and sensors, which are
26 specified to be provided by the BAS/Temperature control
27 contractor.

28
29 All input/output signals shall be directly hardwired to the SDC.
30 Troubleshooting of input/output signals shall be easily executed
31 with a volt-ohm meter (VOM). As a result of this intent, it is
32 specified that power line carrier systems, or other systems which
33 command multiple outputs over a single pair of wires, shall not be
34 utilized.

35
36 SDC's shall be in continuous direct communication with the network
37 which forms the facility wide Building Automation System. The
38 SDC's shall communicate with the GDC at a minimum baud rate of
39 9,600 baud.

40
41 Non-Volatile Memory

42
43 All control sequences programmed into the GDC shall be stored in
44 non-volatile memory, which is not dependent upon the presence of a
45 battery, to be retained. Power failures shall not cause the GDC
46 memory to be lost, nor shall there be any need for batteries to be
47 recharged or replaced to maintain the integrity of the controller
48 database. The GDC shall allow for the creation of unique
49 application control sequences. Systems that only allow selection
50 of sequences from a library or table, are not acceptable.

51
52 All control sequences shall be fully programmable at the SDC,
53 allowing for the creation and editing of an application control
54 sequence, while at the unit.

55

1 The SDC shall be provided with an interface port for the HHOT.
2 The interface port shall allow the HHOT to have full functionality
3 as described above. From the interface port or network terminal,
4 the HHOT shall be able to directly access any SDC, or UDC in the
5 network.
6

7 The SDC shall provide an input/output point trending utility that
8 is capable of accumulating 48 analog point samples and 10 digital
9 point samples, per Input/Output point. Each sample shall be taken
10 on a user defined interval, ranging from 1 second to 255 hours per
11 sample. The digital readings shall be on a change of state
12 occurrence for the digital points. All samples shall be recorded
13 with the engineering units for the value, along with a time and
14 date identifier for each sample taken. The samples shall be
15 protected against loss due to power interruptions through a
16 battery or capacitor backup method for a minimum of 30 days.
17

18 Systems unable to provide the above capability shall provide for
19 the individual Input/Output point trending at the GDC. Specifics
20 as to how each SDC point will be trended, at the GDC, shall be
21 provided in the submittal documents. Included in the explanation
22 shall be the sample intervals, the memory allocation in the GDC
23 and the number of SDC's per GDC that can be expected.
24

25 The SDC shall provide LED indication of transmit/receive
26 communications performance, as well as for the proper/improper
27 operation of the controller itself.
28

29 The SDC shall be provided with a battery backed time clock that is
30 capable of maintaining the time of day and calendar for up to
31 thirty days, upon loss of power to the SDC, without loss of
32 setting. The battery for the time clock shall be replaceable by
33 the customer. The SDC shall be provided with integral time
34 schedules; as a minimum, two seven day schedules with eight on/off
35 periods per day shall be provided. Holiday override of weekly
36 schedules shall be provided for pre-scheduling of holidays, for
37 the year in advance.
38

39 Controller Location

40

41 To simplify controls and mechanical service troubleshooting, the
42 SDC shall be capable of being mounted directly in or on the
43 controls compartment of the air handling system. The SDC shall be
44 housed in a NEMA 1 enclosure to accommodate direct mounting on the
45 equipment to be controlled. The SDC shall be constructed in a
46 modular orientation such that service of the failed components can
47 be done quickly and easily. The modular construction should limit
48 the quantities of printed circuit boards to a maximum of two. All
49 logic, control system, power supply and input/output circuitry
50 shall be contained on a single plug-in circuit board. When
51 required to replace a printed circuit board, it shall not be
52 necessary to disconnect any field wiring. This shall allow all
53 controls maintenance and troubleshooting to be made while at the
54 air handling unit. The SDC shall be directly wired to sensory
55 devices, staging relays or modulating valves for heating and
56 cooling.
57

1 For compatibility to the environment of the air handling unit,
2 SDC's shall have wide ambient ratings. SDC's shall be rated for
3 service from -40 DegF (Degrees Fahrenheit) to 140 DegF.

4
5 Contractor shall submit description of location of SDC's on all
6 mechanical and air handling equipment.

7
8 Unitary Digital Controller (UDC)

9
10 General

11
12 Controls shall be microprocessor based Unitary Digital Controllers
13 (UDC's). UDC's shall be provided for Unit Ventilators, Fan Coils,
14 Heat Pumps and other applications as shown on the drawings. UDC's
15 shall be based on a minimum 16 bit microprocessor working from
16 software program memory which is physically located in the UDC.
17 The application control program shall be resident within the same
18 enclosure as the input/output circuitry which translates the
19 sensor signals. All input/output signal conversion shall be
20 performed through a minimum of a 10 bit A to D converter.

21
22 Contractor shall provide a minimum of one UDC controller per
23 unitary system as shown on the drawings.

24
25 The BAS contractor shall provide and install all UDC's specified
26 under this section.

27
28 All input/output signals shall be directly hardwired to the UDC.
29 Troubleshooting of input/output signals shall be easily executed
30 with a volt-ohm meter (VOM). As a result of this intent, it is
31 specified that power line carrier systems, or other systems which
32 command multiple outputs over a single pair of wires, shall not be
33 utilized.

34
35 UDC's shall be in continuous, direct communication with the
36 network which forms the facility wide building automation system.
37 The UDC's shall communicate with the GDC at a baud rate of not
38 less than 9,600 baud.

39
40 Non-Volatile Memory

41
42 All control sequences programmed into the UDC shall be stored in
43 non-volatile memory, which is not dependent upon the presence of a
44 battery, to be retained. Power failures shall not cause the UDC
45 memory to be lost, nor shall there be any need for batteries to be
46 recharged or replaced to maintain the integrity of the controller
47 database. The UDC shall allow for the creation of unique
48 application control sequences.

49
50 The UDC shall be provided with the ability to interface with the
51 HHOT. The interface port shall be provided at the wall sensor or
52 within the unitary equipment.

53

1 The UDC shall provide an input/output point trending utility that
2 is capable of accumulating 48 analog point samples and 10 digital
3 point samples per Input/Output point. Each sample shall be taken
4 on a user defined interval, ranging from 1 second to 255 hours per
5 sample. The digital readings shall be on a change of state
6 occurrence for the digital points. All samples shall be recorded
7 with the engineering units for the value, along with a time and
8 date identifier for each sample taken.
9

10 Systems unable to provide the above capability shall provide for
11 the individual input/output point trending at the GDC. Specifics
12 as to how each UDC point will be trended, at the GDC, shall be
13 provided in the submittal documents. Included in the explanation
14 shall be the sample intervals, the memory allocation in the GDC
15 and the number of UDC's per GDC that can be expected.

16 17 Controller Location

18
19 To simplify controls and mechanical service troubleshooting, the
20 UDC shall be mounted directly in the controls compartment of the
21 unitary system. The UDC shall be provided with a sheet metal or
22 polymeric enclosure that is constructed of material allowing for
23 the direct mounting within the primary air stream, as defined by
24 UL-465. The direct mounting shall allow all controls maintenance
25 and troubleshooting to be made while at the unitary equipment.
26 The UDC shall be directly wired to sensory devices, staging relays
27 or modulating valves for heating and cooling.
28

29 For compatibility to the environment of the unitary equipment,
30 UDC's shall have wide ambient ratings. UDC's shall be rated for
31 service from 32 DegF (Degrees Fahrenheit) to 140 DegF.
32

33 Contractor shall submit description of location of UDC's on all
34 mechanical and unitary equipment.
35

36 37 CONTROL PANELS

38
39 Panelboard shall contain all instruments and accessories. Provide
40 each item of equipment with an engraved nameplate. Panelboard
41 shall be wall-mounted or stand-mounted and shall be completely
42 enclosed.
43

44 As far as is practical, the control components for each system
45 shall be grouped. Provide each group of components with
46 identification.
47

48 The entire panelboard shall be pre-wired and brought to a main
49 terminal strip. All relays, switches, etc., shall be installed,
50 furnished and wired on panelboard. Clearly mark each terminal
51 strip as to which wire from which component is to be connected.
52

53 Fabricate panels of 0.06-inch- (1.5-mm-) thick, furniture-quality
54 steel, or extruded-aluminum alloy, totally enclosed, with hinged
55 doors and keyed lock, with manufacturer's standard shop-painted
56 finish and color.
57

1 Panel-Mounted Equipment: Temperature and humidity controllers,
2 relays, and automatic switches; except safety devices. Mount
3 devices with adjustments accessible through front of panel.

