

TSTC – Installation of Pre-Purchased Ductwork/Accessories for Dust Collection System – RFP# 012015 – Scope of Work

Jobsite Location: TSTC Campus
BCT Building
305 Airline Drive
Waco, TX 76705

Attached:

Documents from EMA Engineering and Consulting

- Cover Sheet
- Sheet M-1
- Specifications

DUST COLLECTOR RELOCATION

TEXAS STATE TECHNICAL COLLEGE

WACO, TEXAS

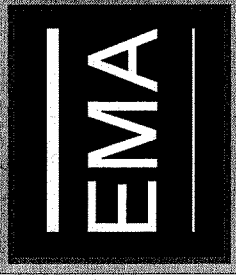


EMA Engineering and Consulting
Tyler ▪ Austin ▪ Houston
Phone: 1-800-933-0538
TBPE Firm Registration No. 893
www.estesmccclure.com

SHEET INDEX

M1 MECHANICAL FLOOR PLAN

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS



EMA Engineering and Consulting
Tyler ▪ Austin ▪ Houston
Phone: 1-800-933-0538
TBPE Firm Registration No. 893
www.estesmccclure.com



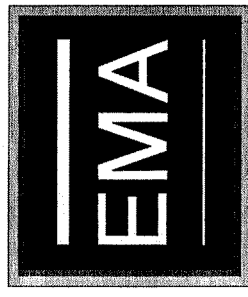
ISSUE DATE	DEC 08, 2014
REVISION	DATE

EMA JOB #	1 001 1288 001
DRAWN BY	SULL
CHECKED	RCS

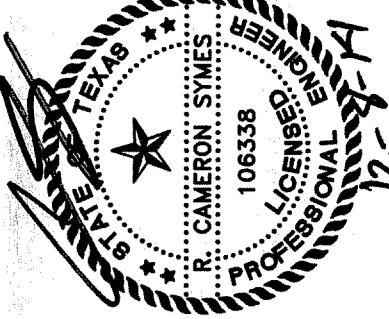
COVER SHEET

SHEET NUMBER	COVER
SHEET	OF

SUBMISSION OF BID WILL BE CONSIDERED ACKNOWLEDGEMENT THAT THE CONTRACTOR HAS VISITED THE SITE AND HAS VERIFIED ALL EXISTING JOB CONDITIONS AND INCLUDED ANY NECESSARY MODIFICATION TO EXISTING AND NEW WORK REQUIRED FOR INSTALLATION OF A COMPLETE AND WORKING SYSTEM.



EMA Engineering and Consulting
Tyler • Austin • Houston
Phone: 1-800-933-0538
TBPE Firm Registration No. 883
www.estesmcclure.com



ISSUE DATE
DEC 08, 2014
REVISION
DATE

DUST COLLECTOR RELOCATION

TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

EMA JOB #: 1 001 1286 001
DRAWN BY: SML
CHECKED: RCS
MECHANICAL FLOOR PLAN
SHEET NUMBER
M1
SHEET
OF

MECHANICAL GENERAL NOTES:

- MECHANICAL CONTRACTOR TO PROVIDE TO THE PLUMBING CONTRACTOR THE RECOMMENDED AS MANUFACTURERS DATA FOR CONDENSATE TRAPS PER EACH TYPE OF UNIT.
 - THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVAL OR ADJUSTMENT OF ALL HOLD DOWN BOLTS AND ANCHORS FOR MECHANICAL EQUIPMENT TO ALLOW FOR PROPER VIBRATION ISOLATION.
 - THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER SELECTION OF CONDENSATE DRAINING, TRAP, PIPING, PACKING PRODUCTS, ETC. FROM ROOF.
 - ALL EQUIPMENT ON THE ROOF SHALL BE PROPERLY LABELED PER SPECIFICATIONS.
 - CLOSE ALL OUTSIDE AIR DAMPERS UPON INSTALLATION AND KEEP ALL OUTSIDE AIR DAMPERS CLOSED UNTIL THE TEST AND BALANCE IS PERFORMED.
 - THE MECHANICAL CONTRACTOR SHALL NOT INSTALL ANY ROOF EQUIPMENT CLOSER THAN 5 FT TO ANY ADJACENT WALLS, EXPANSION JOINTS, AND/OR TRAPERS.
 - PROVIDE AND INSTALL MANUAL VOLUME CONTROL DAMPERS IN ALL EXHAUST BRANCH DUCT SERVING A DIFFUSER OR REGISTER.
 - ALL MANUAL DAMPERS INSTALLED ABOVE HARD CEILINGS SHALL BE INSTALLED WITH A CABLE OPERATED DAMPER EQUAL TO YOUNG REGULATOR MODEL 800A-CC.
 - DUCT MOUNTED SMOKE DETECTORS SHALL BE FURNISHED BY THE MECHANICAL CONTRACTOR, AND FINAL TIE-IN BY THE FIRE ALARM CONTRACTOR.
 - SEAL WITH FIRE RETARDING SEALANT AROUND PIPE THROUGH ANY PENETRATION OF FIRE WALLS.
 - ALL GRILLES ARE SHOWN IN APPROXIMATE LOCATION. FIELD VERIFY PLACEMENT WITH CEILING GRID.
 - ALL DIFFUSERS/GRILL CONNECTIONS SHALL HAVE A RIGID METAL ELBOW UNLESS COMING DIRECTLY DOWN FROM A UNIT OR HEIGHT OF CEILING IS EXTREME. ALL FLEX DUCT TO HAVE AT LEAST ONE SUPPORT STRAP.
- MECHANICAL PLAN NOTES
- INSTALL RELOCATED DUST COLLECTOR AS SHOWN.
 - MECHANICAL CONTRACTOR TO PROVIDE 8" CONCRETE PAD.
 - MEDIUM PRESSURE DUCTWORK.
 - COVER END OF DUCT WITH 1/2" WIRE MESH.
 - DUST COLLECTOR MOTOR STARTER.
 - DUST COLLECTOR MOTOR STARTER OR FILTER CONTROL PANEL.
 - ALL EXPOSED DUCTWORK IN SPACE ASSOCIATED WITH DUST COLLECTOR IS TO BE SINGLE-WALLED PAINTABLE DUCTWORK. DUCT INSTALLATION TO BE NEAT AND CLEAN IN APPEARANCE. ROUTE DUCT AS HIGH AS POSSIBLE THROUGH STRUCTURE.
 - INSTALL BLEEDER VALVE FOR PROPER SYSTEM OPERATION.
 - INSTALL BRANCH LINE WITH CAP.

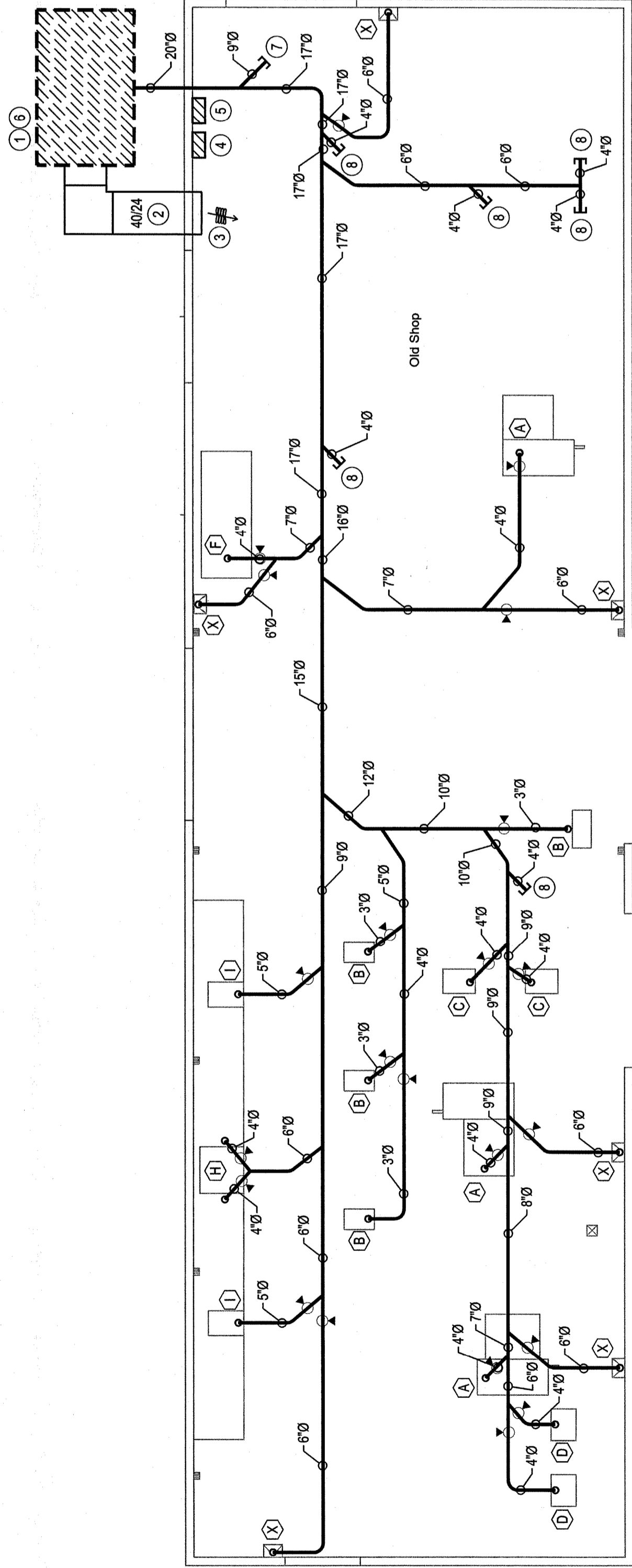
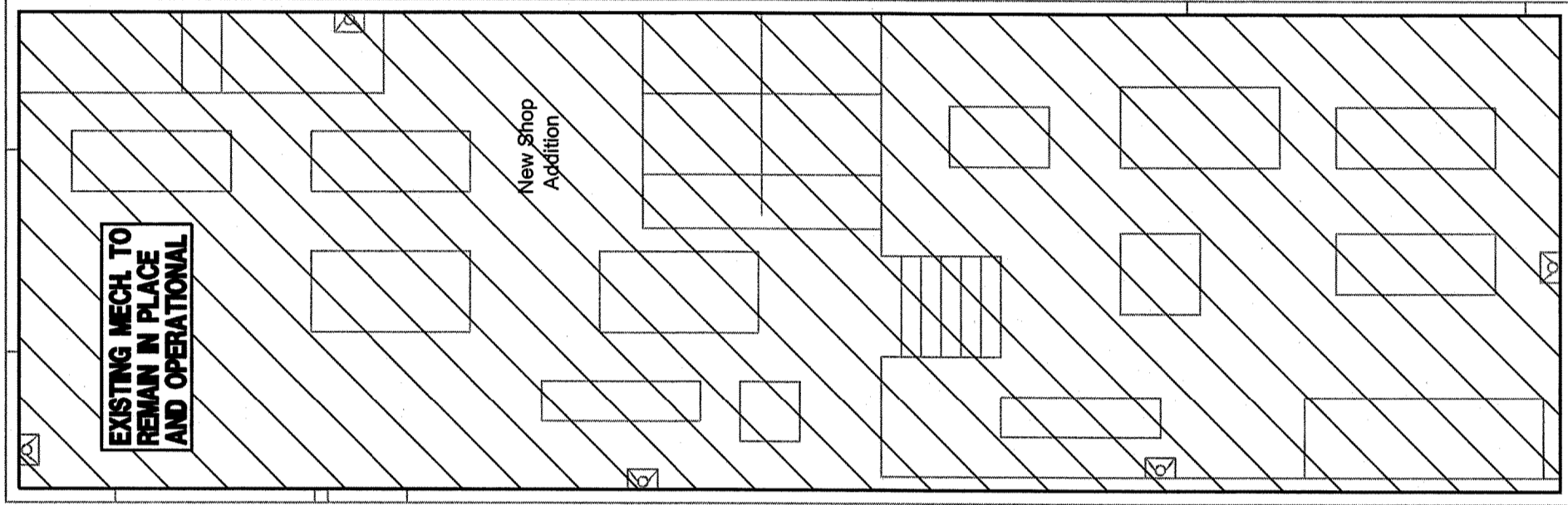
MECHANICAL DEMOLITION GENERAL NOTES:

- CONTRACTOR TO VISIT SITE AND BE FAMILIAR WITH BUILDING MECHANICAL AND ELECTRICAL LAYOUTS.
- IF ASBESTOS IS FOUND CONTACT OWNER IMMEDIATELY. DO NOT WORK IN ANY AREA SUSPECTED TO CONTAIN ASBESTOS.
- ALL EXISTING EQUIPMENT SHOWN IN APPROXIMATE LOCATION. FIELD VERIFY.
- DO NOT RELEASE ANY REFRIGERANT TO ATMOSPHERE. DISPOSE OF IN A LAWFUL MANNER.
- LEAVE ALL EXISTING EXHAUST FANS IN PLACE AND OPERATIONAL UNLESS SHOWN TO REPLACE OR ADD EXHAUST FANS.
- ALL REUSED EXISTING MECHANICAL EQUIPMENT SHALL BE REUSED AND NOT DESTROYED FOR PROPER OPERATION. CHANGE ALL BELTS.
- MECHANICAL CONTRACTOR TO REMOVE EXISTING AIR MOUNTED THERMISTAT REFRIGERATION AS REQUIRED FOR WEATHER TIGHT SEAL. MATCH EXISTING.
- ALL MATERIAL, EQUIPMENT, DUCTS, PIPE, ETC. TO BE REMOVED SHALL BE DISPOSED OF OFF SITE IN A LEGAL AND LAWFUL MANNER.
- REMOVE ONLY CEILING TILE NECESSARY TO ACCOMPLISH DEMOLITION AND NEW WORK DUCT, ELECTRICAL, ETC. REPLACE ALL BROKEN TILES WITH NEW TILES TO MATCH EXISTING WHERE REQUIRED. REUSE EXISTING TILES.
- ALL EXISTING FIRE DAMPERS OR SMOKE DAMPERS BEING REUSED SHALL REMAIN IN PLACE AND OPERATIONAL.

