

SECTION 15897
STAINLESS STEEL DUCTWORK AND ACCESSORIES-ALL WELDED

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. This section includes: General requirements for the fabrication and installation of Stainless Steel ductwork having all welded seams and joints for operation at static pressure not to exceed 20 inches of WG positive or negative static pressure, and at any velocity.
- B. The supply or exhaust metal ductwork and accessories may be rectangular, round and flat oval. Duct accessories in this context are: Balancing or Isolation Valves / Dampers, Supply Grilles, Exhaust Registers, Air-Flow Measuring Stations, Air Flow Meters and Fire Dampers. These accessories are designed specifically for the following systems:
1. Secondary Confinement Exhaust (SCE) systems.
 2. Beam Dump Confinement Exhaust (BDCE) systems.
 3. Secondary Confinement Supply Air distribution ductwork from Fan-Coil units.
- C. Related Sections include the following:
1. Division 15, Section 15990, "Testing, Adjusting and Balancing."
 2. Division 18, Section 18100A, "General Welding Requirements for Target Building Systems."
 3. Division 18, Section 18350, "Pipe Welding Specifications."
 4. Division 18, Section 18450, "Ductwork Welding Procedure Specifications."

1.3 REFERENCES

- A. American National Standards Institute (ANSI) and The American Society of Mechanical Engineers (ASME):
1. ANSI/ASME N509-89, Nuclear Power Plant Air-Cleaning Units and Components.
 2. ASME N510-89, Testing of Nuclear Air-Cleaning Systems.
- B. American Society for Testing and Materials (ASTM):
1. ASTM A240-94, Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
 2. ASTM A276-94, Rev. A Standard Specification for Stainless Steel, and Heat-Resisting Steel Bars and Shapes.
 3. ASTM D1056-91, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
- C. National Fire Protection Association (NFPA):
1. NFPA 90A-93, Standard for the Installation of Air Conditioning and Ventilating Systems.
- D. Sheet Metal and Air Conditioning Contractors National Association (SMANCA):
1. SMACNA, HVAC Duct Construction Standards - Metal and Flexible, 1985.
 2. SMACNA, Rectangular Industrial Duct Construction Standards, 1980.
 3. SMACNA, Round Industrial Duct Construction Standards, 1977.
 4. SMACNA, HVAC Air Duct Leakage Test Manual, 1985.

1.4 SUBMITTALS

- A. Submit the following for approval:
 - 1. Material identification (Mill certified).
- B. Submit the following Test and Inspection Reports for information:
 - 1. Leakage test report summary, prior to concealment of ductwork.
- C. Submit the following for information:
 - 1. Redlined, "As-Built" Drawings.
- D. Shop Drawings: Show details of the following:
 - 1. Show large scale (not less than $\frac{1}{4}'' = 1' 0''$) fabrication, assembly, and installation details, including plans, elevations, sections, components, and attachments to other work.
 - 2. Duct layout indicating pressure classifications and sizes on plans.
 - 3. Fittings.
 - 4. Reinforcement and spacing.
 - 5. Seam and joint construction.
 - 6. Penetrations through fire-rated and other partitions.
 - 7. Hangers and supports, including methods for building attachment, vibration isolation, seismic restraints, and duct attachments.
 - 8. Air-Flow measuring stations details and installations.
- E. Coordination Drawings: Floor plans drawn to scale, and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Ceiling suspension assembly members.
 - 2. Other systems installed in same space as ducts.
 - 3. Ceiling- and wall-mounted access doors and panels required providing access to dampers and other operating devices.
 - 4. Coordinate with ceiling-mounted items, including lighting fixtures, cable trays, conduits, pull boxes, piping, diffusers, grilles, speakers, sprinkler heads and access panels.
- F. Welding Certificates: Copies of certificates indicating welding procedures and personnel that comply with requirements in "Quality Assurance" Article.
- G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
- H. Record Drawings: Indicate actual routing, fitting details, reinforcement, support, and installed accessories and devices.

1.5 QUALITY ASSURANCE

- A. Welding Standards: Qualify welding procedures and welding personnel to perform welding processes for this Project according to AWS D1.1, "Structural Welding Code--Steel," for hangers and supports; AWS D9.1, "Sheet Metal Welding Code," for SS duct joint and seam welding.