4
5 Door-Mounted Equipment: Flush-mount (on hinged door) manual
6 switches, including damper-positioning switches, changeover
7 switches, thermometers, and gages.

8
9 Graphics: Color-coded graphic, laminated-plastic displays on
10 doors, schematically showing system being controlled, with
11 protective, clear plastic sheet bonded to entire door.

12
13
14 SENSORS

15
16 Electronic Sensors used in air ducts or liquid lines shall utilize
17 non-adjustable RTD or thermistor sensing elements with + or -
18 0.36°F. accuracy and stability of at least + or -0.05°F. per year.
19 All sensors used in liquid line shall be provided with separable
20 stainless steel immersion wells. Averaging sensors shall be a
21 minimum of five (5) feet in length, and shall be installed in such
22 a manner so as to sense representative sample of the medium being
23 controlled.

24
25 Pneumatic Transmitters: Vibration and corrosion resistant.

26
27 Pressure Transmitters: Pressure sensor and transmitter of
28 linear-output type, with range of 0 to 6 inches wg (0 to 1492
29 Pa) adjustable in 2-inch wg (497-Pa) spans, 3- to 15-psi (21-
30 to 103-kPa) output. One pipe, direct acting for gas, liquid,
31 or steam service.

32
33 Static-Pressure Transmitters: One pipe, direct acting,
34 double bell, unidirectional with suitable range for expected
35 input, temperature compensated.

36
37 Accuracy: 5 percent of full range and 2 percent of full-
38 scale, midrange accuracy.

39
40 Output: 3 to 15 psi (21 to 103 kPa).

41
42 Equipment Operation Sensors: As follows:

43
44 Status Inputs for Fans: Differential-pressure switch with
45 adjustable range set to 175 percent of rated fan static
46 pressure.

47
48 Status Inputs for Electric Motors: Current-sensing relay
49 with current transformers, adjustable and set to 175 percent
50 of rated motor current.

51
52 Damper Position Indication: Potentiometer mounted in enclosure
53 with adjustable crank-arm assembly connected to damper to transmit
54 0 to 100 percent damper travel.

55
56
57 SENSOR INPUT AND OUTPUT DEVICES:

1
2 The following sensors and devices, or their equivalents, shall be
3 considered acceptable. Other sensors and devices required for
4 this specification are outlined in their respective subsystem.
5
6 Analog sensing elements for remote indication to be independent of
7 local pneumatic sensors used for local control loops.
8
9 System Accuracy: The system shall maintain an end-to-end accuracy
10 for one year from sensor to operators console display for the
11 application specified.

12
13 STANDARD Pressure Sensor
14
15 TYPE Electronic with LVDT element.
16
17 APPLICATION 4-20 mA Output (2 wire)
18 Wire in conduit
19 Input voltage 10-35 volts DC
20 Loop resistance greater than or equal to 500
21 ohms
22
23 MECHANICAL Linear variable differential transformer
24 (LVDT) element
25 Allowable Standard Ranges 0- 30 PSI
26 0-100 PSI
27 0-200 PSI
28 Other ranges with Owner written approval
29 1/2" NPT input thread and conduit
30 connection.
31 Provide differential inputs unless otherwise
32 approved.
33
34 Provide an air filter on unused differential
35 ports.
36
37 Provide with a NEMA 4 watertight enclosure
38 unless otherwise approved.
39
40 Min. rate pressure - 150% FS proof and 450
41 PSI static.
42
43 OVERALL ACCURACY \pm 0.5% F.S. including Linearity, hysteresis and
44 repeatability.

45
46 ACCURACY NOTE: If pressure transducer is used to calculate
47 flow with a pilot tube, then the accuracy of the pressure sensor
48 should be dictated by the overall accuracy requirement of the
49 system and would probably require a high accuracy sensor.

50
51 EXAMPLE OF UNITS THAT MEET THESE SPECIFICATIONS:
52
53 Pressure Sensor 0 - 30 PSI Robinson-Halpren 153C-D030-W
54 Pressure Sensor 0 - 100 PSI Robinson-Halpren 153C-D030-W
55 Pressure Sensor 0 - 200 PSI Robinson-Halpren 153C-D030-W
56 High Accuracy 0-XXX" W.C. Robinson-Halpren 157-C-DXXX-W
57

1 All fan status sensors shall be CLEAFS405 Cleveland SPDT pressure
2 switches with a range of .05 - 12" w.c. or equal.

3
4 This section covers all new transducers provided. All new
5 transducers provided shall be of the following type:

6	7	8	9
	<u>INPUT</u>		<u>OUTPUT</u>
10	1.	Temperature (deg.F.)	4-20 mA, 2 wire
11		Temperature (deg.F.)	100 ohm platinum wire RTD
12	2.	Pressure	4-20 mA, 2 wire
13			
14	3.	Flow Instantaneous	4-20 mA, 2 wire
15			
16	4.	Flow Integrated	Pulse 10 PPS Max A25
17			msec open (min.) 40 msec
18			closed (min.)
19			
20	5.	KW Instantaneous	4-20 mA, 2 wire
21			
22	6.	KWH - Integrated	Pulse - 10 PPS Max A25
23			msec open (min.) 40 msec
24			closed (min.)
25			

26 Digital inputs from devices with isolated, dry type contacts (no
27 grounds, no voltage) of either normally open (N.O.) or normally
28 closed (N.C.) configuration. Live contact inputs, those that have
29 voltage present, shall be provided with isolating devices to meet
30 dry contact requirement.

31
32 AIR SUPPLY

33
34 Connect to the existing pneumatic piping in the penthouse.

35
36 Control and Instrumentation Tubing: Seamless copper tubing;
37 Type K, ASTM B 88 or Type ACR, ASTM B 280; with cast-bronze
38 solder-joint fittings, ASME B16.18; or wrought-copper solder-joint
39 fittings, ASME B16.22; soldered or brazed; except forged brass
40 compression-type fittings at connections to equipment.

41
42 Control and Instrumentation Tubing: Virgin-polyethylene, flame-
43 retardant, nonmetallic tubing, ASTM D 2737, and with flame-
44 retardant harness for multiple tubing; compression or push-on
45 polyethylene fittings.

46
47 Pneumatic Accessories: As follows:

48
49 Pressure Gages: Manufacturer's standard, black letters on white
50 background, 2-1/2-inch (64-mm) diameter, flush or surface mounted,
51 with front calibration screw to match sensor, in appropriate
52 units.

53
54 Instrument Pressure Gages: Manufacturer's standard, black letters
55 on white background, 1-1/2-inch (38-mm) diameter, stem mounted,
56 with suitable dial range.

57

1 Gage Cocks: Tee or level handle, bronze, rated for 125 psi (862
2 kPa).

3
4 Relays: For summing, reversing, amplifying, highest or lowest
5 pressure selection, with adjustable input/output ratio.

6
7 Switches: With indicating plates, accessible adjustment,
8 calibrated and marked.

9
10
11 ACTUATORS:

12
13 Pneumatic Damper Operators: Rolling-diaphragm, piston type with
14 adjustable stops and spring return, sized to operate with
15 sufficient reserve power to provide smooth modulating action or 2-
16 position action. Where actuators operate in sequence, provide
17 pilot positioners.

18
19 Pilot Positioners: Starting point adjustable from 2 to 12 psi (14
20 to 83 kPa) and operating span adjustable from 5 to 13 psi (35 to
21 90 kPa).

22
23 Provide separate motor for each outside air, return air and
24 exhaust air damper. Do not link dampers with different functions
25 together on one damper motor.