MARK	EQUIPMENT
(A)	PM-200 TABLE SAW
(B)	PM-PW8-H BAND SAW
(C)	PM-15 FLANER
(D)	PM-100 3/4 SANDER
(E)	PM-511 PANEL SAW
(H)	HOODED RADIAL ARM SAW
(I)	5" CONNECTION POINT
(X)	FLOOR SWEEP

MECHANICAL SYMBOLS	
THERMISTAT SENSOR (PER SPEC.)	(1)
CO2 SENSOR	(2)
HUMIDISTAT	(H)
THERMISTAT HUMIDISTAT	(H)
CFM (CUBIC FT. PER MIN.)	(C)
GRILLE TYPE	(G)
DUCT DIAMETER	(D)
RETURN AIR GRILLE WITH ARROW	(R)
SUPPLY GRILLE WITH AIR FLOW	(S)
CONTROL RELAY	(C)
FIRE STAT	(F)
DUCT DETECTOR	(D)
DUCT DETECTOR RELAY	(D)
BACK DRAFT DAMPER	(BDD)
FIRE DAMPER	(FD)
SMOKE FIRE DAMPER	(SFD)
MANUAL VOLUME DAMPER	(MVD)
BALANCING DAMPER *	(BAL)
SHUTTER DAMPER	(SD)
EXHAUST SUPPLY FAN	(EF)
ROOF RELIEF	(RR)
SERVICE ACCESS AREA	(SA)
REFRIGERANT CONDENSATE LINE	(RCL)
SPIRAL DUCT	(SD)
CAP	(C)
UNIT	(U)
MOTORIZED DAMPER	(MD)
DOWN	(DN)
WITH MANUAL VOLUME DAMPER	(MVD)
FLAT OVAL DUCT	(FOD)
MEDIUM PRESSURE DUCT	(MPD)

NOTE: SOME SYMBOLS MAY NOT BE USED.
* OPPOSED BLADE DAMPER TO BE.
WALKER SERIES 1127 OR EQUAL FOR AIR BALANCING



MECHANICAL FLOOR PLAN

1/8"=1'-0"

SUBMISSION OF BID WILL BE CONSIDERED ACKNOWLEDGMENT THAT THE SUBMITTER HAS READ AND UNDERSTANDS THE REQUIREMENTS OF THE SPECIFICATIONS AND INCLUDED ANY NECESSARY MODIFICATION TO EXISTING AND NEW WORK REQUIRED FOR INSTALLATION OF A COMPLETE AND WORKING SYSTEM.

PROJECT MANUAL

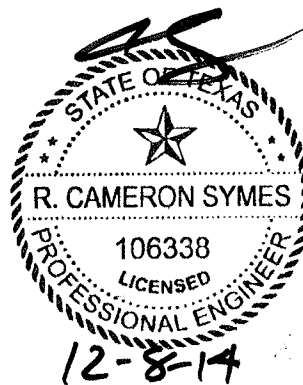
**TEXAS STATE TECHNICAL COLLEGE
EMA PROJECT NO. 1 001 1268 001**

December 8, 2014

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

**ENGINEER:
ESTES, McCLURE & ASSOCIATES, INC.
ENGINEERING AND CONSULTING
3608 WEST WAY
TYLER, TEXAS 75703
903-581-2677 (PHONE)
903-581-2721 (FAX)**

REGISTRATION NO. F-000893



Set #

Cameron Symes, P.E.

TABLE OF CONTENTS

SECTION

PAGES

DIVISION 23 - HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

23 00 10	BASIC MECHANICAL REQUIREMENTS	13	PAGES
23 00 90	HVAC SUBMITTAL PROCEDURES	6	PAGES
23 05 54	MECHANICAL IDENTIFICATION	7	PAGES
23 08 01	AIR BALANCE AND SYSTEM TESTING	8	PAGES
23 31 01	DUCTWORK	11	PAGES
23 33 34	ACCESS DOORS	2	PAGES
23 35 13	DUST COLLECTION SYSTEM (REFERENCE ONLY)	2	PAGES
23 37 14	AIR DISTRIBUTION DEVICES	3	PAGES

DRAWING LIST

M1 MECHANICAL FLOOR PLAN

SECTION 23 00 10

BASIC MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications and Section 23 00 10, apply to this Section.

1.2 SECTION INCLUDES

- A. Basic mechanical requirements necessary to provide complete installation of all Division 23 work.

1.3 WORK INCLUDED

- A. This section of work comprises furnishing of all materials, equipment, tools, scaffolding, rigging, hoisting, labor and transportation necessary for the complete installation of the mechanical systems as shown on the plans and as specified herein.
- B. Bidders shall determine the contents of a complete set of drawings and specifications and be aware that they may be bidding from a partial set of drawings, applicable only to the various separate contracts, subcontracts, or trades as may be issued for bidding purposes only. The contract documents and the complete scope of work for the project are illustrated on the combined Plumbing, Heating, Ventilating, Air Conditioning and Electrical, and each Bidder shall thoroughly acquaint himself with all the details of the complete set of drawings and specifications before submitting his bid. All drawings and specifications form a part of the contract documents for each separate contract and shall be considered as bound therewith in the event partial sets of plans and specifications are issued for bidding only. The submission of bids shall be deemed evidence of the review and examination of all drawings, specifications, and addenda issued for this project as no allowances will be made because of unfamiliarity with any portion of the complete set of documents.

1.4 RELATED SECTIONS

- A. The conditions of the Division 01 requirements and the contract requirements which include the General Conditions and the Supplementary Conditions apply to the work of this division.

1.5 CODES & REFERENCE STANDARDS

- A. General:
1. Perform all Division 23 work in strict accordance with the requirements and recommendations stated in the codes and standards except when requirements are modified by the contract documents.
 2. Nothing in the Contract Documents shall be construed to permit work not conforming to these codes.
 3. When two or more codes or standards are applicable to the same work, then the stricter code or standard shall govern.
 4. The date of the code or standard that is in effect on the date of issue of the contract documents except when a particular publication date is specified.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

5. The Contractor shall be held responsible for verifying all local codes and ordinances that may alter any part of the plans or specifications. The Contractor shall bear all costs for correcting the deficiencies.
 6. Where local codes and ordinances are not in writing or on record but a local precedence has been set, the Owner shall pay for any additional cost incurred.
- B. Applicable Codes and Standards for All Division 23 Work:
1. International Building Code 2012
 2. International Gas Code 2012
 3. International Plumbing Code 2012
 4. International Mechanical Code 2012
 5. International Energy Conservation Code 2012
 6. National Electrical Code
 7. American Society of Heating, Refrigerating and Air Conditioning Engineers Standards.
 8. Occupational Safety and Health Administration Standards:
 - a. OSHA Standard 2207 - Construction Industry Standards
 - b. OSHA 29 CFR Part 1926 – Regulation of Excavation
 - c. Texas Underground Facility Damage Prevention Act (H.B. 2295)
 - d. All other applicable standards
 9. National Fire Protection Association:
 - a. NFPA No. 90A Installation of Air Conditioning and Ventilating Systems
 10. Fire Sprinkler System:
 - a. NFPA 13
 - b. NFPA 14
 - c. NFPA Life Safety Code 101 Section 8-3
 - d. All other applicable codes
 11. National Appliance Energy Conservation Act of 1987
 12. Texas State Board of Insurance Standards
 13. Clean Air Act and Clean Air Act Amendments of 1990
 14. State Codes:
 - a. Texas Department of Labor Boiler Rules and Regulations
 - b. All other applicable codes
 15. Local Municipal Codes and Ordinances

1.6 SCHEDULE OF ABBREVIATIONS

- A. Reference Standards are listed in Section 23 using abbreviations listed below:
- | | |
|--------|---|
| AABC | Associated Air Balance Council |
| AASHTO | American Association of State Highway and Transportation Officials |
| ADA | Americans with Disabilities Act |
| ADC | Air Diffusion Council |
| AGA | American Gas Association |
| AMCA | Air Moving and Conditioning Association |
| ANSI | American National Standards Institute |
| AHRI | Air-Conditioning and Refrigeration Institute |
| ASHRAE | American Society of Heating, Refrigerating and Air-Conditioning Engineers |
| ASME | American Society of Mechanical Engineers |
| ASPE | American Society of Plumbing Engineers |
| ASTM | American Society for Testing and Materials |
| AWE | American Welding Society |
| AWWA | American Water Works Association |
| BOCA | Building Officials and Code Administrators |
| CGA | Compressed Gas Association |
| CISPI | Cast Iron Soil Pipe Institute |
| CS | Commercial Standard |

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

1	CSA	Canadian Standards Association
2	DIPRA	Ductile Iron Pipe Research Association
3	DOT	Department of Transportation
4	DOC	Department of Commerce
5	FCC	Federal Communications Commission
6	FM	Factory Mutual
7	FS	Federal Specification
8	IBC	International Building Code
9	ITL	Independent Testing Laboratories
10	NEC	National Electric Code
11	NFPA	National Fire Protection Association
12	NSF	National Sanitation Foundation
13	OSHA	Occupational Safety and Health Administration
14	PDI	Plumbing and Drainage Institute
15	SMACNA	Sheet Metal and Air Conditioning National Association
16	TCEQ	Texas Commission on Environmental Quality
17	TDH	Texas Department of Health
18	TWC	Texas Water Commission
19	UL	Underwriters Laboratories

20
21 1.7 QUALITY ASSURANCE

- 22
- 23 A. Provide complete installations of all systems.
- 24
- 25 B. Furnish all items of equipment, material, and labor to complete the Contract even though each
- 26 and every item necessary is not specifically mentioned or shown.
- 27
- 28 C. In case of any conflict between the specifications, plans and ordinances, the ordinances shall
- 29 govern.
- 30
- 31 D. All materials furnished under this Contract shall be new, free from defects of any kind, of the
- 32 quality and design hereinafter specified, and shall conform to the standards of Underwriter's
- 33 Laboratories Inc., except for equipment which U.L. does not list or provide label service.
- 34
- 35 E. All mechanical equipment and fixtures shall be the same brand unless scheduled differently
- 36 on plans.
- 37
- 38 F. Contractor's Responsibility:
- 39 1. Erect barricades, protective fencing, and signs to prevent injury to personnel on site.
- 40 2. Make permanent connection to utilities or existing lines. Determine depth and location,
- 41 and bid accordingly.
- 42 3. Relocate and repair any existing lines cut by general construction work.
- 43 4. Pay all costs in connection with metering devices.
- 44 5. Plans do not show exact location and elevations of lines, nor do they show all offsets
- 45 required.
- 46 6. Deviate from plans as required to conform to the general construction and provide proper
- 47 grading.
- 48 7. Maintain all utility services during construction to existing portions of job that remain.
- 49 8. Procure and pay for all necessary permits or licenses to carry out the work.
- 50 9. Obtain and pay for all the necessary certificates of approval which must be delivered to
- 51 the Engineer before final acceptance of the work.
- 52 10. Periodically remove rubbish, clean or repair all surfaces marred by the work required
- 53 under this contract.
- 54 11. Protect work from damage by other trades.
- 55 12. Make all tests required by law; pay all costs in connection with the testing.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

13. Where job conditions require changes in indicated locations and arrangement, make such changes without extra cost to Owner.
14. Provide motor starters, controls, relays, all low-voltage wiring, conduit and wiring related to HVAC and other equipment and devices to form a complete working system. See Section 26 00 00.

1.8 DEFINITIONS

A. Approval:

1. It is understood that approval must be obtained from the Engineer in writing before proceeding with the proposed work.
2. Approval by the Engineer of any changes, submitted by the Contractor will be considered as general only to aid the Contractor in expediting his work.

B. Contractor:

1. The Contractor engaged to execute the work included in a particular section only, even though he may be technically described as a Subcontractor to the General Contractor.
2. If the Contractor engaged to execute said work employs Sub-Contractors to perform various portions of the work included under this Section, he shall be held responsible for the execution of same, in full conformity with Contract Document requirements.
3. The Contractor shall cooperate at all times and shall be responsible for the satisfactory cooperation of his Subcontractors with the other Contractors on the job so that all of the various phases of the work may be properly coordinated without unnecessary delays or damage to any parts of the work of any Contractor.

C. Provide:

1. Defined as requiring the furnishing and installing of the item or facility indicated, complete in all respects and ready for operation unless otherwise specifically noted.

1.9 WARRANTY

- A. The Contractor shall warranty his work against defective materials and workmanship for a period of one year from date of acceptance of the job.
- B. Neither the final payment nor any provisions in Contract Documents shall relieve the Contractor of the responsibility for faulty materials or workmanship.
- C. He shall remedy any defects due thereto, and pay for any damage to other work resulting therefrom, which shall appear within a period of one year from date of substantial completion.
- D. The Owner shall give notice of observed defects with reasonable promptness.
- E. This Guarantee shall not be construed to include the normal maintenance of the various components of the system covered by these specifications.

1.10 SITE VISIT

- A. Before submitting his proposal, each bidder shall examine all plans and specifications relating to the work, shall visit the site of the project and become fully informed of the extent and character of the work required.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- B. No consideration will be granted for any alleged misunderstanding of the materials to be furnished or the amount of work to be done, it being fully understood that the tender of a proposal carries with it the agreement to all items and conditions referred to herein, or indicated on the accompanying plans or required by nature of the site of which may be fairly implied as essential to the execution and completion of any and all parts of the work.

1.11 SUBMITTALS

A. Submittal Procedures:

1. Bidding requirements, contract forms, conditions of the contract, Division 01 - General Requirements and Division 23 apply to work of this division, in addition to the following:
 - a. The materials, workmanship, design, and arrangement of all work installed under this contract shall be subject to the review of the Engineer and Owner.
 - b. Where specified materials, process, or methods of construction or manufactured article is specified by name or by reference to the catalog number of a manufacturer, the specifications are to be used as a guide and are not intended to take precedence over the basic duty and performance specified or noted on the Drawings.
 - c. In all cases, the Contractor shall verify the duty and available electric characteristics with the specific characteristics of the equipment offered for review. All component parts of each item of equipment or device shall bear the manufacturer's name plate giving name of manufacturer, description, size, type, serial or model number, electrical characteristics, etc., in order to facilitate maintenance or replacement.
 - d. If materials or equipment are installed before they have been reviewed without comment by the Engineer, the Contractor shall be liable for their removal and replacement at no additional expense to the Owner, if the equipment does not meet the intent of the Drawings and Specifications.
 - e. This Contractor shall call to the attention of the Engineer by letter or on shop drawing submittals, any instance in which the shop drawings differ from the requirements of the Drawings and Specifications.
 - f. Data and shop drawings shall be coordinated and included in a single submission. Multiple submissions are not acceptable except where prior approval has been obtained from the Engineer. In such cases, a list of data to be submitted later shall be included with the first submission. Failure to submit shop drawings that meet the requirements of the Drawings and Specifications in ample time for review shall not entitle the Contractor to an extension of contract time, and no claim for extension by reason of such default shall be allowed.
 - g. Catalogs, pamphlets, or other documents submitted to describe items on which review is being requested shall be specific and identifications in catalog, pamphlets, etc., of items submitted shall be clearly made in a contrasting ink. Data of a general nature shall not be acceptable. Data and shop drawings shall be identified in accordance with Division 01. In addition, shop drawings shall be identified by the name of the item and system and the applicable Specification paragraph number.

B. Submittal Preparation:

1. Minimum of six copies are required, complete (all items submitted at one time), index to each Section of Specifications requiring submittals, and include the following information and action taken.
2. **Organize all required data in a 3-ring black (in color) of sufficient size, hard cover binder, complete with index tabs, and appropriate title of specification section.**
 - a. Project Name
 - b. Date
 - c. Name and Address of Engineer
 - d. (See Division 01 of Specifications)
 - e. Name, Address and Telephone Number of Contractor or Sub-contractors.
 - f. Manufacturer's Name

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- g. Published ratings or capacity data
- h. Detailed equipment drawing for fabricated items
- i. Panel diagrams
- j. Wiring diagrams
- k. Installation instructions
- l. Mechanical room layout of all HVAC equipment and other equipment drawn to 1/4" = 1'-0" scale and dimensioned.
- m. Other pertinent data
- n. **All required submittals and data, bound together, submitted at one time.**

C. Submittal Organization:

1. Organize all required data in a 3-ring black (in color) of sufficient size, hard cover binder, complete with index tabs, and appropriate title of specification section. Submit the following sections:
 - 23 00 10 Basic Mechanical Requirements
 - 23 00 90 HVAC Submittal Procedures
 - 23 05 54 Mechanical Identification
 - 23 08 01 Air Balance & System Testing
 - 23 31 01 Ductwork
 - 23 33 34 Access Doors
 - 23 35 13 Dust Collection System **(Reference Only)**
 - 23 37 14 Air Distribution Devices
2. Provide a cover sheet and an index sheet listing all items submitted. The second and third sheet shall be blank for stamping of submittals.
3. The successful review rendered on shop drawings shall not be considered as a guarantee of building conditions. Where drawings have been successfully reviewed, said review does not mean that the drawings have been checked in detail and does not in any way relieve the Contractor from the responsibility, nor the necessity of furnishing the material or performing the work as required by the Drawings and Specifications.
4. All equipment and materials to be furnished under this Division of these Specifications shall be as manufactured by the manufacturer(s) listed on the Drawings, herein specified, or accepted by addendum.
5. The Engineer's review of submittals is only for confirmation of adherence to design of project and does not relieve the Contractor of responsibility of furnishing all material for a complete working system and equivalent products as specified.
6. The Mechanical Contractor shall submit a schematic of all control wiring for all equipment. This can be a manufacturer's diagram. A copy of the control schematic shall be submitted to the Electrical Contractor at the same time for his comments. No submittal will be approved until all control diagrams are submitted.
7. Mechanical Contractor and Plumbing Contractor shall submit 1/4 inch per foot shop drawing(s) showing all piping, ductwork and equipment shown by the plans and specifications. The drawing(s) shall be coordinated with structural drawings and all other trades especially the fire sprinkler (if required) and electrical. A reproducible drawing shall be corrected to "as built" and submitted to Owner at the termination of the project. If contractor has obtained an electronic copy of construction documents merely reproducing these drawings will not be acceptable.
8. Equipment, rooms and other complex areas shall be drawn at a larger scale (1/2 inch per foot or greater) as required to indicate complete layout.

1.12 PROJECT RECORD DOCUMENTS

- A. The Contractor shall keep a set of plans on the job, noting daily all changes made in connection with the final installation including exact dimensioned locations of all new and uncovered existing utility piping outside the building.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- 1 B. Upon submitting his request for final payment, he shall turn over to the Engineer, for
2 subsequent transmittal to the Owner, a clean, neatly marked set of reproducible plans showing
3 "as installed" work and an electronic file with changes of materials.
4
5 C. In addition to the above, the Contractor shall accumulate during the job's progress the
6 following data, in duplication (2 each), prepared in 3 ring binders of sufficient size, black in
7 color, neat in appearance, and turned over to the Engineer for checking and subsequent
8 delivery to the Owner:
9 1. All warranties, guarantees and manufacturer's directions on equipment and material
10 covered by the Contract.
11 2. Approved fixture brochures.
12 3. Copies of approved shop drawings.
13 4. Set of operating instructions. Operating instructions shall also include recommended
14 maintenance and seasonal changeover procedures.
15 5. Any and all other data and/or plans required during construction.
16 6. Repair parts lists of all major items and equipment including name, address and
17 telephone number of local supplier or agent.
18
19 D. The first page, or pages, shall have the names, addresses, and telephone numbers of the
20 following:
21 1. General Contractor and all sub-contractors.
22 2. Major Equipment Suppliers.
23

24 **1.13 TRAINING**
25

- 26 A. Upon completion of the work and at a time designated by the Owner's representative, provide
27 a formal training session for the Owner's operating personnel to include location, operation,
28 and maintenance of all mechanical equipment and systems, some sections have further
29 instructions.
30
31 B. Before proceeding with instruction, prepare a typed outline in triplicate listing the subjects that
32 will be covered. Submit the outline for review by the Owner's representative.
33
34 C. At the conclusion of the instruction, obtain the signatures of the attendees on each copy of the
35 outline to signify that they have a proper understanding of the operation and maintenance of
36 the system. Submit the signed outlines to the Owner's representative and Engineer as a
37 condition of final acceptance.
38

39 **1.14 PLANS AND SPECIFICATIONS**
40

- 41 A. The plans show diagrammatically the locations of the various lines, ducts, conduits, fixtures,
42 and equipment and the method of connecting and controlling them.
43
44 B. It is not intended to show every connection in detail and all fittings required for a complete
45 system.
46
47 C. The systems shall include but are not limited to the items shown on the plans.
48
49 D. Exact locations of these items shall be determined by reference to the general plans and
50 measurements of the building and in cooperation with other contractors, and in all cases, shall
51 be subject to the approval of the Engineer.
52
53 E. The Engineer reserves the right to make any reasonable change in the location of any part of
54 this work without additional cost to the Owner.
55

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- F. Contractor, subcontractor, vendors and suppliers are required to waive subrogation against Owner and Engineer.

1.15 UTILITIES, LOCATIONS, AND ELEVATIONS

- A. Locations and elevations of the various utilities within the scope of this work have been obtained from the City and/or other substantially reliable sources and are offered separately from the Contract documents, as a general guide only, without guarantees as to accuracy.
- B. The Contractor shall examine the site, shall verify to his own satisfaction the locations, elevations and availability of all utilities and services required, and shall adequately inform himself as to their relation to the work; the submission of bids shall be deemed evidence thereof.
- C. The Contractor shall coordinate all services with the Utility Companies during construction, coordinate changes made by Utility Companies to the design of project, and coordinate with the Owner, Engineer, and Utility the scheduling of any shutdowns or delays that may occur in providing service.
- D. The Contractor shall verify location, conduct all necessary tests, inspections, coordinate with Owner's representatives and utilities, and check for existing underground utilities and lines before ditching.
- E. The Contractor shall be responsible for repair of any cut or damaged lines or utilities he uncovers. There are lines and utilities not shown on any plans.

1.16 SUBSTITUTION OF PRODUCTS

- A. Substitution of products specified herein will be considered only when a complete list of proposed alternative equipment is submitted to the Engineer in writing, supported by adequate technical and cost data. This includes a complete description of the proposed substitution, drawings, catalog cuts, performance data, test data, or any other data or information necessary for evaluation.
- B. All proposed substitutions and data must be received by the Engineer no less than ten working days prior to the schedule date for opening of bids.
- C. The Engineer will consider all such submittals and will issue an addendum listing items which the Engineer considers acceptable. Only such items as specified or approved as acceptable will be installed on this project.
- D. Manufacturers' names are listed herein and on the plans to establish a standard of quality and design. Where a manufacturer's name is mentioned, products of other manufacturers will be acceptable, if in the opinion of the Engineer, the substitute material is of equivalent quality or better than that of the material specified.
- E. The Contractor's Bid represents that the bid price is based solely upon the materials and equipment described in the Bid Documents (including addenda, if any) and that he contemplates no substitutions or extras.
- F. Requests for substitution are understood to mean that the Contractor:
1. Has personally investigated the proposed substitution and determined that it is equal or superior in all respects to that specified.
 2. Will provide the same guarantee for the substitution that he would for that specified.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

3. Will, at no cost to the Owner, replace the substitute item with the specified product if the substitute item fails to perform satisfactorily.
4. After Award of the Contract, substitutions will be considered only under one or more of the following circumstances:
 - a. The substitution is required for compliance with subsequent interpretations of code or insurance requirements.
 - b. The specified product is unavailable through no fault of the Contractor.
 - c. The manufacturer refuses to warranty the specified products as required.
 - d. Subsequent information that the specified product is unable to perform properly or to fit in the designated space.
 - e. In the Engineer's sole judgment, the substitution would be in the Owner's best interest.
5. Revisions to the mechanical system shall be under the supervision of the Engineer at a standard hourly rate charged by the Engineer and shall be paid by the Contractor originating the changes.

1.17 PROTECTION OF EQUIPMENT AND MATERIALS

- A. The Contractor shall take such precautions as may be necessary to properly protect his apparatus from damage.
- B. This shall include the creation of all required temporary shelters to adequately protect any apparatus above the floor of the construction and the covering of apparatus in the completed building with tarpaulins or other protective covering.
- C. Failure to comply with the above to the satisfaction of the Owner's inspector will be sufficient cause for the rejection of the equipment in question and its complete replacement by this Contractor.
- D. All apparatus shall be cribbed up from the floor or ground by the Contractor and covered with tarpaulins or other protective covering where necessary or directed.

1.18 FINAL INSPECTION

- A. It shall be the duty of this Contractor to make a careful inspection trip of the entire project, assuring himself that the work on the project is ready for final acceptance before calling upon the Engineer to make a final inspection.
- B. To avoid delay of final acceptance of the work, the Contractor shall have all necessary bonds, warranties, receipts, affidavits, etc., called for in the various articles of these specifications, prepared and signed in advance, together with a letter of transmittal, listing each paper included, and shall deliver the same to the Engineer at or before the time of said final inspection. The Contractor is cautioned to check over each bond, receipt, etc., before preparing for submission to verify that the terms check with the requirements of the specifications.

1.19 ASBESTOS

- A. No asbestos or asbestos containing materials shall be permitted in this project.

1.20 CUTTING AND PATCHING

- A. All Subcontractors shall notify the General Contractor sufficiently ahead of construction of any floors, walls, ceiling, roof, etc., of any openings that will be required for his work.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- 1 B. He shall see that all sleeves required for his work are set at proper times so as to avoid delay
2 of the job.
3
4 C. All necessary cutting of walls, floors, partitions, ceilings, etc., as required for the proper
5 installation of the work under this Contract shall be done at the Subcontractor's expense in a
6 neat and workmanlike manner, and as approved by the Engineer.
7
8 D. No joists, beams, girders or columns shall be cut by any Contractor without first obtaining
9 written permission of the Engineer.
10
11 E. Patching of openings and/or alterations shall be provided by the General Contractor.
12
13 F. All openings in firewalls and floors, such as thimbles, shall be completely sealed after
14 installation for a completely airtight installation. Sealing material shall be non-combustible and
15 UL approved. The installed sealing assembly shall not cause the fire rating of the penetrated
16 structure to be decreased.
17
18 G. All openings in exterior walls shall be sealed watertight.
19

20 1.21 IDENTIFICATION
21

- 22 A. Refer to Section 23 05 54.
23

24 1.22 MANUFACTURER'S INSTRUCTIONS
25

- 26 A. All equipment and devices shall be installed in accordance with these plans and specifications,
27 manufacturer's instructions and applicable codes.
28
29 B. Where specifications call for installation of a product to be in accordance with manufacturer's
30 instructions and/or where manufacturer's instructions are required for installation of a product,
31 it shall be the contractor's responsibility to obtain the necessary applicable manufacturer's
32 instructions and install the product in accordance with the manufacturer's instructions.
33
34 C. It shall be the Contractor's responsibility to install all equipment, materials, and devices shown
35 on the plans and as called out in these specifications even if manufacturer's instructions are
36 absolutely unattainable.
37

38 1.23 RELATED WORK
39

- 40 A. The various specification sections for this division may or may not include related work listings.
41
42 B. All related work shall be coordinated and provided by the Mechanical Contractor regardless
43 whether specifically identified or not.
44

45 1.24 ELECTRICAL WIRING AND EQUIPMENT FOR MECHANICAL SYSTEMS
46

- 47 A. All wiring, conduit, boxes, equipment (controls, thermostats, relays, contactors, motor starters,
48 heaters, switches) and any other control devices or equipment required to form a complete
49 and properly operating system, shall be the responsibility of the Mechanical Contractor.
50
51 B. The Electrical Contractor shall only provide line voltage (including hook-up) to all mechanical
52 equipment.
53

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- 1 C. All mechanical controls and devices shall be low voltage unless otherwise noted or shown on
2 the plans. Where line voltage controls or devices are noted, the Contractor shall provide
3 complete wiring diagrams (approved by the Engineer) to the Electrical Contractor prior to final
4 hook-up.
5
6 D. All electrical resistance heating elements which are scheduled to be served by three-phase
7 electrical power shall impose an equal electrical load on all phases. Electrical resistance
8 elements which are not balanced over all three phases are not acceptable.
9
10 E. The Mechanical and Electrical plans are based on the equipment and devices scheduled as
11 shown on the plans or as called for in the specifications. Should any mechanical equipment
12 or device be changed or approved from those which are shown or noted, all electrical and/or
13 mechanical changes shall be made at the expense of the trade or contractor initiating the
14 change with no expense to the Owner, Engineer or their representatives.
15
16 F. All wiring provided by this Contractor shall be installed in a workmanlike manner using tie
17 wraps, labels, anchors and etc. Loose wiring is not acceptable.
18
19 G. All conduit and boxes required in all walls for control purposes (thermostats, etc.) shall be
20 provided by electrical contractor. All conduit required in attic, clear spaces, or on roof shall be
21 by mechanical contractor.
22

23 1.25 DEMOLITION AND REMODEL
24

- 25 A. It shall be the responsibility of this Contractor to see that all demolition and remodeling work
26 involving his trade (including but not limited to chilled and hot water piping used for space
27 cooling and heating, condensate lines, control air piping, air handlers, mechanical equipment,
28 etc.) is accomplished in a manner and completeness to provide the appearance of new
29 construction work.
30
31 B. Abandoned air conditioning units shall be removed and disposed of off site in a legal manner.
32
33 C. Any usable equipment and/or structure damaged during demolition and remodel work shall be
34 replaced.
35
36 D. All abandoned and/or otherwise unused piping shall be securely capped using materials of
37 the same composition as the original piping.
38
39 E. No exposed piping and/or other materials will be permitted in the finished job.
40
41 F. Any abandoned piping which penetrates the slab in an exposed area shall be securely capped
42 below the slab.
43

44 1.26 OPERATION PRIOR TO COMPLETION
45

- 46 A. When any piece of mechanical or electrical equipment is operable and the Contractor needs
47 to operate the equipment, he may do so providing that he properly supervises the operation.
48
49 B. The warranty period shall, however, not commence until such time as the equipment is
50 operated for the beneficial use of the Owner.
51
52 C. Regardless of whether or not the equipment has or has not been operated, the Contractor
53 shall properly clean the equipment, install clean filter media, properly adjust and complete all
54 punch list items before final acceptance by the Owner.
55

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

D. The date of acceptance and the start of the warranty may not be the same date.

1.27 SAFETY GUARDS

A. Contractor shall furnish and install all safety guards required. All belt driven equipment, projecting shafts and other rotating parts shall be enclosed or adequately guarded.