26
27 Provide separate motor for each damper when overall damper size
28 exceeds 48" in either dimension. Do not link different dampers
29 together on one damper motor.

30
31
32 MISCELLANEOUS:

33
34 Lightning Protection: All electric/electronic equipment supplied
35 must be internally or externally lightning/transient surge voltage
36 protected on all external power feeder and input/output
37 connections which are subject to surge voltage transients.
38 Provide high speed clamping elements which meet IEEE. STD. 472
39 (SWC) on all digital or analog data channels.

40
41 Pressure Instruments:

42
43 Differential Pressure and Pressure Sensors: Sensors shall
44 have 4-20 mA output proportional signal with provisions for
45 field checking. Sensors shall withstand up to 150% of rated
46 pressure, without damaging device. Accuracy shall be within
47 2% of full scale.

48
49 Pressure Switches: Pressure switches shall have repetitive
50 accuracy of +2% of range and withstand up to 150% of rated
51 pressure. Sensors shall be diaphragm or bourdon tube design.
52 Switch operation shall be adjustable over operating pressure
53 range. Switch shall have application rated Form C, snap-
54 acting, self-wiping contact of platinum alloy, silver alloy
55 or gold plating.

1 Current Sensing Relays: Relays shall monitor status of motor
2 loads. Switch shall have self-wiping, snap-acting Form C contacts
3 rated for application. Setpoint of contact operation shall be
4 field adjustable.

5
6 Low Voltage Wiring: Control wiring for analog functions shall be
7 18 AWG minimum with 600 volt insulation, twisted and shielded, 2
8 or 3 wire to match analog function hardware.

9
10 Low Voltage Wiring: Wiring for electric or electronic circuits
11 less than 25 volts shall be cabling manufactured for express use
12 in air plenums. The plenum cable shall be 24 gauge or larger as
13 required, tinned copper, teflon insulated, twisted pairs, shielded
14 or unshielded, as required, a color coded, overall tape wrap, with
15 transparent teflon jacket, 150V., NEC725, Class 2 classified for
16 use in air plenum non-conduit signalling application.

17
18 Manual Override Switches: In case of failure of the DDC system,
19 provide override switches to operate fans, pumps, air handling
20 units, cooling tower, heat exchangers, etc., manually in local
21 interface control panel. Also for temperature and pressure
22 control provide switches to allow supply temperatures, water
23 temperatures, supply air pressure and fans to be manually
24 regulated. All switches shall be located in locked panel to
25 prevent unauthorized use of the manual override switches.

26
27
28 PART 3 - EXECUTION

29
30
31 INSPECTION:

32
33 Examine areas and conditions under which control systems are to be
34 installed. Do not proceed with work until unsatisfactory
35 conditions have been corrected in manner acceptable to Installer.

36
37
38 INSTALLATION OF AUTOMATIC TEMPERATURE CONTROLS

39
40 General: Install systems and materials in accordance with
41 manufacturer's instructions, roughing-in drawings and details
42 shown on the Drawings.

43
44
45 CONTROL AIR PIPING:

46
47 Accessible tubing is defined as that tubing run in mechanical
48 equipment rooms; inside mechanical equipment enclosures, such as
49 heating and cooling units, instrument panels, etc.; in pipe
50 chases, or suspended ceilings with easy access. Inaccessible
51 tubing is defined as that tubing run in concrete slabs; furred
52 walls; or ceilings with no access.

1 Run air piping in a neat, workmanlike manner. In general, main
2 air lines shall be 3/8" and branch lines shall be 1/4". Conceal
3 piping in finished areas. In Mechanical Rooms and areas without
4 ceilings, run tubing exposed, run parallel with building structure
5 and securely fasten to the building structure at regular
6 intervals. Do not support tubing from other mechanical or
7 electrical work. Air tubing shall not "bridge" flexible
8 connections on air units unless provided with a section of
9 flexible tubing.

10
11 Provide copper tubing with maximum unsupported length of 4'-0",
12 for accessible tubing run exposed to view. Polyethylene tubing
13 may be used in lieu of above, when run within adequately
14 supported, rigid enclosure, such as metallic raceways or EMT
15 conduit. Terminal single-line connections less than 18" in length
16 shall be copper tubing, or polyethylene tubing run inside flexible
17 steel protection, or may be exposed if length is 12 inches or
18 less.

19
20 No plastic-to-copper transitions shall be made in inaccessible
21 areas, such as wall cavities.

22
23 Provide copper tubing or polyethylene tubing for inaccessible
24 tubing, other than in concrete pour. If polyethylene tubing is
25 used, install in EMT conduit.

26
27 Provide copper tubing or polyethylene tubing for inaccessible
28 tubing installed in concrete. If copper is used, protect at
29 surfaces of concrete with EMT extending 6" out and 6" into pour.
30 If polyethylene is used, provide EMT conduit throughout all
31 concrete work. Pressure test before and after pour for leak and
32 pinch.

33
34 Polyethylene plastic tubing may be used, as an option, providing
35 it is run within electrical thinwall conduit with junction boxes
36 at short turns and junctions. Tubing shall be fully coded (using
37 colors or numbers) -- no two (2) tubes in a common conduit shall
38 have the same coding. Terminate conduit with insulated bushings.

39 Plastic tubing may be used within panelboards and within and on
40 air boxes without the conduit. Submit sizes of conduit and
41 junction boxes and obtain approval before installation. Plastic
42 tubing shall be equal to Dektron Type "P", black, designed to
43 operate at 180°F. The Contractor under this Division shall assume
44 the responsibility of protecting plastic tubing during
45 construction and shall take precautions against crimping, severe
46 bends and locating near excessive heat sources. There shall be no
47 more than three (3) 90° bends between pull boxes. Pull boxes shall
48 be appropriate size to allow free movement of the tubing and space
49 for all connections. Minimum size of junction boxes shall be 4" x
50 4" x 2-1/2". Boxes shall be at least 16-gauge. Conduit
51 connections shall have plastic inserts.

52
53 The maximum number of 1/4" air lines which may be installed in
54 thinwall conduit shall be as follows:

55
56

<u>Size of Conduit</u>	<u>Number of Air Lines</u>
------------------------	----------------------------

1	1/2" -- Size <u>NOT</u> allowed on project	
2	3/4"	5
3	1"	10
4	1-1/4"	16
5	1-1/2"	20
6	2"	32

7
8 Pressure test control air piping at 30 psi for 24 hours. Test
9 fails if more than 5 PSI loss occurs.

10
11 Fasten flexible connections bridging cabinets and doors, neatly
12 along hinge side, and protect against abrasion. Tie and support
13 tubing neatly.

14
15 Number-code or color-code tubing, except local individual room
16 control tubing, for future identification and servicing of control
17 system.

18
19
20 CONTROL WIRING: Install control wiring, without splices between
21 terminal points, color-coded. Install in neat workmanlike manner,
22 securely fastened. Install in accordance with National Electrical
23 Code. Install wiring in electrical conduit in all areas.

24
25 Conceal wiring and cable, except in mechanical rooms and areas
26 where other conduit and piping are exposed.

27
28 Install all control wiring with color-coded wire in 3/4" minimum
29 size conduit. Wire gauge to be in accordance with National
30 Electrical Code.

31
32 Number-code or color-code conductors, except local individual room
33 controls, for future identification and servicing of control
34 system.

35
36 Connect electrical components to wiring systems and to ground as
37 indicated and instructed by manufacturer. Tighten connectors and
38 terminals, including screws and bolts, according to equipment
39 manufacturer's published torque-tightening values for equipment
40 connectors. Where manufacturer's torquing requirements are not
41 indicated, tighten connectors and terminals according to
42 tightening requirements specified in UL 486A.

43
44
45 POWER WIRING:
46
47 Furnish and install power cabling and conduit for temperature
48 controls from emergency power panels. Each temperature control
49 panel shall be connected to a separate circuit. Conduits shall
50 connect to panels at the locations directed by the Contractor
51 under Division 16. Final connection in the power panels shall be
52 by Temperature Control Contractor in coordination with Division 16
53 Contractor.