1.28 FLAME SPREAD PROPERTIES OF MATERIALS

A. All materials and adhesives used for air conditioning filters, acoustical lining and insulation shall conform to NFPA and UL life and flame spread properties of materials.

B. The composite classifications shall not exceed 25 for a flame spread rating and 50 for a smoke developed rating as listed for the basic material, the finishes, adhesives, etc., specified for each system and shall be such when completely assembled.

1.29 FILTER ASSEMBLIES

A. All filter housings and assemblies shall be factory built and supplied with the unit.

B. Access doors (panels) which must be opened to change the air filters shall be labeled "Filter Access" and the number and size of required filters shall be identified.

C. No piping conduit etc. shall be installed in front of this access door.

D. Install clean filters prior to substantial completion.

E. All air handlers shall have filters installed upstream of all coils.

1.30 LEAD MATERIALS

A. No lead or lead containing materials shall be allowed in any domestic or potable water supply piping, valves, fixtures, components, equipment or any other item.

1.31 REFRIGERANTS

A. Chlorofluorocarbons (CFCs) shall not be allowed in any equipment on this project.

B. Comply with ASHRAE Standards 15 and 34.

1.32 REFRIGERANT RECOVERY AND RECYCLE

A. Refrigerants shall not be released to the environment.

B. Contractor shall provide recovery and recycle equipment that has been certified by the Electrical Testing Laboratories or Underwriters Laboratories.

C. Contractor shall also provide properly trained and certified (in accordance with EPA) personnel for refrigerant work during installation, demolition, start-up, servicing, etc.

1.33 ACCESS CLEARANCE

A. Proper access to all installed equipment shall be provided. The Mechanical Contractor shall label all points of access immediately upon installation with a marker pen.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- B. A minimum of 3 feet shall be maintained in front of all access points.
- C. If another trade violates this space, the Mechanical Contractor shall immediately notify the General Contractor to correct this condition.
- D. When equipment is installed above lay-in ceiling the Mechanical Contractor shall coordinate with the Ceiling Contractor to provide access without removing part of T-bar ceiling.
- E. No speakers, lights, fire alarm equipment, etc. shall be installed in lay-in ceiling tiles where access is to be gained.

PART 2 PRODUCTS

- A. Not Applicable

PART 3 EXECUTION

3.1 TESTING

- A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequence and operation throughout the range of operation regardless of the season the contractor shall test all HVAC equipment in both heating and cooling modes.
- B. Each and every phase of the new air conditioning, heating and ventilating systems shall be operated separately, or in conjunction with the other, for a period of time, to demonstrate to the satisfaction of the Engineer the ability of the equipment to meet the capacity and performance requirements while maintaining design conditions in accordance with the true intent and purpose of these specifications.
- C. Previous to such performance tests, the Contractor shall have set all valves, dampers, motors, controllers, thermostats, etc., and shall have the system operating and maintaining design temperatures, humidity and air circulation throughout all areas of the building.
- D. Make adjustments as required to ensure proper functioning of all systems.
- E. Special tests on individual systems are specified under individual sections.
- F. See Section 23 08 01 for air balancing.

END OF SECTION

SECTION 23 00 90

HVAC SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SUMMARY

- A. This section contains requirements applicable to Division 23 submittals.

1.2 SECTION INCLUDES

- A. This section includes, but is not limited to:
1. HVAC submittal procedures
 2. List of required Division 23 submittals to the engineer
 3. This section applies only to the Division 23 specifications. Submittals required by other specification divisions are not included here, even though the same subcontractor may be providing work under other divisions.

1.3 DEFINITIONS

- A. Product Data: Illustrations, standard schedules, performance charts, instructions, and brochures furnished by the contractor, subcontractor, manufacturer, or supplier to illustrate materials or equipment or to illustrate some portion of the work. Provide a summary of scheduled items with all data in schedules.
- B. Shop Drawings: Drawings, diagrams, schedules and other data specifically prepared for the work by the contractor, subcontractor, manufacturer, or supplier to illustrate some portion of the work.
- C. Equipment/Material Submittal Package: A compilation of the product data, shop drawings, and other items as required by the specifications, submitted near the start of the work. Typically, the specifications require the initial submittal package to be submitted within a certain number of days after the work starts.
- D. Quality Assurance Submittal: Items submitted before and during the execution of a particular portion of the work for the purpose of guarding against defects and deficiencies.
- E. Quality Control Submittal: Items submitted at the completion of a particular portion of the work for the purpose of evaluating completed activities and elements of the work for conformance with contract requirements (e.g. start up reports).
- F. Closeout Submittals: Items submitted at or near the completion of the contract.

1.4 SUBMITTALS

- A. The materials, workmanship, design, and arrangement of all work installed under this contract shall be subject to the review of the engineer and owner.
- B. Manufacturers: Manufacturers submitted shall be as per the acceptable manufacturers listed in each specification section or referenced schedule. For additional manufacturers requiring approval, reference the Substitution of Products article in Section 23 00 10.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- 1 C. Required Submittals: Refer to the Submittals article of each individual Division 23 specification
2 section for the required items to be submitted.
3
- 4 D. Contractor's Coordination Submittals: The contractor may require his subcontractors to
5 provide drawings, setting diagrams, and similar information to help coordinate the project, but
6 such data shall remain between the contractor and his subcontractors and will not be reviewed
7 by the engineer.
8
- 9 E. Electronic Submittals: Fax, e-mail, or other electronic forms of submittals from the contractor
10 are acceptable. With the prior approval of the Engineer and the engineer, the contractor may
11 request that the review comments of the engineer be returned in electronic form. If this method
12 is agreed upon, then the procedures described in this section shall be modified as follows:
13 1. The contractor shall supply only one copy of the submittal, rather than the six copies
14 described in this section. The submittal shall be accompanied by a letter stating that the
15 contractor desires the response in electronic form, and that prior approval for this method
16 has been granted.
17 2. After reviewing the submittal, the engineer will create electronic files from the reviewed
18 submittal material.
19 3. The electronic files will either be mailed to the Engineer, or posted to a web site,
20 depending on the Engineer's requirements. The Engineer and contractor can distribute
21 copies of the files as desired.
22 4. The engineer will retain the paper copy of the submittal as a file copy.
23
- 24 F. Coordination Correspondence: The contractor may desire to verify the acceptability of a
25 particular item prior to assembling the initial submittal package. The contractor may send
26 material directly to the engineer for comments and feedback. This communication, whether
27 by mail, fax, or e-mail, will be treated as normal coordination correspondence and will not be
28 tracked or documented as a formal submittal. The engineer may or may not respond to such
29 correspondence. If the engineer agrees, in writing, to the use of a particular item, then that
30 same material shall be included in the initial submittal package along with a copy of the
31 correspondence.
32
- 33 G. Unapproved Products: If materials or equipment are installed before being reviewed by the
34 engineer, the contractor shall be liable for the removal and replacement of such unapproved
35 materials and equipment, at no additional expense to the owner. Additionally, if the removal
36 and replacement of rejected materials or equipment necessitates the removal and
37 replacement of other related materials or equipment, then the contractor shall be liable for the
38 removal and replacement of the related materials and equipment at no additional expense to
39 the owner.
40
- 41 H. Product Data:
42 1. Where the content of manufacturer submittal literature includes data not pertinent to the
43 submittal, clearly indicate which portions of the contents are being submitted for review.
44 Catalogs, pamphlets, or other documents submitted to describe items on which review is
45 being requested shall be specific and identifications in catalog, pamphlets, etc., of items
46 submitted shall be clearly made in a contrasting ink or highlighting. Data of a general
47 nature shall not be acceptable.
48
- 49 I. Shop Drawings:
50 1. Scale and measurements: Make shop drawings accurately to a scale sufficiently large to
51 show all pertinent aspects of the item.
52 2. Types of prints required: Submit shop drawings in blue-line or black-line prints,
53 minimum of six (6) sets blue-line or black-line prints of each sheet.
54

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

1.5 QUALITY ASSURANCE / CONTROL SUBMITTALS

- A. Quality assurance and quality control submittals may be in the form of documentation, or may be in the form of completed physical work that is offered for review by the engineer, or owner.
- B. If documentation is the subject, then submit in a manner similar to the initial submittal package.
- C. If completed physical work is the subject, then the work shall not be concealed, nor shall subsequent work be performed, until the engineer's representative has reviewed the work. If the work is concealed, or if subsequent work is performed, before the engineer's representative has reviewed the work, then the contractor shall be liable for removal and replacement at no additional expense to the owner.
- D. Sequencing:
 - 1. Within 30 calendar days after the contractor has received the owner's notice to proceed, provide the complete submittal package.
 - 2. After the engineer has reviewed the submittal package, make necessary revisions to the submittals as directed by the engineer and resubmit.
 - 3. After the submittal has been reviewed by the engineer, proceed to purchase materials and perform the work.
- E. Scheduling:
 - 1. Failure to submit items that meet the requirements of the contract documents in ample time for review shall not entitle the contractor to an extension of contract time, and no claim for extension by reason of such default shall be allowed. The contractor may be held liable for delays so occasioned.

PART 2 PRODUCTS

- A. Not applicable

PART 3 EXECUTION

3.1 SUBMITTALS

- A. Make submittals of product data, shop drawings, samples, quality assurance submittals, quality control submittals, and other items in accordance with the requirements of this section, applicable sections in Division 23, and additional requirements of each individual Division 23 specification section.
- B. Grouping of Submittals:
 - 1. The submittal package shall be coordinated and included in a single submission. Multiple submissions are not acceptable except where prior written approval has been obtained from the engineer. Partial submittals may be rejected, without being reviewed, as not complying with the provisions of the contract.
- C. Submittal Organization:
 - 1. Provide a submittal cover sheet that lists at least the following:
 - a. Project name
 - b. Date
 - c. Name and address of engineer
 - d. Name, address and telephone number of prime contractor
 - e. Name, address and telephone number of HVAC contractor

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- f. Name, address and telephone number of HVAC supplier
 2. The second and third sheet shall be blank for stamping of submittals.
 3. Provide an index sheet listing all items submitted.
 4. The contractor shall call to the attention of the engineer by letter, included in the submittal after the index sheet, any instance in which the submittals are known to differ from the requirements of the contract documents.
 5. Organize all required items by specification section. The material for each specification section shall be organized as follows:
 - a. Provide a tabbed index divider with the specification number and title.
 - b. Provide a section cover sheet that lists the same information as the submittal cover sheet, plus the specification number and title and the name, address and telephone number of the vendor or vendor's representative, if applicable.
 - c. Refer to the individual Division 23 specification sections for any required organization of the submittal material within each tabbed submittal section.
 - d. Tabbed sections shall be arranged by specification section number in numerical order.
 - e. Organize all required data in a 3-ring hard cover binder suitable for filing. Soft binders are not acceptable.
 - f. Provide a minimum of six copies, each in a separate binder.
 - g. Submit in accordance with the procedures described in Division 01 Submittal Procedures.
 - h. Submittals not organized as described here may be rejected, without being reviewed, as not complying with the provisions of the contract.
- D. Response to engineer's review:
1. Review comments: Review comments of the engineer will either be shown on the returned sets to the contractor, or shown on a document attached to the sets. If the comments are on an attached document, then the engineer will place a note on the submittal referring to the attached comments. In such cases, the engineer's signature will appear only on the attached document. If the attached, signed document becomes physically separated from the submittal, then the submittal will no longer be considered as being a reviewed submittal.
 2. Complete rejection: If the submittal is not complete or does not meet the requirements of this specification section, then the engineer may reject the entire submittal and return the submittal without further review or comment. In such cases, the entire submittal shall be completely revised and resubmitted. The resubmittal shall be given a new submittal number and shall be documented and processed as a separate submittal from the original.
 3. Held for completion: If the submittal is not complete, but is only missing some minor item, the engineer may, at the engineer's sole discretion, hold the submittal rather than rejecting and returning the submittal. In such cases, the engineer will notify the contractor that the submittal is being held for completion. The contractor will be given a predetermined amount of time to provide the missing item. Upon receipt of the missing item, the engineer will insert the missing item into the submittal package and proceed with the review process.
 4. Partial rejection: The engineer may reject only certain portions of the submittal. In such cases, only those rejected portions or items need to be revised and resubmitted.
 5. Provide as corrected: The engineer may note a required change to a submitted item, but may not consider the change serious enough to require a resubmittal. In such cases, the engineer will note that the item is to be provided as noted or corrected. In such cases, the contractor may proceed to provide the item. However, if subsequent observations reveal that the noted change was not made, then the contractor shall be liable for removal and replacement of the item at no additional cost to the owner.
 6. Reviewed without comment: The contractor may proceed to provide all materials and equipment.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

- 1
 - 2
 - 3
 - 4
 - 5
 - 6
 - 7
 - 8
 - 9
 - 10
 - 11
 - 12
 - 13
 - 14
- E. Quality Assurance / Quality Control Submittals:
1. Provide quality assurance and quality control submittals at those points in the progress of the work in accordance with the requirements of individual Division 23 specification sections.
 2. If the subject of the submittal is completed physical work, then submit the work for review by notifying the engineer's representative in sufficient time to schedule the site visit. The engineer's representative will document the review in an observation report. Make noted corrections to the work and resubmit the work for review before covering the work or proceeding with subsequent work.
- F. Close-out Submittals:
1. Provide close-out submittals in accordance with the requirements of Division 1.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

1

Submittal Checklist – HVAC			
Grouping of submittals is by written permission only. Listed items shall be organized and bound in a 3-ring binder in accordance with the specifications. Incomplete or unbound submittals will be rejected.			
Required submittals in the mechanical group of the initial submittal package include but are not limited to the following. Always refer to the individual specification sections.			
Specification Reference			Description
<input type="checkbox"/>	23 00 10	<input type="checkbox"/> Basic HVAC Requirements	
<input type="checkbox"/>	23 05 54	<input type="checkbox"/> Mechanical Identification	<input type="checkbox"/> Types of Tags And Labels
<input type="checkbox"/>	23 08 01	<input type="checkbox"/> Air Balance	<input type="checkbox"/> Report at End of Job & Punch List During Job
<input type="checkbox"/>	23 31 01	<input type="checkbox"/> Ductwork	<input type="checkbox"/> SMACNA Requirements
<input type="checkbox"/>	23 33 34	<input type="checkbox"/> Access Doors	<input type="checkbox"/> Manufacturer's Data And Schedules
<input type="checkbox"/>	23 37 14	<input type="checkbox"/> Air Distribution	<input type="checkbox"/> Manufacturer's Data, Spec, NC

2
3

END OF SECTION

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

SECTION 23 05 54

MECHANICAL IDENTIFICATION

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications and Section 23 00 10, apply to this Section.

1.2 SECTION INCLUDES

- A. Identification required for mechanical systems.
- B. Code required identification not shown on plans nor specified herein shall be provided.

1.3 RELATED SECTION

- A. Section 23 00 10 - Basic Mechanical Requirements

1.4 SUBMITTALS

- A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 10, General Conditions, and Division 01.
- B. Submit wording of nameplates with submittals.
- C. Submit list of all products incorporated in this section.

1.5 REFERENCES

- A. Comply with ANSI A13.1
- B. USAS Code B31.8
- C. NTSB-PSS-73-1
- D. AGA
- E. API

1.6 DESCRIPTION OF WORK

- A. Provide signs for following equipment identification:
 - 1. Air Handlers
 - 2. Boilers/Water Heaters
 - 3. Condensing Units
 - 4. Duct Dampers
 - 5. Filter Sizes for Air Handlers
 - 6. Fire Dampers
 - 7. Heat Exchangers
 - 8. Outside Air Units
 - 9. Piping

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- 10. Pumps
- 11. Starters
- 12. Supply/Exhaust Fans
- 13. Valves

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Seton
- B. Brady

2.2 EQUIPMENT LABELS

- A. Type: Engraving-Stock, melamine plastic laminate, 3 layer.
 - 1. Thickness:
 - a. Less than 25 square inches: 1/16 inch
 - b. 25 square inches or more: 1/8 inch
- B. Color:
 - 1. Black
- C. Conform to FS L-P-287

2.3 LETTERING

- A. Style:
 - 1. Engraved standard print, unless otherwise indicated.
- B. Size:
 - 1. 3/16 inch to 1/4 inch
- C. Color:
 - 1. White letters, black background

2.4 SIGN INFORMATION

- A. HVAC Equipment:
 - 1. Unit mark from Drawings/Owner
 - 2. Voltage - Phase
 - 3. Manufacturer and Model Number

2.5 NAMEPLATE FASTENERS

- A. Securely attach nameplates to equipment with noncorroding stainless steel screws.
- B. Non-corroding pop rivets are acceptable.
- C. Stick-ons or adhesives will not be allowed.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

2.6 PIPING AND CONTROL DIAGRAM SIGNS

- A. Material: 1/4 inch acrylic cover and backing screwed together with brass screw/bolts.
1. Size:
 - a. Minimum: 12" x 17"
 - b. Maximum: 24" x 36"
- B. Provide a diagram in each mechanical room similar to the diagrams shown on the plans, and/or as required for the area served.

2.7 IDENTIFICATION OF PRODUCTS

- A. Hazard Markers for Pipe-Conveyed Material:
1. Conform to ANSI A13.1 for classification of hazards of materials.
 2. Use markers of the following colors to identify the materials conveyed by the pipes:
- | Material | Field | Letters |
|----------------------------|--------|---------|
| Inherently Hazardous | Yellow | Black |
| Inherently Low Hazard: | | |
| Liquid or Liquid Admixture | Green | White |
| Gas or Gaseous Admixture | Blue | White |
| Fire Quenching Materials | Red | White |
- B. Provide pipe markers with the following features.
1. Letters from 1/2" to 3-1/2"; size letters to afford readability from the appropriate viewing position.
 2. Repeated and reversed words for viewing from 360° around pipe.
 3. Self-clinging, coiled markers that snap into place around pipe and do not require any other securement.
 4. Integral directional arrows.
- C. Letters on Field:
1. Identify the specific material conveyed, e.g., "Domestic Cold Water", "Sprinkler", etc.
- D. Model:
1. Less than 3/4":
 - a. Tags, same as Paragraph: Piping System Devices, color codes for hazard.
 2. 3/4" up to 6"; Seton Setmark SNA snap-on.
 3. Over 6"; Seton Setmark STR strap-on, with stainless steel spring straps.
 4. Use Seton Ultra-Mark for outdoor use.
- E. Piping System Devices (Valves, Thermometers, Pressure Gages, etc., and Pipe Less Than 3/4"):
1. Identify with the following:
 - a. Tags:
 - (1) Not less than 1-1/2 inch brass or aluminum tags, round, square, or octagonal.
 - b. Stamp tags with minimum 1/2" high descriptive characters, 1/2" high numbers with black enamel-filled indentations.
- F. Attachment:
1. Stainless steel or solid brass jack chain; Seton JA16, or stainless steel or brass "S" hooks
- G. Ductwork:
1. Stenciled letters or self-adhesive labels, minimum 1" high characters.
 2. Red ribbon at each balancing damper.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

H. Underground Warning Tapes:

1. Provide materials that meet the codes or have the approvals listed below:
 - a. Office of Pipeline Safety Regulation, USAS Code B31.8.
 - b. GSA Public Building Service Guide Specification.
 - c. National Transportation Safety Board Report NTSB-PSS-73-1.
 - d. AGA Report 72-D-56.
 - e. API Report API RP 1109.
2. Material:
 - a. Plastic, continuous tape, color-coded, marked for hazard.
 - b. For Non-metallic Piping System:
 - (1) Aluminum foil core encased in plastic.
 - c. Metallic Piping:
 - (1) Plastic tape.

I. Color:

1. Colored (not printed color) plastic, coded for material conveyed by piping.

J. Width:

1. As scheduled for piping system burial depth.

K. Legend:

1. "Caution [System Name] Line Buried Below".

L. Tape Colors:

Utility	Color
Natural Gas, Oil, Dangerous Materials	Hi Visibility Safety Yellow
Communications	Safety Alert Orange

M. Model:

1. Metallic Piping System:
 - a. Seton Polyethylene Tape.
2. Non-Metallic Piping System:
 - a. Seton Metallic Detection Tape.

N. Underground Gas Piping:

1. Attach No. 18 gauge copper tracer wire to the piping and terminate above grade at each end.

O. Pipeline Markers for Pipe Beneath Pavement and Slabs:

1. Minimum 2" round, square, or octagonal, same as specified in Subparagraph: Piping System Devices.

P. Attachment:

1. 1-1/2" screw, bolted to tag as anchor.
2. Anchor Setting Compound:
 - a. Epoxy or epoxy grout, compatible with the pavement.

PART 3 EXECUTION

3.1 GENERAL

- A. Contractor shall verify room numbers with Owner/Engineer before nameplates are fabricated.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- B. The following shall be permanently and clearly identified:
 1. Each air handler, condensing unit, compressor, exhaust fan, and pump.
 2. Each zone duct, outside air duct, and return air duct whose duty is not immediately apparent.
 3. Each valve whose service and/or duty is not immediately apparent.

3.2 INSTALLATION

- A. Install signs on non-removable panels. Attach to equipment with pop rivets or stainless steel screws.
- B. Mount in an easily visible location.
- C. All labeling identification shall conform to final room numbers. Coordinate with General Contractor, Engineer and Owner to secure construction room numbers.
- D. Provide all additional signage required by local authority at no cost to the Owner.
- E. Provide filter sizes and quantity on all air handlers.
- F. Complete installation in accordance with ANSI A13.1 and manufacturer's installation instructions and with the Drawings. Fasten each unit securely in place with stainless steel screws.
- G. Equipment Labeling:
 1. Install on scheduled items of equipment, including the following:
 - a. Water heaters
 - b. Air conditioning equipment
 - c. Pumps
 - d. Control panels and major control components
 - e. Other items of equipment
 - f. Include Mark Number and descriptive name from Drawing and Specification schedules
 - g. Attach with corrosion resistant, stainless steel screws or pop rivets
 - h. Install 1/2" diameter adhesive marker (color to be approved by Engineer), and apply to T-bar below any mechanical equipment and fire dampers above lay-in ceiling.
- H. Hazard Markers for Pipe-Conveyed Material:
 1. Location:
 - a. In crawlspaces
 - b. Where exposed beneath suspended slabs
 - c. Outside above grade
 - d. Above roofs
 - e. Piping in tunnels
 - f. Other places where pipe is exposed in occupiable rooms and spaces, indoors and outdoors
 2. Spacing:
 - a. Where pipe passes through walls, floors, and other barriers.
 - b. In Tunnel Vaults and Equipment Rooms: Maximum spacing, 10 feet; closer where piping is congested, and where piping continuity is obscured from view.
 - c. Piping in Tunnels:
 - (1) Maximum spacing 100 feet
 - d. Other Places:
 - (1) Maximum spacing 50 feet

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- I. Piping System Color Coding:
1. Designate for painter the following:
 - a. Types of piping services
 - b. Direction of flow
 - c. Other information required for proper identification.
- J. Surfaces to be Painted:
1. Bare piping
 2. Insulation covering of insulated piping
- K. Paint according to the following schedule:
- | System | Pastel Color |
|--------------------|-------------------------------------|
| Gas Piping on Roof | Black or selected by Owner/Engineer |
- L. Piping System Devices (Valves, Thermometers, Pressure Gages, etc.):
1. Identify with the following information:
 - a. System
 - b. Device number
 - c. Device Function
- M. Device Chart:
1. Key devices to device chart
 2. Give complete description of device function and system.
- N. Key devices to drawings as follows:
1. Floor plans
 2. Schematic drawings of piping systems
- O. Underground Warning Tapes:
1. Tape Widths:
- | Piping Burial | Depth | Tape Width |
|---------------|-------|------------|
| 10" | 2" | |
| 20" | 3" | |
| 27" | 6" | |
| 30" | 9" | |
| 40" | 12" | |
| 50" or more | 18" | |
- P. Recommended Tape Bury Depth:
1. Minimum Depth:
 - a. 6".
 2. Distance Between Pipe and Tape:
 - a. Minimum 12".
 - b. Maximum Depth: 12".
 3. Tie tape to pipe where pipe leaves the ground.
- Q. Pipeline Markers for Pipe Beneath Pavement and Slabs.
1. Location:
 - a. Accuracy:
 - (1) Plus or minus 6" from piping centerline.
 - b. Flat Edge Pavement and Slabs:
 - (1) Set within 6" of pavement or slab edge.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- c. Concrete Curbs:
 - (1) Set in top of curb.
- d. Spacing:
 - (1) Each change in direction, each edge of pavement or slab, maximum spacing of 100'.

R. Legend:

- 1. Same as tags plus an engraved or stamped line; set marker with line parallel to buried line.

S. Attachment:

- 1. Drill hole for anchor bolt, full depth of bolt plus 1/2"; set full tag and bolt in epoxy, flush with pavement or slab.

END OF SECTION

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

SECTION 23 08 01

AIR BALANCE AND SYSTEM TESTING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications and Section 23 00 10, apply to this Section.

1.2 SECTION INCLUDES

- A. Testing and balancing services for the heating, ventilating, and air conditioning (HVAC) systems of this project. Final approval of the balancing agency shall be by the Engineer.
- B. The balancing agency will have a contractual relationship with the General Contractor for the satisfactory execution of testing and balancing the HVAC systems.
- C. The following are acceptable agencies:
 - 1. Austin Air Balancing, Austin (Phone: 512-477-7247)
 - 2. Delta-T, Inc., Garland (Phone: 972-494-2300)
 - 3. Engineered Air Balance, Addison (Phone: 972-818-9000)
 - 4. Air Engineering & Testing, Inc. (Phone: 972-386-0144)
 - 5. Complete System Balance, Rockwall (Phone: 972-965-4289)

1.3 RELATED SECTIONS

- A. Section 23 00 10 - Basic Mechanical Requirements
- B. Section 23 31 01 – Ductwork
- C. Section 23 35 13 - Dust Collection System
- D. Section 23 37 14 - Air Distribution Devices

1.4 STANDARDS

- A. The balancing agency shall perform the services specified herein in accordance with the Associated Air Balance Council's National Standards, including revisions, to the date of the contract.
- B. All terms in this specification shall have their meaning defined as stated in the National Standards.
- C. If these specifications set forth more stringent requirements than the AABC National Standards, these specifications shall prevail.

1.5 QUALIFICATIONS OF THE BALANCING AGENCY

- A. The balancing agency shall be a member of the Associated Air Balance Council (AABC).
- B. To perform required professional services, the balancing agency shall have a minimum of one "Test and Balance Engineer" certified by the Associated Air Balance Council.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- 1
2 C. This certified "Test and Balance Engineer" shall be responsible for supervision and
3 certification for the total work herein specified.
4
5 D. The balancing agency shall submit records of experience in the field of air and hydronic system
6 balancing or any other data as requested by the Owner/Engineer. The supervisory personnel
7 for the firm shall have at least five (5) years' experience, and be a full time employee for a
8 minimum of six (6) months prior to the project. All employees used in this project shall be
9 qualified technicians in this specific field.
10
11 E. The balancing agency shall furnish all necessary calibrated instrumentation to adequately
12 perform the specified services. An inventory of all instruments and devices in possession of
13 the balancing agency may be required by the Owner to determine the balancing agency's
14 performance capability.
15
16 F. The balancing agency shall have operated for a minimum of five (5) years under its current
17 name.
18

19 **1.6 DOCUMENTS**

- 20
21 A. The General Contractor will provide the balancing agency one copy of the following
22 documents:
23 1. Project drawings (mechanical sepia's if requested) and specifications.
24 2. Reviewed construction revisions pertaining to the HVAC systems.
25 3. Reviewed submittal data on HVAC equipment and systems to be installed by the
26 Mechanical Subcontractor.
27 4. Reviewed HVAC shop drawings.
28 5. Reviewed HVAC wiring diagrams, control diagrams, and equipment brochures, as
29 appropriate.
30

31 **1.7 COORDINATION**

- 32
33 A. It will be necessary for the balancing agency to perform its services in close coordination with
34 the Mechanical Subcontractor.
35
36 B. The plans and specifications indicate meters, valves, dampers, and other devices for the
37 purpose of adjusting the system to obtain optimum operating conditions. It will be the
38 responsibility of the Mechanical Subcontractor to install these devices in a manner that will
39 leave them accessible, readily adjustable and complete. The balancing agency shall provide
40 guidance if there is a questionable arrangement of a control or balancing device.
41
42 C. The General Contractor, Mechanical Contractor, Temperature Controls Subcontractor, and
43 the suppliers of the HVAC equipment shall all cooperate with the balancing agency to provide
44 all necessary data on the design and proper application of the system components. In addition,
45 they shall furnish all labor and materials required to eliminate any system deficiencies.
46

47 **1.8 RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR**

- 48
49 A. The Mechanical Contractor shall complete the installation and start all HVAC systems to
50 ensure they are working properly, and shall perform all other items as described hereinafter
51 to assist the balancing agency in performing the testing and balancing of the HVAC systems.
52
53 B. Air Distribution Systems:
54 1. Verify installation for conformity to design.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

2. Terminate all supply, return, and exhaust ducts, and pressure test them, for leakage, as required by specification.
3. Ensure that all splitters, extractors, and volume and fire dampers are properly located and functional. Dampers serving requirements of minimum and maximum outside, return, relief, and exhaust air shall provide tight closure and full opening, with a smooth and free operation.
4. Verify that all supply, return, exhaust, and transfer grilles; registers; diffusers; and high-pressure terminal units are installed and operational.
5. Ensure that air-handling systems, units, and associated apparatus, such as heating and cooling coils, filter sections, access doors, etc., are blanked and/or sealed to eliminate excessive bypass or leakage of air.
6. Ensure that all fans (supply, return, relief, and exhaust) are operating and free of vibration. All fans and drives shall be checked for proper fan rotation and belt tension. Overload protection shall be of proper size and rating. A record of motor current and voltage shall be made to verify that the motors do not exceed nameplate rating.
7. Make any necessary changes to the sheaves, belts, and dampers, as required by the balancing agency, at no additional cost to the Owner.
8. Install clean filters.