54
55
56 MISCELLANEOUS:
57

1 Connect the Digital System Controllers to a remote console. The
2 interconnection, all conduit and transmission cabling, including
3 hardware shall be furnished and installed by this Contractor.

4
5 Software Programming: All software programs, including color
6 graphic generation, shall be programmed by this Contractor.

7
8 Installation of Mechanical Devices: Refer to Division 15 sections
9 for installation of valve bodies, control wells and dampers; not
10 work of this section.

11
12
13 ADJUSTMENT AND SERVICE:

14
15 After completion of the installation, the automatic temperature
16 control manufacturer shall regulate and adjust all thermostats,
17 control valves, motors, and other equipment provided under his
18 contract and shall place them in complete operating condition,
19 subject to approval by the Architect and Owner.

20
21 This Contractor shall work with the Balancing Contractor to
22 provide verification of CFM reading from the DDC terminal unit
23 controllers.

24
25 Final adjustment shall be performed by specially trained personnel
26 in direct employ of manufacturer of primary temperature control
27 system.

28
29 After completion of installation, perform the following:

30
31 Installation.

32 Check proper installation and connection of each control
33 device.

34 Verify electric power.

35 Verify each sensor and actuator connection to field computer.

36
37 Field Computer Operation.

38 Point Test.

39 - check of wiring of each sensor and actuator end-to-end

40 - verify calibration of each sensor.

41 - verify manual operation of each actuator.

42
43 Local loop control.

44 - bring each local loop under control.

45 - check response to upset, change in setpoint.

46 - check full and partial load operation.

47
48 Supervisory functions.

49 - verify time clock schedules.

50 - verify reset control.

51
52 Verify host computer operation.

53
54 Verify communication with each field device.

55 - perform end-to-end sensor and actuator checks.

56 - verify that the database is correct.

57

- 1 Develop graphic display for each subsystem.
- 2
- 3 Test other software.
- 4 Trend Logging.
- 5 Report Generation.
- 6 Remote Access.
- 7 System Documentation.
- 8
- 9 Verify proper operation of every control point in the presence of
- 10 the Engineer. Include point-by-point checkout.
- 11
- 12 The control manufacturer shall provide a period of free service
- 13 extending through one complete heating season and one complete
- 14 cooling season, after acceptance of the control system, and shall
- 15 report the condition of the control equipment to the Owner and the
- 16 Architect.
- 17
- 18

19 PART 4 - SEQUENCE OF OPERATION:

20

21

22 Abbreviation "DDC" is for Direct Digital Controller.

23

24 Exhaust Fans:

25

26 Exhaust fans shall be indexed on through DDC/EMS system and shall

27 run continuously. Exhaust dampers shall open when their

28 respective fans operate and close when they stop. The fan's

29 frequency drive shall be regulated to maintain 2" S.P.

30 (adjustable) in the unit's exhaust plenum. The bypass damper

31 shall be modulated to maintain a minimum discharge stack velocity

32 of 3000 fpm (adjustable). Provide air pressure differential

33 switch across each exhaust fan for status and failure.

34

35 Do not "mix" controls. All controllers required to perform the

36 above mentioned sequence shall be by the same manufacturer.

37

38

39 **BACnet Functionality**

40

41 The system shall support BACnet standard ANSI/ASHRAE 135-1995 utilizing a high speed Ethernet LAN

42 (IEEE 8802.3) communications network. It shall support, at a minimum the following:

43

44 BACnet Function Groups Supported

Clock	Files
HHWS	Reinitialize
PCWS	Virtual Operator Interface
Event Initialization	Virtual Terminal
COV Event Initialization	Time Master
COV Event Response	

45

46 **BACnet Standard Application Services Supported**

Application Service
ConfirmedCOVNotifications
Subscribe COV

University of Kentucky
 HSRB Exhaust Fans Replacement
 Chandler Medical Center
 UK Project#
 S&F Job No. 90316G

UnconfirmedCOVNotification
ReadProperty
WriteProperty
WritePropertyMultiple
Who-Is

1
 2 Standard Object Types Supported

Object Type
Analog Input
Analog Output
Analog Value
Binary Input
Binary Output
Binary Value
Calendar
Command
Device
Event Enrolment
File
Group
Loop
Schedule

3
 4 **Data Link Layer Options**

ISO 8802-3, 10BASE5	X
ISO 8802-3, 10BASE2	X
ISO 8802-3, 10BASET	X
ISO 8802-3, Fiber	X

5
 6 (I/O SUMMARY SHEET TO FOLLOW THIS SECTION)

1 SECTION 15981 - TESTING, ADJUSTING AND BALANCING

2
3
4 PART 1 - GENERAL

5
6
7 RELATED DOCUMENTS:

8
9 Drawings and general provisions of Contract, including General and
10 Supplementary Conditions, General Mechanical Provisions and
11 Division-1 Specification sections, apply to work of this section.
12

13
14 DESCRIPTION OF WORK:

15
16 Extent of testing, adjusting, and balancing work is indicated by
17 requirements of this section, and also by drawings and schedules,
18 and is defined to include, but is not necessarily limited to, air
19 distribution systems, hydronic distribution systems and associated
20 equipment and apparatus of mechanical work. The work consists of
21 setting speed and volume (flow) adjusting facilities provided for
22 systems, recording data, conducting tests, preparing and submitting
23 reports, and recommending modifications to work as required by
24 contract documents.
25

26 Component types of testing, adjusting, and balancing specified in
27 this section includes the following as applied to mechanical
28 equipment:

29
30 Fans.
31

32
33 DEFINITIONS

34
35 AABC: The Associated Air Balance Council is a non-profit
36 association of independent, certified agencies specializing in
37 testing and balancing HVAC systems.
38

39 ASHRAE: American Society of Heating, Refrigerating and Air
40 Conditioning Engineers.
41

42 HVAC: Heating, Ventilating and Air Conditioning.
43

44 NAS: National Account Services. An enhanced program of testing and
45 balancing offering an expanded range of services including a Quality
46 Assurance Guaranty.
47

48
49 TAB: Testing, Adjusting and Balancing of HVAC systems to meet
50 design objectives and obtain optimum system performance.

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1
2 TBE: Test and Balance Engineer is an individual certified by the
3 Kentucky Board of Professional Engineers and having a degree in
4 engineering and 3 years of test and balance experience.

5
6
7 REFERENCES

8
9 Associated Air Balance Council, National Standards, Fifth Edition,
10 1989.

11
12 1987 ASHRAE Handbook, HVAC Systems and Applications, Chapter 57,
13 Testing, Adjusting and Balancing.

14
15
16 QUALITY ASSURANCE:

17
18 Testing and Balancing (TAB) Agency shall comply with the
19 requirements of the AABC National Account Services (NAS) or NEBB.

20
21 The project manager shall be a registered Professional Engineer (PE)
22 and shall oversee the project and shall check, and stamp all data
23 for correctness before submitting.

24
25 The project superintendent will be on the site and supervise any TAB
26 work being performed. The project superintendent shall, at a
27 minimum, possess their EIT and a Bachelor of Science Engineering
28 Degree.

29
30 In addition, the project superintendent and manager must possess at
31 least 3 years of field experience in testing and balancing and work
32 on at least three projects of similar size and complexity.

33
34 All work shall be performed in accordance with AABC National
35 Standards or NEBB Standards. If these specifications set forth more
36 stringent requirements than the AABC National Standards, these
37 specifications shall prevail.

38
39 Industry Standards: Comply with American Society of Heating,
40 Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
41 recommendations pertaining to measurements, instruments and testing,
42 adjusting and balancing, except as otherwise indicated.

43
44
45 SUBMITTALS:

46
47 Submit certified test reports signed by TBE Supervisor who performed
48 TAB work.