1.9 RESPONSIBILITIES OF THE TEMPERATURE CONTROLS CONTRACTOR

- A. The Temperature-Controls Contractor shall allow sufficient time in the project to provide assistance and instruction to the balancing agency in the proper use and setting of control components such as, but not limited to, computers, static pressure controllers, or any other device that may need set points changed so that the testing and balancing work can be performed.
- B. Furnish to the balancing agency any software and cables required to make adjustments to controls. Any unique micro-processor required to set controls shall be furnished by Temperature Controls Contractor.
- C. The Temperature Controls Contractor shall complete the installation of the temperature control system, and operate and test all control systems to ensure they are functioning properly as designed. The Temperature Controls Contractor shall assist the balancing agency in testing and balancing the HVAC systems, as described hereinafter.
 1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, and fire and freeze-stats.
 2. Verify that all controlling instruments are calibrated and set for design operating conditions.
 3. Calibrate room thermostats/sensors after installation, and before the thermostat control verification tests are performed. The balancing agency shall prove the accuracy of final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.

1.10 PRE-BALANCING CONFERENCE

- A. Prior to beginning of the testing, adjusting and balancing procedures, schedule and conduct a conference with the Engineer, General Contractor, Mechanical Contractor, Electrical Contractor and Temperature Controls Contractor. The objective of the conference is final coordination and verification of system operation and readiness for testing, adjusting, and balancing.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

1.11 NOTIFICATION FOR TESTING AND BALANCING WORK TO BEGIN

- A. The general contractor shall notify the balancing agency in writing when all heating, ventilating, and air conditioning systems are complete and ready for testing and balancing. The Mechanical Contractor shall attest that he has completed all items as described in "RESPONSIBILITIES OF THE MECHANICAL CONTRACTOR" Section of these specifications.
- B. If, upon commencing the work, the balancing agency finds that the systems are not ready, or if a dispute occurs as to the readiness of the systems, the balancing agency shall request an inspection to be made by the Mechanical Engineer. This inspection shall establish to the satisfaction of the represented parties whether or not the systems meet the basic requirements for testing and balancing. Should the inspection reveal the notification to have been premature, the balancing agency shall be reimbursed for all costs for the inspection and work previously accomplished. Furthermore, such items that are not ready for testing and balancing shall be completed and placed in operational readiness before testing and balancing services shall again be requested.

PART 2 PRODUCTS

- A. Not Applicable

PART 3 EXECUTION

3.1 SCOPE

- A. In accordance with Project Drawings and Specifications and as specified herein, the balancing agency shall provide all supervision, personnel, instruments, calibration equipment, and all other materials and services necessary to perform all testing and balancing of the heating, ventilating, and air conditioning systems. All test data including all pertinent calculations shall be reported on appropriate forms.

3.2 GENERAL

- A. The testing and balancing of the heating, ventilating, and air conditioning systems shall be performed by an independent balancing agency approved by the Engineer. The balancing agency shall have a minimum of five years specialized experience in air and hydronic system balancing, possess calibrated instruments, certified "Test and Balance Engineers", and skilled technicians to perform all required tests. The balancing agency shall be a certified member of the Associated Air Balance Council.
- B. The tests shall demonstrate the specified capacities and operation of all equipment and materials comprising the systems. The balancing agency shall then make available to the Owner's representative such instruments and technicians as are required for spot checks of the system.
- C. The balancing agency shall not instruct or direct the Mechanical Contractor in any of the work. Any proposed changes or revision in the work shall be submitted to the Engineer and General Contractor in writing.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

D. Document Review:

1. The Test and Balance Firm shall be responsible for reviewing the HVAC plans and specifications relating to the test and balance services for proper arrangement and adequate provisions of devices for testing, adjusting and balancing.
2. Test and Balance Firm shall review HVAC manufacturers' submittals data relative to balanceability.
3. Test and Balance Firm shall review submitted HVAC automatic temperature control sequences for conformity to the specifications.

3.3 SERVICES

- A. During construction, the balancing agency shall inspect the installation of pipe systems, sheet metal work, temperature controls, and other component parts of the heating, ventilating, and air conditioning systems.
- B. The inspections shall be performed periodically as the work progresses. A minimum of two inspections are required as follows: (1) when 60 percent of the duct work is installed; (2) when 90 percent of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the General Contractor and Engineer.
- C. Upon completion of the installation and start-up of the mechanical equipment by the Mechanical Contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space in the building.

3.4 DEFICIENCIES

- A. If in the process of performing the TAB work, any deficiencies encountered shall be brought to the attention of the contractor responsible through defined procedures, and entered in the punch list of deficiencies on the next daily Status Report. If correction of the deficiency is urgent, the matter shall be brought to the attention of all involved parties for quick resolution. The General Contractor shall provide and coordinate services of qualified responsible subcontractors, suppliers and personnel as required to correct, repair or replace any and all deficient items or conditions during the testing, adjusting and balancing period.
- B. The notification may be for single or multiple deficiencies. The work necessary to correct items on the listing shall be performed and verified in writing by the affected trade.
- C. All deficiencies that prevent proper TAB work from being completed shall be corrected prior to submittal of the Final TAB Report, unless the correction of such deficiencies cannot be accomplished in a reasonable period of time, in which case the Mechanical Engineer may grant permission to submit the Final TAB Report with the deficiencies detailed in the report.

3.5 AIR SYSTEM PROCEDURES

- A. The balancing agency shall perform the following testing and balancing functions in accordance with the Associated Air Balance Council's National Standards:
 1. Fan Speeds:
 - a. Test and adjust fan RPM to achieve design CFM requirements.
 2. Current and Voltage:
 - a. Measure and record motor current and voltage.
 3. Pitot-tube Traverse:
 - a. Perform a Pitot-tube traverse of main supply and return ducts to obtain total CFM. If a Pitot-tube traverse is not practical, the summation of the outlets or inlets may be used. An explanation why a traverse was not made must appear on the appropriate data sheet.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

4. Outside Air:
 - a. Test and adjust system minimum outside air by Pitot-tube traverse. If a Pitot-tube traverse is not practical, the percentage of outside air may be determined by calculations from the return air, outside air, and mixed air temperatures. Make allowances for heat of compression and motor heat where applicable.
5. Static Pressure:
 - a. Test and record system static pressures, including suction and discharge static pressure of each fan.
6. Air Temperature:
 - a. Take wet-bulb and dry-bulb air temperatures on the entering and leaving side of each cooling coil. Dry-bulb temperature shall be taken on the entering and leaving side of each heating coil.
7. Zone Ducts:
 - a. Adjust zone ducts to within design CFM requirements. At least one zone balancing damper shall be completely open.
8. Main Ducts:
 - a. Adjust main ducts to within design CFM requirements and traverse for total CFM quantities.
9. Branch Ducts:
 - a. Adjust branch ducts to within design CFM requirements. Multi-diffuser branch ducts shall have at least one outlet or inlet volume damper completely open.
10. Tolerances:
 - a. Test and balance each diffuser, grille, and register to within 10 percent of design requirements.
11. Identification:
 - a. Identify the location and area of each grille, diffuser, register, and terminal box. This information shall be recorded on air outlet data sheets.
12. Description:
 - a. Record the size, type, and manufacturer of each diffuser, grille, and register on air outlet data sheets.
13. Terminal Boxes:
 - a. Set volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements. All associated temperature controls shall be checked for proper operation and calibration. If the terminal boxes have separate settings for heating and cooling CFM, the CFM quantities for each shall be recorded on air outlet data sheets. All diffusers connected to the terminal box shall be read in the heating and cooling modes and their readings recorded on air outlet data sheets.
14. Minimizing Drafts:
 - a. Adjust all diffusers, grilles, and registers to minimize drafts in all areas.

3.6 VERIFICATION OF TEMPERATURE CONTROL

- A. The balancing agency shall be assisted by the Temperature Controls Contractor in verifying the operation and calibration of all temperature control systems. The following tests shall be conducted:
 1. Verify that all control components are installed in accordance with project requirements and are functional, including all electrical interlocks, damper sequences, air and water reset, and fire and freeze stats.
 2. Verify that all controlling instruments are calibrated and set for design operating conditions.
 3. Verify the accuracy of the final settings by taking temperature readings. The readings shall be in a typical conditioned space for each separately controlled zone.
- B. In the process of performing the TAB work, the balancing agency firm shall:
 1. Verify that all dampers, valves and other controlled devices are operated by the intended controller.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

2. Verify that all dampers and valves are in the position indicated by the controller (open, closed, or modulating).
 3. Verify the integrity of valves and dampers in terms of tightness of close-off and of full-open position. This includes dampers in VAV terminals.
 4. Check that all valves are properly installed in the piping system in relation to direction of flow and location.
 5. Verify the proper application of all normally open and normally closed valves.
 6. Check the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts, or cold/hot walls.
 7. Check the locations of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media.
 8. Check the sequence of operation for any control mode to ensure that it is in accordance with the Contract Documents.
- C. Verify that all controller set points meet the design intent. Record observations of systems under DDC control. Record all default set points if different from operating set points.
- D. Check all dampers for free and full operation, record any obstructions.
- E. Verify the operation of all interlock systems.
- F. Perform all system verifications to assure the safety of the system and its components.
- G. Verify that the changeover from heating to cooling mode occurs as specified.

3.7 TEST AND BALANCE REPORT

- A. The test and balance report shall be complete with logs, data, and records as required herein. All logs, data, and records shall be typed on white bond paper and bound. The report shall be certified, accurate and complete by the balancing agency's certified Test and Balance Engineer.
- B. The report shall contain the following general data in a format selected by the balancing agency:
1. Project number
 2. Contract number
 3. Project title
 4. Project location
 5. Project Mechanical Engineer
 6. Test & Balance agency
 7. Test & Balance Engineer
 8. General Contractor
 9. Mechanical Subcontractor
 10. Dates tests were performed
 11. Certification
- C. The test and balance report shall be recorded on report forms conforming to the recommended forms in the AABC National Standards. At a minimum, the report shall include:
1. Preface
 2. A general discussion of the system, any abnormalities and problems encountered.
 3. Instrumentation list
 4. The list of instruments including type, model, manufacturer, serial number, and calibration dates.
 5. Data

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

6. All test and balance data indicating design and actual conditions of operation for each device and/or piece of HVAC equipment.
7. System Identification
8. In each report, the VAV boxes, zones, supply, return, and exhaust openings, and traverse points shall be numbered and/or lettered on mechanical drawings to correspond to the numbers and letters used on the report data sheets.
9. Controls
10. Document verification of controls.
11. Occupancy Inspection
12. Make a total of three (3) inspections within ninety (90) days after occupancy of the building, and make adjustments if required, to insure that satisfactory conditions are being maintained throughout. Inspections to be coordinated with Engineer and Owner and shall be documented with a supplemental report containing data and information as required.
13. Instructions to Operating Personnel
14. Test and Balance Firm shall instruct the operating personnel regarding the following:
 - a. Systems Operation
 - b. Unusual Operating Conditions.
 - c. System Troubleshooting Procedures.

3.8 REPORT SUBMITTAL

- A. Five bound copies of the test and balance report are required and shall be submitted to the General Contractor for distribution to the Owner, Engineer and Mechanical Engineer.

3.9 FINAL ACCEPTANCE

- A. At the time of final inspection, the balancing agency shall recheck, in the presence of the Owner's representative, specific and random selections of data recorded in the certified test and balance report.
- B. Points and areas for recheck shall be selected by the Owner's representative.
- C. Measurements and test procedures shall be the same as the original test and balance.
- D. Selections for recheck, specific plus random, shall not normally exceed 15 percent of the total number tabulated in the report, except where special air systems require a complete recheck for safety reasons.
- E. If random tests demonstrate a measured flow deviation of 10 percent or more from that recorded in the certified test and balance report, the report shall automatically be rejected. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, a new certified test and balance report submitted, and a new inspection test made, all at no additional cost to the Owner.

3.10 OPPOSITE SEASON TEST

- A. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that in which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

END OF SECTION

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

SECTION 23 31 01

DUCTWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications and Section 23 00 10, apply to this Section.

1.2 SECTION INCLUDES

A. Ductwork:

1. Furnishing and installation of all ductwork as shown on the Drawings; acoustical and thermal linings and wrappings; flexible ducts and connections; combination smoke and fire dampers, smoke dampers, and fire dampers; duct access doors; air diffusers, grilles and registers; air volume control devices; hangers and supports; plenums and casings; turning vanes; air filters; installation of temperature control dampers, and other appurtenances necessary for a complete and operational system.
2. All work shall be preceded by taking measurements at the job site, fully coordinating all work with other trades, verifying available spaces for ductwork, and developing Shop Drawings.

1.3 RELATED SECTIONS

- A. Section 23 33 34 - Access Doors
- B. Section 23 00 10 - Basic Mechanical Requirements
- C. Section 23 08 01 - Air Balance and System Testing
- D. Section 23 37 14 - Air Distribution Devices

1.4 REFERENCES

- | | |
|-------------|--|
| AMCA 500 | Test Methods for Louvers, Dampers and Shutters |
| AMCA 511 | Certified Ratings Program for Air Control Devices |
| ASTM 653 | Sheet Metal, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanized) by the Hot-Dipped Process |
| ASTM A924 | Hot Dip Galvanized Coils & Sheets – Tolerances |
| ASTM A463 | Steel Sheet Aluminum Coated by the Hot Dip Process |
| NFPA 90A | National Fire Protection Association – Installation of Air Conditioning and Ventilation Systems |
| NFPA 92A | Smoke-Control Systems |
| SMACNA | Sheet Metal and Air Conditioning Contractors Association |
| SMACNA HVAC | Duct Construction Standards, Second Edition 1995, for Metal and Flexible Ducts |
| U.L. | Underwriter's Laboratories |
| UL 555 | Standard for Safety; Fire Dampers |
| UL 555S | Standard for Safety; Leakage Rated Dampers for Use in Smoke Control Systems |

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

1.5 SYSTEM DESCRIPTION

- A. Design static pressure: 3 inch w.g. minimum, unless otherwise noted.