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 Include identification and types of instruments used and their
2 most recent calibration date with submission of final test
3 report.
4

5 Maintenance Data: Include in maintenance manuals, copies of
6 certified test reports.
7

8
9 JOB CONDITIONS:

10
11 Do not proceed with testing, adjusting, and balancing work until
12 work has been completed and is operable. Ensure that there is no
13 latent residual work still to be completed.
14

15 Do not proceed until work scheduled for testing, adjusting, and
16 balancing is clean and free from debris, dirt and discarded building
17 materials.
18

19 **PART 2 - PRODUCTS**

20
21 PATCHING MATERIALS:

22
23 Except as otherwise indicated, use same products as used by original
24 Installer for patching holes in insulation, ductwork and housings
25 which have been cut or drilled for test purposes, including access
26 for test instruments, attaching jigs, and similar purposes.
27

28 At Tester's option, plastic plugs with retainers may be used
29 to patch drilled holes in ductwork and housings.
30

31
32 TEST INSTRUMENTS:

33
34 Utilize test instruments and equipment for TAB work required, of
35 type, precision, and capacity as recommended in the following TAB
36 standards:
37

38 AABC's Manual MN-1 "AABC National Standards".
39
40

41 **PART 3 - EXECUTION**

42
43
44 General

45
46 Examine installed work and conditions under which testing is to be
47 done to ensure that work has been completed, cleaned and is
48 operable. Do not proceed with TAB work until unsatisfactory
49 conditions have been corrected in manner acceptable to Tester.
50

1 Test, adjust and balance environmental systems and components, as
2 indicated, in accordance with procedures outlined in applicable
3 standards.

4
5 Prepare report of test results, including instrumentation
6 calibration reports, in format recommended by applicable standards.

7
8 Patch holes in insulation, ductwork and housings, which have been
9 cut or drilled for test purposes, in manner recommended by original
10 Installer.

11
12 Make equipment settings, including damper control positions, valve
13 indicators, fan speed control levers, and similar controls and
14 devices, to show final settings at completion of TAB work. Provide
15 markings with paint or other suitable permanent identification
16 materials.

17
18
19 PROCEDURES:

20
21 Air System Test and Balance Procedures:

22
23 Where shown on the plans, this Contractor shall field verify
24 existing air flow in existing duct before any demolition is
25 performed on the system.

26
27 Fan CFM: Measure each fan's performance, inlet air flow, discharge
28 air flow, pressures, and current.

29
30 Pitot Tube Traverse: Perform a Pitot tube traverse of main exhaust
31 ducts to obtain total CFM.

32
33 Static Pressure: Test and record plenum static pressures.

34
35 Air Monitor Verification: Measure the exhaust air CFM at the air
36 monitoring station and coordinate adjustment with the Temperature
37 Control Contractor.

38
39 Control Systems Verification:

40
41 Verify that all control devices are properly connected.

42
43 Verify that all dampers, and other controlled devices are operated
44 by the intended controller.

45
46 Verify that all dampers are in the position indicated by the
47 controller (open, closed or modulating).

48
49 Check the calibration of all controllers.

50

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 Verify that all controller set points meet the design intent.

2

3 Check all dampers for free travel.

4

5 Verify the operation of all interlock systems.

6

7

8 RECORD AND REPORT DATA

9

10 The Test and Balance Report shall be complete with logs, data and
11 records as required herein. All logs, data and records shall be
12 typed on white bond paper and bound. The report shall be certified
13 accurate and complete by the Testing and Balancing (TAB) Agency's
14 certified Test and Balance Engineer.

15

16 Four (4) copies of the Test and Balance Report are required and
17 shall be submitted to the Owner, or the Owner's representative.

18

19 The report shall contain the following general data in a format
20 selected by the TAB Agency:

21

22 Project number

23

24 Contract number

25

26 Project title

27

28 Project location

29

30 Project Architect

31

32 Project Mechanical Engineer

33

34 Test and balance agency

35

36 Test and Balance Engineer

37

38 General Contractor

39

40 Mechanical Subcontractor

41

42 Date tests were performed

43

44 Certification

45

46 The Test and Balance Report shall be recorded on report forms
47 conforming to the recommended forms in AABC National Standards. At
48 a minimum, the report shall include:

49

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 Preface: A general discussion of the system, any abnormalities and
2 problems encountered.
3
4 Instrumentation List: The list of instruments including type,
5 model, manufacturer, serial number and calibration dates.
6
7 System Identification: In each report, the VAV boxes, zones,
8 supply, return and exhaust openings, and traverse points shall be
9 numbered and/or lettered to correspond to the numbers and letters
10 used on the report data sheets.
11
12 Exhaust System:
13
14 Manufacturer, model number and serial number.
15
16 All design and manufacturer related data.
17
18 Total actual CFM by traverse if practical, if not practical, the sum
19 of the outlets may be used, or a combination of each of these
20 procedures. For specific systems, such as ones with diversity, see
21 the AABC National Standards.
22
23 Suction and discharge static pressure of each fan, as applicable.
24
25 Actual operating current, voltage and brake horsepower of each fan
26 motor.
27
28 Final RPM of each fan.
29
30 Static pressure controls' final operating set points.
31
32 END OF SECTION 15981

1 DIVISION 16 - ELECTRICAL

2
3
4 SECTION 16010 - GENERAL ELECTRICAL PROVISIONS

5
6
7 GENERAL

8
9 The Contractor's attention is called to Division 1 of the
10 Specifications. The General Conditions and Special Conditions
11 and all other Contract Documents shall apply to this branch of
12 the work as well as to all other branches. The Contractor shall
13 be governed by any unit prices called for in the Form of Proposal
14 insofar as they affect this part of the work.
15

16
17 SCOPE

18
19 Furnish and install all wiring devices and equipment, etc.,
20 unless otherwise indicated, for the complete electrical systems.
21 It is the intent that the entire electrical work and all
22 electrical systems shall be complete in every respect and that
23 all outlets, receptacles, fixtures, motors, equipment, devices,
24 etc., shown, noted, or required shall be completely connected
25 from source of power to final connection, ready for satisfactory
26 operation.
27

28 The work to be done under this Division shall include, but not
29 necessarily be limited to, the following:

30 -- Conduit, wireways, outlet boxes, wire and other necessary
31 materials to complete the installation

32
33 -- Connections to motors and equipment furnished under other
34 Divisions

35
36 -- Modifications to existing installation; removal of existing
37 work; reconnecting of existing work; and all temporary wiring
38 required for maintenance of existing building operation during
39 construction
40

41
42
43 PROTECTION

44
45 All work, equipment and materials shall be protected at all
46 times. All conduit openings shall be closed with caps or plugs
47 during construction. All equipment and accessories shall be
48 tightly covered and protected against dirt, water or other injury
49 during the period of construction.
50

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43

CONNECTION TO EQUIPMENT FURNISHED UNDER OTHER DIVISIONS

All automatic motor starters required for heating, air conditioning, ventilation, plumbing and sprinkler equipment will be furnished by the Contractor for Division 16. The Contractor for this Division shall mount all starters and control relays, and shall provide channel iron floor mounting frames where required.

Motors, thermostats and other control equipment are furnished and installed by Contractors for other Divisions. The Contractor for this Division shall furnish and install all conduit, wire, disconnect switches and miscellaneous materials to make all power connections. The Contractor for Division 15 shall furnish and install all control wiring and control conduit and shall make all electrical connections to control equipment, except as otherwise noted on the Drawings.

INSTALLATION OF EQUIPMENT

All appliances, materials and equipment shall be installed and connected in accordance with the best engineering practice and in accordance with manufacturers' instructions and recommendations. All electrical connections, etc., recommended by the manufacturer or required for proper operation shall be furnished and installed complete.

OPENINGS

The Contractor under this Division shall be responsible for the openings he may require in floors, walls or ceilings of any type construction.

FIRE BARRIER PENETRATION SEALS:

Provide seals for any opening through any walls, floors, or ceilings used as passage for electrical components such as conduit, cabling, etc.

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 General: Provide manufacturer's standard fire-stopping sealant,
2 with accessory materials, having fire-resistance ratings as
3 established by testing identical assemblies per ASTM E 814 by
4 Underwriters' Laboratories, Inc. or other testing and inspecting
5 agency acceptable to authorities having jurisdiction. Sealant
6 shall provide protection equal or exceeding the fire resistance
7 rating of fire rated walls, partitions, ceilings or floors. Use
8 two-part or one part sealants as required to meet required fire
9 resistance ratings.

10
11 Foamed-In-Place Fire-Stopping Sealant: Two-part,
12 foamed-in-place, silicone sealant formulated for use in a
13 through-penetration fire-stop system for filling openings around
14 cables, conduit, pipes and similar penetrations through walls and
15 floors.

16
17 One-Part Fire-Stopping Sealant: One part elastomeric sealant
18 formulated for use in a through-penetration fire-stop system for
19 sealing openings around cables, conduit, pipes and similar
20 penetrations through walls and floors.

21
22 Available Products: Subject to compliance with requirements,
23 products which may be incorporated in the Work include, but are
24 not limited to, the following:

25
26 Foamed-in-Place Fire-Stopping Sealant:
27 "Dow Corning Fire Stop Foam"; Dow Corning Corp.
28 "Pensil 851"; General Electric Co.

29
30 One-Part Fire-Stopping Sealant:
31
32 "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
33 "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
34 "RTV 7403"; General Electric Co.
35 "Fyre Putty"; Standard Oil Engineered Materials Co.

36
37 Installation of Fire-Stopping Sealant: Install sealant,
38 including forming, packing, and other accessory materials to fill
39 openings around mechanical and electrical services penetrating
40 floors and walls to provide fire-stops with fire resistance
41 ratings indicated for floor or wall assembly in which penetration
42 occurs. Comply with installation requirements established by
43 testing and inspecting agency.

44
45
46 SINGULAR NUMBER
47

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 In all cases where a device or piece of equipment is referred to
2 in the singular number (such as a light fixture, etc.), it is
3 intended that such reference shall apply to as many such items as
4 are required to complete the installation.
5
6

7 CONNECTION TO EXISTING ELECTRICAL SYSTEMS
8

9 The Contractor under this Division shall make all necessary
10 electrical connections to all undisturbed existing electrical
11 systems, as shown on the Drawings and/or required for their
12 proper operation with the new system.
13
14

15 CATALOG DATA FOR THE OWNER
16

17 The Contractor under this Division shall prepare four (4)
18 loose-leaf, plastic bound brochures entitled "**UNIVERSITY OF**
19 **KENTUCKY MEDICAL CENTER, HSRB EXHAUST FAN REPLACEMENT, LEXINGTON,**
20 **KENTUCKY, PROJECT NO.** -- Electrical Operation and Maintenance
21 Data."
22

23 Each brochure shall contain the following information:
24

25 Name and address of Consulting Engineer, Contractor and index of
26 equipment, including vendor (name and).
27

28 Complete brochures, descriptive data, etc., on each piece of
29 equipment, including all reviewed and stamped shop drawings.
30

31 Complete maintenance and operating instructions and parts list,
32 prepared by the manufacturer, on each major piece of equipment.
33

34 All wiring diagrams for equipment and systems and control
35 schematics.
36

37 Brochures shall be provided with tabbed index and complete Table
38 of Contents. The page after index of each tab shall contain a
39 summary schedule listing checks and maintenance functions
40 required for each piece of equipment. The schedule shall be
41 divided into daily, weekly, monthly and annual time frames as
42 required.
43

44 Brochures shall be submitted to the Engineer prior to final
45 inspection of the building.
46
47

48 EQUIPMENT IDENTIFICATION
49

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1 The Contractor for this Division shall furnish and install on all
2 electrical equipment such as switches, starters, panelboards,
3 etc., a nameplate giving its name and function.

4
5 Nameplates shall be engraved bakelite (white letters on black
6 background) and shall be equal to Seton Nameplate, C. H. Hanson
7 or Identifications.

8
9
10 MOTOR PROTECTION INFORMATION

11
12 The Contractor for this Division shall provide the following
13 information for each motor installed on this project, regardless
14 of the supplying Contractor:

15
16 Motor full load current

17
18 Motor starter heater size - where applicable

19
20 Fuse size

21
22 This information shall be provided in tabulation form before
23 final payment will be made to the Contractor.

24
25
26 EQUIVALENT MATERIAL AND EQUIPMENT

27
28 The material and equipment described herein have been specified
29 according to particular trade names or makes; however, the
30 Contractor may offer substitute material and equipment in lieu of
31 that specified, provided such material and equipment meet all the
32 requirements of those specified and are approved by the Engineer.

33 The manufacturer's warranty covering each item of substituted
34 material or equipment shall be equal to the warranty covering the
35 material or equipment specified.

36
37 Where equipment is approved which requires different arrangement
38 of connections from those shown, it shall be the responsibility
39 of the Contractor to install the equipment to operate properly
40 and in harmony with the intent of the Drawings and
41 Specifications, and to make all changes in the work required by
42 the different arrangement of connections.

43
44
45 PERMITS, CODES AND APPROVALS

46
47 Permits

48

1 All permits necessary for the complete Electrical systems shall
2 be obtained by the Contractor for Division 16 from the
3 authorities governing such work. The cost of all permits shall
4 be borne by this Contractor.

5
6 Codes and Rules and Regulations

7
8 The minimum standard for all electrical work shall be the latest
9 revision of the National Electrical Code. Whenever and wherever
10 state and/or local laws and/or regulations require a higher
11 standard than the current National Electrical Code, then these
12 laws and/or regulations shall be followed.

13
14 Approvals

15
16 All work must be approved by the Engineer and the Owner before
17 final payment will be made.

18
19 The Contractor for Division 16 shall furnish electrical
20 inspection by the inspection agency having jurisdiction. The
21 Electrical Inspector shall be notified in writing immediately
22 upon the start of the work and a copy of the notice shall be sent
23 to the Engineer. All costs incidental to the electrical
24 inspection shall be borne by the Contractor for Division 16.

25
26 The inspection shall be scheduled for rough as well as finished
27 work. The rough inspection shall be divided into as many
28 inspections as may become necessary to cover all roughing-in. A
29 punch list inspection shall be scheduled with a representative of
30 the Engineer present. The punch list inspection shall be made
31 with panelboard and junction box covers removed.

32
33 Before final acceptance, the Contractor for Division 16 shall
34 furnish a Certificate of Final Approval by the Electrical
35 Inspector to the Engineer and the Owner.

36
37 Materials and appliances for the type for which there are
38 Underwriters' Laboratories standard requirements listings and
39 labels, shall have listing of Underwriters' Laboratories and
40 shall be so labeled, or shall conform to their requirements, in
41 which case certified statements to that effect shall be furnished
42 by the manufacturer with a copy of an examination report by a
43 recognized testing laboratory acceptable to the Engineer.

44
45 Competent workmen shall be employed on all phases of the work.
46 Poor workmanship will be rejected and will constitute cause for
47 removal of the individual performing the work.

48
49
50 COOPERATION WITH OTHER CONTRACTORS

1
2 Each Contractor shall demand and examine all Drawings and
3 Specifications pertaining to the construction before installing
4 the work described and shown under these Drawings and
5 Specifications. Each Contractor shall cooperate with all other
6 Contractors in locating piping, conduit, openings, chases and
7 equipment in order to avoid conflict with any other Contractor's
8 work.

9
10 If any discrepancies occur between the accompanying Drawings and
11 these Specifications and Drawings and Specifications covering
12 other Contracts, each Contractor shall report such discrepancies
13 to the Engineer far enough in advance so that a workable solution
14 can be presented. No extra payment will be allowed for
15 relocation of piping, ductwork, conduit and equipment not
16 installed in accordance with the above instructions, and which
17 interferes with work and equipment of other Contractors.

18
19

20 MAINTAINING EXISTING FACILITIES

21

22 The existing services to and within the building shall be
23 maintained during the construction without interruption, except
24 for short periods of time that may be required to make changeover
25 connections. The Engineer shall be notified in advance and an
26 agreement reached as to when the connections are to be made and
27 the length of time the particular facility will be out of
28 service.

29

30 All temporary connections that may be necessary to continue these
31 services shall be properly made and maintained in a safe and
32 substantial manner until the permanent facilities are activated.
33 Upon completion, remove all temporary work, and completely
34 restore all areas that may be affected.