1.6 SUBMITTALS

A. Product Data:

1. Provide submittal data on all equipment specified in this section in accordance with Section 23 00 10, General Conditions, and Division 01.
2. Submit product data indicating typical catalog of information including arrangements.
3. Submit product data sheets indicating dimensions, general assembly, and materials used in fabrication.
4. Indicate mechanical and electrical service locations and requirements of equipment.
5. Submit manufacturer's installation instructions.

B. Shop Drawings:

1. Submit 1/4" per foot shop drawing(s) showing all ducts, piping and equipment shown by plans and specifications. Submit drawings on all mechanical rooms. The drawings shall be coordinated with structural and electrical. Provide sections for all congested areas and mechanical rooms. Submit prior to construction of ductwork.

1.7 QUALITY ASSURANCE

- A. All equipment and materials shall be new and of the quality as specified herein. All work shall comply with the Local Building Code, Mechanical Code, Fire Code, and all other applicable State and Local Codes or ordinances.

- B. All equipment and materials shall be installed in a workmanlike manner by trained and experienced sheet metal technicians and mechanics as recommended by the manufacturers of the products installed.

- C. All ductwork to be manufactured in accordance with SMACNA standards.

- D. Where the standards and requirements of this specification exceed those of SMACNA, the requirements herein shall govern.

- E. Except where specified otherwise, all sheet metal used shall be constructed from prime galvanized steel sheets or coils up to 60 inches in width. Each sheet shall be stenciled with manufacturer's name and gauge. Coils of sheet steel shall be stenciled throughout on 10 foot centers with manufacturer's name and gauge tolerances in inches.

F. Spiral pipe:

1. All pipe and fittings must be from a single manufacturer.

G. Flexible:

1. The composite assembly including insulation, vapor barrier, and glass scrim shall meet the Class 1 requirements of the latest NFPA Bulletin #90A and be labeled for a spread rating of 25 or less and a smoke development rating of 50 or under.

1.8 WARRANTY

- A. Warranty all ductwork and dampers for 1 year from the date of final acceptance. The warranty will cover workmanship, noise, chatter, whistling, and vibration. Ductwork must be free from pulsation under all conditions of operation.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

PART 2 PRODUCTS

2.1 ACCESS DOORS

- A. Install access doors to facilitate cleaning as required by code.
- B. Install access doors as required for access to fire protection devices.

2.2 SINGLE - WALL, ROUND AND FLAT OVAL DUCT AND FITTINGS (FOR MEDIUM PRESSURE APPLICATION)

- A. Medium Pressure (3-inch w.g.) rectangular duct not allowed.
- B. Material:
 - 1. New, prime grade sheet or coil steel.
 - a. Gauge:
 - (1) Select gauge in accordance with SMACNA duct construction standards.
- C. Fittings:
 - 1. By Duct Manufacturer
- D. Coatings:
 - 1. Type:
 - a. Continuous, hot-dip galvanized coating.
- E. Application:
 - 1. 1-1/4 ounces per 1 square foot, two-sided sheet.
 - 2. Comply with ASTM A653.
- F. Identification:
 - 1. Sheet Steel
 - 2. Stencil each sheet with manufacturer's name and gauge.
- G. Construction:
 - 1. Manufacture in accordance with SMACNA standards.
- H. Approved Manufacturers:
 - 1. United McGill Corporation ACOUSTI-k27
 - 2. Lewis & Lambert, LLP
 - 3. Lindab
 - 4. Precision Spiral Pipe
 - 5. Spiral Pipe of Texas Corporation, Inc.

2.3 VOLUME CONTROL DAMPERS

- A. Manufacturer: Nailor Industries Series 1020, 1021 or equal.
- B. Type:
 - 1. Manually operated single blade or multi-blade
 - 2. Conform to SMACNA Duct Standards (Metal & Flexible), Figures 2-12 & 2-13.
- C. Application:
 - 1. Provide in all branches, splits and taps whether indicated on plans or not.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

D. Construction:

1. Provide an indicating device with lock to hold damper in proper position.
2. All manual dampers installed above hard ceilings or at other in-accessible areas shall be supplied with a cable operated damper equal to Young Regulator Model 830A-CC. Damper(s) to be opposed blade type constructed of .050 minimum heavy duty extruded aluminum frames and blades. All necessary hardware to ensure compatibility with remote cable control system shall be included. Damper blades to include individual blade bushings for smooth and quiet operation. Damper blades shall rotate between a matched pair of formed and punched 306 stainless steel connecting slide rails which facilitate smooth blade movement and ensure alignment.

2.4 TURNING VANES

- A. Provide on all rectangular elbows except for return air jumper ducts noted on plans.
- B. Conform to SMACNA Duct Standards, Figures 2-3 and 2-4.

2.5 DUCT SEALANT

- A. Equal to Glenkote "Seal-Flex" duct sealer, Hardcast "Irongrip 601", Foster 32-19" or "Childers CP-146"

2.6 FIRE DAMPERS

A. Manufacturer/Model:

1. Fire Dampers – Pottorff, Ruskin, Greenheck, National Controlled Air or Nailor
2. Ceiling Fire Dampers/Thermal Blankets - CK-2000-1 thermal blanket and Model CFSR-2 ceiling damper for supply outlets (round or square) and CFSR-2 for return outlets (square).

B. Type:

1. 212° F fusible link fire damper.
2. Fire protection rating: 1.5 hours
3. Conform to UL Standard 555 and be UL labeled
4. Tested in accordance with AMCA 500.

C. Application:

1. Provide at locations shown on plans and where required by Local and State ordinances.

D. Features:

1. Maximum leakage 8 cfm at 4-inch S.P.
2. Vertical or horizontal installation
3. Interface with fire alarm
4. Radiation blanket
5. Blades 16 gauge galvanized, maximum 6-inch width.
6. 5 year warranty.

E. Manufacturer/Model:

1. Ceiling Fire Dampers:
 - a. Pottorff Ceiling Fire Dampers/Thermal Blankets – Series CFD
 - b. Equals by Nailor Industries, NCA, United Air, Ruskin, Greenheck

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

2.7 SMOKE FIRE DAMPERS

A. Manufacturer/Model:

1. Pottorff Model FSD Series. To have 120 VAC 'fail-safe' operation motor. Motor normally energized, any power interruption to activate damper to the closed position.
2. Pottorff Ceiling Fire Dampers/Thermal Blankets – Series CFD Pottorff, Ruskin, or Greenheck.
3. Equals by Nailor Industries, Air Balance, Inc., United Air

B. Type:

1. Resettable combination fire smoke dampers.
2. Fire protection rating: 1.5 hours
3. Conform to UL Standard 555S, Class II-250° F
4. UL labeled
5. Tested in accordance with AMCA-500, AMCA 511

C. Application: Provide at locations shown on plans and where required by Local and State ordinances.

D. All smoke/fire dampers under 16" in height shall be oversized and transitioned down to duct size to maximize free area. Where it is impossible to oversize duct/openings, then a flat top and bottom frame style shall be used.

E. Features:

1. Resettable thermostat 212 °F control point with 120 volt AC Belimo motor.
2. 120 VAC motor
3. Vertical or horizontal installation
4. Radiation blanket
5. Maximum leakage to be 8 cfm at 4-inch S.P.
6. Interface with fire alarm
7. Blades 16 gauge galvanized, maximum 6-inch width.
8. 5 year warranty.

2.8 COMBINATION FIRE/SMOKE DAMPERS

A. Manufacturer/Model:

1. Pottorff Model FSD Series to have 120 VAC 'fail-safe' operation motor. Motor normally energized, any power interruption to activate damper to the closed position.
2. Pottorff Ceiling Fire Dampers/Thermal Blankets – Series CFD Pottorff, Ruskin, or Greenheck.
3. Equals by Nailor Industries, Air Balance, Inc., United Air

B. Type:

1. Resettable combination fire smoke dampers.
2. Fire protection rating: 1.5 hours
3. Conform to UL Standard 555S, Class II-250° F
4. UL labeled
5. Tested in accordance with AMCA-500, AMCA 511

C. Application:

1. Provide at locations shown on plans and where required by Local and State ordinances.
2. All smoke/fire dampers under 16" in height shall be oversized and transitioned down to duct size to maximize free area. Where it is impossible to oversize duct/openings, then a flat top and bottom frame style shall be used.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

D. Features:

1. Resettable thermostat 212 °F control point with 120 volt AC Belimo motor.
2. 120 VAC motor
3. Vertical or horizontal installation
4. Radiation blanket
5. Maximum leakage to be 8 CFM at 4-inch S.P.
6. Interface with fire alarm
7. Blades 16 gauge galvanized, maximum 6-inch width.
8. 5 year warranty.

2.9 FIRE SAFETY FUNCTIONS - DUCT MOUNTED SMOKE DETECTORS, CONTROL RELAYS,
AND SMOKE FIRE DAMPER CONTROL

- A. The Mechanical Contractor shall employ a Fire Alarm sub-contractor that is licensed by the State of Texas Fire Marshal and a factory authorized distributor for the brand of existing fire alarm system to provide the devices and perform the final low-voltage hook-up. Duct mounted smoke detector housings and sample tubes shall be furnished by the Fire Alarm sub-contractor and mounted by the Mechanical Contractor. Line voltage hook-up shall be by the Electrical Contractor.
- B. Smoke detectors and control relays shall be provided by the Fire Alarm sub-contractor. The HVAC Control System Contractor shall wire each control relay into the control circuit of each individual air handler so the fire alarm system safety function circuit will de-energize the unit control circuit under fire alarm conditions. The HVAC Control System shall not bypass or replace this shut-down function. The HVAC Control System shall be configured such that when the fire alarm system safety control circuit is re-energized by the fire alarm control panel that the units shall return to normal operation (e.g. start running again) without intervention of the control system.
- C. Duct mounted detector housings with addressable or conventional photoelectric detector heads (to match the existing fire alarm system) shall be provided where shown on the drawings, or as required. Detectors shall operate by the photoelectric light-scattering principal using an LED light source to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density. The detector shall operate in air velocities of 300 to 4,000 ft./min. without a shift in sensitivity. Each detector shall be resettable from the FACP.
- D. The unit shall include a 16-gauge steel or Noryl molded plastic enclosure with molded integral conduit knockouts. The unit shall be provided with gasket seals to provide proper sealing of housing to mechanical ductwork and to insure proper airflow into the detector sampling chamber. Duct housing shall be designed for mounting to rectangular or round ducts.
- E. Each duct mounted detector housing shall be labeled in a visible area with its device hardware address or zone utilizing self-laminating, flexible vinyl film, non-smear, machine printed labels.
- F. The Duct Detector Unit shall be UL listed to the most current UL 268A standard and be cross-listed for use with the fire alarm control panel. Each duct unit shall be equipped with sampling tubes protruding into the associated ductwork. For ducts up to 3' wide, the supply tube shall be 1" shorter than the duct width. For ducts 3' to 8' wide the sampling tube to be 1" longer than the duct width and protrude through the opposite side of the duct for support. Duct widths greater than 8' will require internal bracing. Sampling tubes shall be configured to provide adequate airflow through the detector housing and fitted with an integral porosity filter system to aid in reducing detector contamination. Detectors shall be installed per NFPA 90A and the manufacturer's instructions.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

- 1 G. When smoke is detected by a duct mounted smoke detector, it shall activate either a
2 supervisory fire alarm condition at the fire alarm control panel as directed by the AHJ. Duct
3 mounted smoke detectors shall indicate a supervisory alarm unless otherwise directed, duct
4 mounted smoke detectors are not a substitute for area detection. In either case the activation
5 of any duct mounted smoke detector shall actuate all related air handler shut down relays,
6 smoke fire damper motors, fire door release devices, et cetera.
7
- 8 H. Each smoke detector shall be attached to a SLC and set to a distinct address and internal
9 identification code, which the control panel shall use to identify the location, status, and type
10 of device. Duct detectors must be powered from the fire alarm system.
11
- 12 I. Each detector shall be provided with a remote power/status LED. The remote LED indicator
13 shall be located in the nearest corridor ceiling unless otherwise directed. The status LED shall
14 flash under normal conditions, indicating that the detector is operational and in regular
15 communication with the control panel. The LED shall be placed into steady illumination when
16 a supervisory condition has been detected.
17
- 18 J. Each remote LED faceplate shall have an engraved plastic nameplate permanently attached
19 indicating the HVAC unit number, type, and device identification number as programmed in
20 panel. Labels shall be 1/16" thick two ply black/white acrylic sheet engraving stock with all
21 sides beveled.
22
- 23 K. Each HVAC unit for which a Duct mounted Smoke detector is installed shall also have a blower
24 shutdown relay as listed below.
25
- 26 L. It is also acceptable for smoke detectors that are UL listed to UL 268A specifically for use in
27 no-flow/low-flow air-handling systems to be pendant / plate mounted in the duct air stream
28 (without sampling tubes). Pendant mounted duct smoke detectors shall be installed in
29 accordance with the manufacturers' instructions and shall be easily accessible for service,
30 with a labeled access door or removable plate and a remote LED.
31
- 32 M. Provide housing with base and photoelectric detector head, sampling tube, and remote LED.
33
- 34 N. Fire Safety Function HVAC Unit Blower Shut-Down and Smoke Fire Damper Operation:
35 1. Provide a power relay for each fire safety control circuit as required to operate smoke fire
36 dampers, control relays for shut-down of each air handler, et cetera, as indicated on
37 plans.
38
- 39 O. Fire Safety Function Control Module:
40 1. Addressable Control/Relay Modules shall be provided where required to provide NAC
41 interface or relay controlled fire alarm functions. The control module will mount in a
42 standard 4-inch electrical box. The control module shall provide a dry contact (form C)
43 relay with SPDT dry contacts rated at 2.0 amps @ 24 VDC and 0.5 Amps @ 120 VAC
44 (pilot duty).
45
- 46 P. Power to operate the relay actuation shall be provided by the SLC. Each control module shall
47 be operated by events as programmed in the control panel (i.e. operate on alarm condition).
48 Control modules shall feature status LEDs to indicate the module is operational and when the
49 relay is energized.
50
- 51 Q. Each control module shall be set to a distinct address and internal identification code on the
52 SLC, which the control panel shall use to identify the location, status, and type of device.
53

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

- R. Each control module shall have an engraved plastic nameplate permanently attached indicating the devices function and control panel device identification number. Labels shall be 1/16" thick two ply black/white acrylic sheet engraving stock with all sides beveled.
- S. Fire Safety Function Power Relay:
1. Power Relays shall be provided as required to control each fire safety control functions circuit, one or two circuits may be controlled by each relay. Each relay shall be operated by a 120 VAC coil and feature DPDT dry contacts rated 30 Amps @ 120 VAC. Each relay shall be mounted in a surface mount metal enclosure with conduit knockouts. Relays shall be UL recognized and rated for ten million mechanical operations.
 2. Air Products & Controls model MR-199X-14/C, 120 VAC coil, heavy duty power relay with metal enclosure or approved equivalent.
- T. Fire Safety Function Control Relays:
1. Control Relays shall be provided where a relay control interface is required to perform fire safety control functions; air handler shut-down, fire door control, et cetera. Each relay shall be operated by a multi-voltage coil (24 VDC, 24 VAC, or 120 VAC), feature SPDT dry contacts rated 10 Amps @ 120 VAC, and a status LED to indicate the relay is energized. Each relay shall be mounted in a surface mount metal enclosure with a status LED viewing hole and conduit knockouts. Relays shall be UL recognized and rated for ten million mechanical operations.
 2. Air Products & Controls model MR-101/C, multi-voltage coil, control relay with metal enclosure or approved equivalent.