35

36 At any time the existing building facilities are interrupted, the
37 Contractor shall work continuously until the permanent services
38 are restored. The Contractor shall pay for all premium time
39 necessary to comply with these requirements.

40

41

42 GUARANTY CERTIFICATES

43

44 Certificates of guaranty accompanying those items of mechanical
45 and electrical equipment on which manufacturer's guarantees have
46 been specified, or are normally provided, shall be completely
47 executed by the Contractor and delivered to the Engineer before
48 completion of the work.

49

50

1 REMOVAL OF EXISTING EQUIPMENT AND SALVAGE

2
3 The Contractor for this Division shall remove all exposed
4 electrical equipment and materials that are not to be reused in
5 the new electrical arrangement.
6

7
8 CLEANING

9
10 After the Engineer has completed examination, the Contractor
11 shall remove all stickers, tags, etc., and shall thoroughly clean
12 all equipment, fixtures and materials installed under his section
13 of the work.
14

15 Surplus material, rubbish and equipment resulting from the work
16 shall be removed from the building and premises by the respective
17 Contractors upon completion of the work in accordance with the
18 General Conditions.
19

20
21 INTERPRETATIONS

22
23 Wherever in these Specifications, the term "General Contractor"
24 is used, it shall be understood to mean the Contractor engaged in
25 the general construction portion of the work. Similarly,
26 wherever the "Heating and Air Conditioning Contractor," "Plumbing
27 Contractor," "Sprinkler Contractor," or "Contractor for Division
28 16" is mentioned as such, it shall be understood to refer to the
29 Contractor engaged in that particular branch of the work.
30

31 It shall also be clearly understood that the entire construction
32 is one responsibility and all Contractors for all branches of the
33 work shall cooperate with each other in the coordination of the
34 construction.
35

36
37 ELECTRICAL DRAWINGS AND SPECIFICATIONS

38
39 The Drawings and Specifications are intended to cover all work
40 enumerated under the respective headings. The Drawings are
41 diagrammatic only. The Contractor shall not take advantage of
42 conflict or error between the Drawings and Specifications, but
43 shall request a clarification of such before making his proposal.
44

45
46
47 RESTORATION OF SURFACES
48

1 The Contractor shall restore to their original conditions all
2 paving, curbing, sidewalks, surfaces, drainage ditches, and
3 structures, fences, shrubs, and other items damaged or removed by
4 his operations. Replacement and repairs shall be in accordance
5 with good construction practice and shall match material employed
6 in the original construction of the item to be replaced.

7
8
9 SHOP DRAWINGS

10
11 Equipment and material shop drawings, catalog sheets and
12 descriptive data shall be submitted, each with a cover sheet
13 first listing the project name, the Contractors and Engineer, and
14 date of submittal. Next the section of the Specifications shall
15 be listed stating the section for which the equipment is being
16 proposed. Next, outline equipment showing compliances to the
17 specification requirements, such as capacities, special
18 accessories, options, model, sizes, etc. Reverse side of cover
19 sheet shall be left for Contractors' stamps showing review and
20 space for Engineers' review stamp. Catalog sheets shall be
21 marked showing equipment proposed.

22
23 Materials submitted without cover sheet or Contractor review
24 stamp and without required information will be returned to the
25 Contractor.

26
27
28 PHASING OF WORK

29
30 The Contractor under this Division shall refer to Division 1,
31 Section 01100, for a complete description of the schedule for
32 phasing of work on this project.

33
34
35 CUTTING AND PATCHING

36
37 No cutting and patching of new work will be permitted without the
38 approval of the Engineer, and such work shall be done only under
39 his direction.

40
41 All cutting of existing structures necessary for the installation
42 of new work shall be done by the Contractor under this Division.

43 Cutting shall be neatly executed with a minimum damage to the
44 structure. Patching shall be done in accordance with the best
45 engineering practice by trades skilled in such work.

46
47
48 HAZARDOUS MATERIALS

49
50 Refer to Special Conditions, Section 00801.

University of Kentucky
HSRB Exhaust Fans Replacement
Chandler Medical Center
UK Project#
S&F Job No. 90316G

1

2

3 REQUIRED SUBMITTALS:

4

5 The following chart is supplied for the benefit of the Owner,
6 Engineer and contractor to assure a complete submission of
7 required information. It is a reference listing of documents
8 required by the Specifications under this Section. Refer to
9 Specifications Section - General Provisions for the general
10 requirements of submittals.
11

ITEM	SHOP DRAWING	M & O MANUAL	PARTS LIST	CERTIFICATE
Electrical Inspection Certificate				X

12

13

14

15 END OF SECTION 16010

1 DIVISION 16 - ELECTRICAL

2
3
4 SECTION 16100 - BASIC MATERIALS AND METHODS

5
6
7 CONDUIT

8
9 In general, conduit shall be zinc-coated rigid steel conduit and
10 shall meet, in all respects, the Underwriters' Laboratories,
11 Inc., Standard for Rigid Steel Conduit, Fourth Edition, March
12 1942, or any subsequent revision thereof. The conduit shall be
13 metallized-galvanized, electro-galvanized, sherardized, or
14 approved equal. Minimum conduit and tubing size shall be
15 3/4-inch, except as otherwise noted. Flexible conduit shall not
16 be installed except where permitted in these specifications.

17
18 Install conduit with wiring, including homeruns, as shown on the
19 drawings. Any change resulting in a savings in labor or material
20 is to be made only in accordance with a contract change order.

21
22 Deviations shall be made only when required by National
23 Electrical Code or where necessary to avoid interferences and
24 only after drawings showing the proposed deviations have been
25 submitted to and approved by the Engineer.

26
27 Rigid thick-wall conduit shall be installed underground as
28 required, and in all concrete slabs on grade. Electrical
29 metallic tubing may be used in other places unless otherwise
30 noted. All thick-wall terminals shall be capped with insulating
31 bushings. Electrical metallic tubing shall be terminated with T
32 & B 5123 series, Efcor 750B series, or approved equal, connectors
33 with insulated throat. Metal-lined terminating fittings will not
34 be acceptable. All terminating fittings shall be secured to
35 terminating box or cabinet with double locknut type of
36 construction. Couplings for electrical metallic tubing shall be
37 of the compression type, T & B 5120 series, Efcor 760 series, or
38 approved equal. Set-screw type of connectors will not be
39 acceptable. All conduit fittings shall be steel. Die-cast
40 fittings will not be acceptable.

41
42 Runs of conduit or tubing shall have supports spaced in
43 accordance with the National Electrical Code, and exposed conduit
44 shall be installed with runs parallel or perpendicular to walls,
45 structural members, or intersections of vertical planes and
46 ceilings with right angle turns consisting of cast metal fittings
47 or symmetrical bends. Bends and offsets shall be avoided where
48 possible, but where necessary shall be made with an approved
49 conduit-bending machine. Conduit or tubing which has been
50 crushed or deformed in any way shall not be installed.

1
2 Conduit and tubing shall be supported on approved types of
3 ceiling trapeze, strap hangers, or pipe straps, secured by means
4 of toggle bolts on hollow masonry units, expansion shields in
5 concrete or brick, and machine screws on metal surfaces. Conduit
6 and tubing shall be installed in such manner as to insure against
7 trouble from the collection of trapped condensation, and all runs
8 shall be arranged so as to be devoid of traps wherever possible.

9 The Contractor shall exercise the necessary precautions to
10 prevent the lodgement of dirt, plaster or trash in conduit,
11 tubing, fittings and boxes during construction. A run of conduit
12 or tubing which has become clogged shall be entirely freed of
13 these accumulations, or shall be replaced. Conduit shall be
14 securely fastened to all sheet metal outlets, junction and pull
15 boxes, with double galvanized locknuts and insulating bushings.
16 All conduit in floors or below grade shall be swabbed free of
17 debris and moisture before wires are pulled.

18
19 The final sections of conduit connecting each motor shall be of
20 the flexible Type "UA" neoprene covered. The length of flexible
21 conduit for each application shall not exceed 18 inches.

22
23 Ceiling conduits in all areas having a finished ceiling shall be
24 installed concealed above ceiling. Ceiling conduits in all areas
25 having an exposed concrete ceiling shall be installed in concrete
26 slab, unless otherwise noted. Ceiling conduits in all areas
27 having exposed bar joist construction shall be installed exposed
28 in joist space, unless otherwise noted. Conduits in Mechanical
29 Room may be installed exposed unless otherwise noted. All other
30 conduits shall be installed concealed in masonry walls or in
31 concrete floor slabs.

32
33 All new conduits in finished areas of existing building shall be
34 installed concealed in walls, floors or above existing ceilings.

35
36
37 Identify each spare conduit at each termination.

38
39
40 SAFETY SWITCHES

41
42 In general, safety switches shall be quick-make, quick-break
43 type, fused or unfused as required or specified, rated at 240 or
44 480 volts, as required, and shall be heavy duty type, General
45 Electric, Square D, or Westinghouse. Each switch shall have a
46 capacity indicated on the Drawings.

47

1 Each motor shall be provided with a disconnecting means where
2 required by the National Electrical Code, even though not
3 indicated on the Drawings. A circuit breaker in a panelboard
4 will be accepted as a disconnecting means if located within sight
5 of the motor. A quick-make, quick-break, general use tumbler or
6 snap switch will be acceptable for capacities less than 30
7 amperes, provided the ampere rating of the switch is at least
8 double the rating of the controlled equipment, and provided the
9 required running protection is supplied by other means.

10

11

12 CONDUCTORS (Building)

13

14 All conductors used on this project shall be copper. Conductors
15 No. 10 and smaller shall be solid copper wire. Minimum size
16 conductors shall be No. 12 AWG.

17

18 Branch circuit conductors shall be not smaller than No. 12 AWG,
19 except that conductors for branch circuits whose length from
20 panel to first outlet exceeds 80 feet, shall not be smaller than
21 No. 10 AWG to first outlet. Conductors for signal and pilot
22 control circuits may be No. 14 AWG. Conductors shall be
23 continuous from outlet to outlet and no splices shall be made
24 except within outlet or junction boxes. Junction boxes may be
25 utilized where required. Wire connectors of insulating material,
26 or solderless pressure connectors, properly taped, shall be
27 utilized for all splices in wiring where possible.

28

29 Insulation, unless otherwise noted, shall be Thermo-plastic Type
30 THHN. All feeder and power circuits installed under Ground Floor
31 slab and all exterior underground lighting circuits shall be Type
32 THWN wire.

33

34 The color code of all conductors shall be in accordance with the
35 National Electrical Code.

36

37 All building wires shall be manufactured by Okonite, General
38 Electric, General Cable, Anaconda, Simplex, or Phelps-Dodge.

39

40 The use of soldered joints shall be avoided. Mechanical type
41 splicing devices and lugs shall be employed throughout.

42

43

44 FUSES

45

46 Fuses 600 Volts and Less - Fuses shall not be shipped installed
47 in switches in electrical equipment nor shall they be shipped to
48 the job site until the equipment is ready to be energized. All
49 fuses shall be of the same manufacturer to retain selectivity as
50 designed.

1
2 All fuses shall be current limiting with 200,000 amperes
3 interrupting capacity.
4
5 Motor protection fuses installed in individual circuits shall be
6 sized at 125% of motor nameplate current rating or the next
7 standard size. Where excessive ambient temperature, high inertia
8 motor loads, or frequent "on-off" cycling requires larger fuses,
9 consult electrical designer. These Class RK1 fuses shall be
10 dual-element time-delay type with a spring actuated thermal
11 overload element that operates at 284 degrees Fahrenheit
12 temperature. Bussmann LPN-RK (250 volt) or LPS-RK (600 volt),
13 Low-Peak Fuses.
14
15 Ten percent (10%) spare fuses or a minimum of three (3) of each
16 size and type shall be placed in a spare fuse cabinet wall
17 mounted near the electric service. Mount a spare fuse cabinet
18 similar to the "Bussman Spare Fuse Cabinet" Catalog No. SFC. (1
19 for each building).
20
21 Fuses of equivalent electrical performance and construction will
22 be acceptable - General Electric or Chase-Shawmut.
23
24 A fuse identification label, showing type and size, shall be
25 placed inside the door of each switch.
26
27

28 JUNCTION AND PULL BOXES AND TERMINAL CABINETS

29
30 All junction and pull boxes and terminal cabinets used under this
31 Contract shall be constructed of code-gauge galvanized steel and
32 shall be as manufactured by B & C Metal Stamping Company, Kinney
33 Electrical Manufacturing Company, or approved equal.
34
35

36 POWER FACTOR CORRECTION

37
38 The Contractor under this Division shall provide an individual
39 capacitor installation for each moto at 10 H.P. or more
40 for this project, except as otherwise noted. Capacitor capacity
41 shall be selected to improve the power factor to a minimum of 95%
42 and shall be connected to the load side of the motor overload
43 protection device. A disconnect switch shall be provided for
44 each capacitor and shall have a minimum current rating of 135% of
45 the rated current of the capacitor.
46

47 Capacitors shall be dust-proof all-welded heavy gauge steel
48 enclosure and be provided with a discharge resistor to reduce the
49 voltage to less than 50 volts within 1 minute after the capacitor
50 is disconnected. Capacitors shall be U.L. listed.

1 Capacitors shall be as manufactured by General Electric, RTE,
2 Square D, or Sprague.

3
4 Power factor correction will not be required for motors provided
5 with variable speed drives.

6
7
8 ELECTRICAL WORK IN EXISTING (RENOVATED) AREAS

9
10 In existing areas where new work is shown, remove all existing
11 exposed conduits, wiremold, surface and flush outlet boxes,
12 wiring devices, fixtures, panels, etc., not required for new
13 arrangement.

14
15 Maintain and restore, if interrupted by removals or in path of
16 new construction, all circuits, conduits and feeders passing
17 through and serving undisturbed areas (shown or not shown).

18
19 Install all new work as indicated. Existing concealed conduits
20 may be reused if in good condition, circuitry shown on plans
21 shall govern. All other materials removed shall be removed from
22 the job site.

23
24
25 MOTOR STARTING EQUIPMENT

26
27 The Contractor under this Division shall furnish automatic
28 starting equipment required for all motors listed herein; Square
29 D, General Electric, Westinghouse, or equal to the Allen-Bradley
30 equipment listed.

31
32 The Schedule lists starting equipment for various motors. It
33 shall be the responsibility of the Contractor under this Division
34 to furnish starting equipment for any other motors requiring
35 same, whether included in the Schedule or not.

36
37 Each starter shall be mounted in a NEMA 1 enclosure; shall be
38 designed to operate on 480 volts, 60 cycles, 3-phase power; and
39 shall contain three (3) overload relays, sized from motor
40 nameplate data. Auxiliary contacts and special features shall be
41 provided as shown in the Schedule.

42
43 The Contractor under this Division will mount all starting
44 equipment and make wiring connections to all components.

45
46 Schedule

47
48 *Fuses shall be dual-element type.

49
50 ** Verify all control voltages with control contractor.

University of Kentucky
 HSRB Exhaust Fans Replacement
 Chandler Medical Center
 UK Project#
 S&F Job No. 90316G

- 1
 2 NOTE 1: Provide a HAND-OFF-AUTOMATIC switch in front cover.
 3
 4 NOTE 2: Starter shall have two (2) extra normally open
 5 contacts.
 6 NOTE 3: ** Provide control transformer in starter and 120 volt
 7 holding coil.
 8
 9
 10
 11
 12
 13

14 REQUIRED SUBMITTALS:

15
 16 The following chart is supplied for the benefit of the Owner,
 17 Engineer and contractor to assure a complete submission of
 18 required information. It is a reference listing of documents
 19 required by the Specifications under this Section. Refer to
 20 Specifications Section - General Provisions for the general
 21 requirements of submittals.
 22

ITEM	SHOP DRAWING	M & O MANUAL	PARTS LIST	CERTIFICATE
Safety Switches	X	X		
Motor Starters	X	X		

23
 24
 25 END OF SECTION 16100