PART 3 EXECUTION

3.1 INSTALLATION

- A. General:
1. Erect all ducts in the general locations shown.
- B. Conform to all structural and finish conditions of the building.
- C. Ductwork shall not be allowed to pass through or over designated electrical rooms.
- D. Before fabricating any ductwork, check the physical conditions at the job site and make all necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.
- E. Where ductwork is shown to be lined on the inside with duct liner, the sizes shown on the plans are the inside dimensions. Therefore, sheet metal dimensions shall be increased accordingly.
- F. Seal all joints both transverse and longitudinal seams, with duct sealant in accordance to Table 1-2 Class B.
- G. Install 1" roll type filter media on all return duct openings prior to starting blowers. Leave in place and change as necessary during construction.
- H. Before installing grilles, operate air conditioning unit fans and remove all debris or foreign matter.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

- I. Rectangular duct:
 1. Construct in accordance with SMACNA, Duct Construction Standards for the specific duct pressure classification involved (see pressure classification). Do not use radius ells with square throats.
- J. Round duct:
 1. Connect with slip type joints using a minimum of three sheet metal screws per joint and in accordance with SMACNA.
- K. Exterior Ductwork:
 1. Install so that water sheds off of ductwork and is weathertight.
- L. Reinforcement:
 1. Reinforce all ducts to prevent buckling, breathing, vibration, or unnecessary noise.
 2. Reinforcing shall be in accordance with SMACNA Duct Construction Standards (Metal and Flexible), Tables 1-3, 1-4, 1-5, 1-6, 1-7, 1-8, and 1-9 plus any additional reinforcing to meet job conditions.
 3. All ducts shall be supported in accordance with SMACNA Duct Construction Standards (Metal and Flexible), Tables 4-1, 4-2, 4-3.
- M. Flexible Connections:
 1. Where ducts connect to fans or air handling units, make flexible airtight connections using "Ventglas" fabric.
 2. The fabric must be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard.
 3. Provide a minimum of 1/2 inch slack in the connections, and a minimum of 2-1/2 inches distance between the edges of the ducts.
 4. Provide a minimum of 1 inch slack for each inch of static pressure on the fan system.
 5. Securely fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands.
 6. Do not install outdoors, except where detailed on plans.
 7. Where connections are made in outdoor locations, seal fabric to metal with mastic.
- N. Access Doors:
 1. Install ductwork access doors in structural angle frames and provide with sash locks and hinges arranged for convenient access.
 2. Construct doors which occur in insulated ducts with an insulation filler.
 3. All access doors shall be appropriately labeled.
- O. Flashing and Opening Sealing:
 1. Ducts passing through roofs or exterior walls:
 - a. Provide suitable flashing to prevent rain or air currents from entering the building as detailed on plans.
 - b. The flashing shall be minimum No. 24 gauge galvanized steel.
- P. Ducts passing through mezzanine walls:
 1. Completely seal the penetration with acoustic sealant and fill all gaps between the ductwork and the wall materials.
 2. Sealant must be capable of preventing sound from exiting the mechanical rooms through these openings.
- Q. Ducts penetrating the floor of mezzanine mechanical areas:
 1. Make the entire penetration watertight by installing appropriate flashing and/or application of G.E. silicone sealant.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

2. The penetration must be capable of maintaining standing water in the mechanical area without allowing any water through the opening.

R. Duct Leakage:

1. Seal ductwork in accordance with Table 1-2 of the SMACNA HVAC Duct Construction Standards - Metal and Flexible (1995 edition).
2. Minimal leakage is expected for ductwork constructed to these standards but in no case shall the total leakage exceed 5% of designed CFM.
3. All joints to be sealed with duct sealant.

S. Fire and Smoke Dampers:

1. Install fire and smoke dampers at locations shown on plans, and where required by local and state ordinances.
2. Do not compress or stretch SFD, FD frame into duct or opening.
3. Install dampers square and free from racking with blade running horizontally.
4. Handle damper using sleeve or frame. Do not lift damper using blades actuator, or jackshaft.
5. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.
6. Provide access doors in attached ductwork for inspection.
7. Stencil each door "Fire Damper Access" per U. L. 555 standard.
8. Install fire dampers in openings utilizing steel angles, sleeves, and other materials, and practices required to provide an installation equivalent that used by manufacturer when dampers were tested at UL.
9. Install in accordance with damper manufacturer's published recommendations and instructions and NFPA Standard 90A.

3.2 BALANCING DAMPERS

A. Volume Control Dampers:

1. Install manually operated volume control dampers in all branch ducts, splits or taps whether indicated on the drawings or not. Install a minimum of 5'-0" from grille/diffuser.
2. Provide indicating device with lock to hold damper in position.

B. Cable Operated Dampers:

1. Install a minimum of 5'-0" from grille/diffuser.
2. Install to facilitate smooth blade movement and ensure alignment.

C. Back Draft Dampers:

1. Install back draft dampers as shown on plans.
2. Manufacturer: Nailor Industries Series 1300 or equal.

D. Air Intake Ducts:

1. Insulate all outside air intake ducts.

3.3 DAMPER IDENTIFICATION

- A. Provide a securely attached red band and a label reading "Damper Location" at the location of all concealed manual dampers.

- B. All manual dampers which are not readily visible after duct insulation installation shall be identified in this manner.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

3.4 DUCTWORK SUPPORT

- A. All ducting must be supported from building structure.
- B. Duct straps are not allowed to be screwed to roof decks, support from cross bridging or supported from bottom chord of joists.
- C. Do not support from roof or floor deck joist bridging.
- D. Support sizes and spacing shall conform to SMACNA Standards, 1995 Edition.

END OF SECTION

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

SECTION 23 33 34

ACCESS DOORS

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications and Section 23 00 10, apply to this Section.

1.2 SECTION INCLUDES

- A. Access doors

1.3 RELATED SECTIONS

- A. Section 23 00 10 - Basic Mechanical Requirements
- B. Section 23 08 01 - Air Balance and System Testing
- C. Section 23 31 01 - Ductwork

1.4 SUBMITTALS

- A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 10, General Conditions, and Division 01.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acudor
- B. Elmdor
- C. Mifab

2.2 ACCESS DOORS:

- A. Locations requiring access doors:
 - 1. Concealed valves
 - 2. Traps
 - 3. Trap primers
 - 4. Controls
 - 5. Cleanouts
 - 6. Dampers
 - 7. Ducts adjacent to fire doors, fire dampers, and smoke detectors.
 - 8. Equipment above hard ceilings.
 - 9. Other equipment requiring accessibility for operation and maintenance.

- B. Type:
 - 1. Hinged flush-type steel framed door with straps and exposed narrow border.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

- C. Minimum size:
 - 1. 18" x 18" unless otherwise indicated.
 - 2. 24" x 24" for equipment above hard ceilings.
 - 3. Conform to architectural panel pattern for acoustical ceilings.
 - 4. Confirm size with Building Inspector and Engineer.
- D. Construction:
 - 1. Hinges: Concealed continuous type.
 - 2. Locking Device: Flush cam type, screw driver operated.
- E. Fire Rating:
 - 1. Same or better fire rating than the surrounding area.
- F. Access doors located in kitchens, restrooms or areas where water is present shall be stainless steel.

2.3 FACTORY PAINTING

- A. Apply prime coat of rust inhibiting paint, unless located in wet area.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions and recommendations.
- B. In suspended acoustical ceilings, provide a beaded pin or other approved means for identification and easy removal where necessary.
- C. Access doors shall only be installed in areas/locations that are readily accessible.
- D. Doors shall be installed in such a manner that door will open 180 degrees.

END OF SECTION

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

SECTION 23 35 13

DUST COLLECTION SYSTEM (REFERENCE ONLY)

PART 1 – GENERAL

1.1 GENERAL NOTE: This Section is for Reference Only. Owner's existing Duct Collector is to be relocated and re-installed.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications and Section 23 00 10, apply to this Section.

1.3 SCOPE

- A. This section specifies a complete operational dust collection system as shown on the plans and as called out herein which is to operate to effectively remove sawdust from the wood shop area and deposit it in a collection barrel.

1.4 WORK REQUIRED

- A. Furnish and install a complete dust collector system as manufactured by Torit Co. Inc. or approved equal.

1.5 RELATED SECTIONS

- A. Basic Mechanical Requirements - Section 23 00 10
B. Ductwork - Section 23 31 01
C. Air Balance and System Testing - Section 23 08 01

1.6 SUBMITTALS

- A. Provide submittal data on all items specified in this section in accordance with Specification Section 15010, General Conditions, and Division 1.

PART 2 PRODUCTS

2.1 DUCTWORK

- A. Dust collection piping system shall be complete round spiral piping constructed from 22 U.S. gauge galvanized steel with pipe couplers and fittings.

2.2 FLOOR SWEEPS

- A. All floor sweeps shall be provided with blast gates and riser pipe.

2.3 EQUIPMENT COLLECTORS

- A. Equipment collectors shall be provided as shown on plans. These collectors shall be designed per Industrial Ventilation by American Conference of Governmental Industrial Hygienists and

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

shall collect a minimum of 90% of the sawdust produced by the equipment. Each outlet shall be provided with a blast gate.

PART 3 EXECUTION

3.1 DUCTWORK

- A. Piping shall be hung overhead at the elevation(s) shown or as directed by Engineer and shall be rigidly braced and supported from the building. Cleanouts shall be provided to serve major junction points. Runs shall not exceed 40 ft. between cleanout points. Cleanouts in horizontal runs shall be positioned at the bottom of the pipe. Pipe shall be furnished in 10 ft. lengths with smooth interior, made from a single strip of galvanized steel, continuously lock formed to be air tight. Lap joints, in the direction of air flow at least 1-1/2" long shall be made with all elbows, branches, blast gates and intakes. In long duct runs, pipes shall be connected by snug fitting couplers, each 3" long. The installer shall make all joints air-tight (by High Velocity Duct Sealer). Where connections are required only short pop rivets or sheet metal screws, installed in minimum numbers and only above the center line of horizontal runs, or the inside throat near elbows or branches, will be used.

3.2 IDENTIFICATION

- A. Equipment shall bear an identification plate stating the ventilation rate for which the system was designed.

END OF SECTION

SECTION 23 37 14

AIR DISTRIBUTION DEVICES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 01 Specifications and Section 23 00 10, apply to this Section.

1.2 SECTION INCLUDES

- A. Grilles
- B. Diffusers
- C. Registers

1.3 RELATED SECTIONS

- A. Section 23 33 34 - Access Doors
- B. Section 23 00 10 - Basic Mechanical Requirements
- C. Section 23 08 01 - Air Balance and System Testing
- D. Section 23 31 01 - Ductwork

1.4 REFERENCES

- A. ARI Standard 890-94 Rating of Air Diffusers and Air Assemblies.

1.5 SUBMITTALS

- A. Provide submittal data on all items specified in this section in accordance with Specification Section 23 00 10, General Conditions, and Division 01.
- B. Product data for review prior to placement of purchase order:
 - 1. Outlets
 - 2. Grilles
 - 3. Registers
 - 4. Control devices
 - 5. Diffusers
 - 6. Similar equipment
- C. Product data shall be submitted for each device specified. Data shall be arranged to match grille schedule.
- D. If a manufacturer other than the one scheduled on the plan is used, the sizes shown on the plans shall be checked for performance, noise level, face velocity, throw, pressure drop, etc., before the submittal is made.
- E. Selections shall meet the manufacturer's own published data for the above performance criteria.

**DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS**

- F. If grilles other than those scheduled by name are furnished, manufacturer shall be prepared to demonstrate compliance with noise criteria at Engineer's request and to Engineer's satisfaction.

1.6 COORDINATION

- A. Coordinate this work with work under Division 26 to insure that intended functions of lighting and air systems are achieved.
- B. Locations of outlets on plans are approximate and shall be coordinated with other trades to make symmetrical patterns.
- C. Locations shall be governed by the established pattern of the lighting fixtures or ceiling plan.
- D. The Contractor shall move any grille, register, or outlet up to four feet in any direction as directed by the Engineer at no additional cost.

PART 2 PRODUCTS

2.1 GENERAL

- A. Provide grilles, registers and diffusers as shown or scheduled on the plans. Conform to ARI 890-94.
- B. All air distribution devices in kitchen and any wet areas such as locker rooms, showers and restrooms shall be 100% aluminum construction.
- C. All air distribution devices for 1-hour structures (walls or ceilings) shall be steel construction conforming to all codes and standards.

2.2 MANUFACTURERS

- A. Metalaire
- B. Krueger
- C. Titus
- D. Nailor
- E. Carnes
- F. Price
- G. Tuttle & Bailey

2.3 PERFORMANCE CRITERIA

- A. Throw: Velocity at the end of the throw in the five foot occupancy zone will be between 25 to 50 FPM.

DUST COLLECTOR RELOCATION
TEXAS STATE TECHNICAL COLLEGE
WACO, TEXAS

B. Noise levels (NC Curve):

1. Not to exceed those scheduled below.
 - a. Classrooms & Libraries - 25 N.C.
 - b. Cafeterias - 30 N.C.
 - c. Gymnasiums - 40 N.C.

C. All devices shall be tested per Air Diffusion Council and labeled as such.

2.4 FINISHES

- A. Paint exposed devices with factory standard prime coat or factory finish coat as shown on plans.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Where called for on the schedules, the grilles, registers and ceiling outlets shall be provided with deflecting devices and manual dampers. These shall be the standard product of the manufacturer, subject to review by the Engineer.
- B. All ceiling devices shall be furnished to be compatible with the ceilings in which they are installed.

END OF SECTION