1.6 SCHEDULING

- A. Notify Construction Manager (CM) prior to the actual fabrication start date. The CM shall have the option to inspect prior to, during, and upon completion of fabrication and installation, and witness tests and inspections.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless steel material: Mill certified Type 304L, ASTM A240, and having a maximum carbon content of 0.030% ladle analysis. Sheet material to be stainless steel in accordance with ASTM A240, Type 304L with 2B finish.
- B. Structural shapes: Stainless steel in accordance with ASTM A276.
- C. Fasteners such as bolts and nuts: Series 300 stainless steel.
- D. Flexible connection material: Hypalon-coated fiberglass fabric and be UL listed and NFPA 90A approved as noncombustible fabric and fire-retardant coating and resistant to air and water penetration, ozone, alkalis, acids, gasoline, grease, and abrasion. Material to weigh no less than 24 oz./yd² and be Ventlon (chlorosulfurated polyethylene) by Ventfabrics, Inc., or Durolon by Duro Dyne Corp.
- E. Gaskets for flanged connections: 1/4 in. thick, full face, closed cell polychloroprene, (ASTM D1056, Grade SCE-43) or Hypalon.

2.2 DUCTWORK FABRICATION

- A. Fabricate ductwork system(s) to engineered safety feature unit, Leakage Class 1 of ANSI/ASME N509.
- B. Rectangular Ductwork
 1. Sheet metal gages and structural angle sizes used for fabrication and reinforcement of the ductwork for both positive pressure and negative pressure duct systems are to be sized and positioned in accordance with Table 15897-1 of this specification for the pressure class shown on the drawings. Weld the reinforcement angles to the duct by equally spaced 1-in.-long fillet welds on 12-in. centers (max), staggered on alternate sides of the angle, and on both sides of the angle at each end. Weld leg size to be at least equal to the sheet metal thickness. Reinforcement around the perimeter of the rectangular duct to be made continuous by lapping and welding together the reinforcing angles at each corner.
 2. Fabricate duct and fittings with continuous butt-welded joints and seams. Fillet-welded seams are allowed at corners only.
 3. Duct butt-welded joints or seams or fillet-welded corner joints or seams do not qualify as duct reinforcement or stiffeners.
 4. Duct radius elbows to have a minimum inside turning radius equal to the duct dimension in the direction of turn. Splitters, where required, to be the same type material as the duct and as shown on the drawings and welded to the duct.
 5. Unequal, square elbows shall not be used, unless otherwise detailed on the drawings. Where indicated on the drawings, fabricate 90 degrees equal square elbows with turning vanes. Provide single thickness turning vanes without trailing edges in accordance with Fig. 2-3 of the SMACNA, HVAC Duct Construction Standards - Metal and Flexible. Fabricate vanes and runners of the same material and gage as the ductwork. Tack welds vanes to runners and runners to duct to prevent vibration or fluttering. Welds to be continuous. Install vanes within the elbow to project tangents to the airflow.
 6. Install Instrument Test Ports as shown on drawings.
- C. Round Ductwork

1. Round duct may be either purchased tubing or shop fabricated. Seams and joints to be continuous butt-welded.
2. The sheet metal gages and reinforcement requirements to be used in fabricating the ductwork for positive pressure systems as follows:

| Diameter In. | Gage | Stiffener size, in. | Stiffener Spacing, ft | Number of welds |
|-----------------|------|------------------------|--------------------------|--------------------|
| Up to 12 | 14 | Not required | Not required | Not required |
| 13-36 | 14 | 1 1/4 X 1 1/4 X 3/16 | 14 | 12 |
| 37-48 | 12 | 1 1/2 X 1 1/2 X 3/16 | 14 | 14 |
| 49-60 | 10 | 2 X 2 X 3/16 | 14 | 18 |

3. Sheet metal gages and structural angles used for fabrication and reinforcement of the round ductwork for negative pressure duct systems are to be sized and positioned in accordance with Table 15897-2 of this specification for the pressure class shown on the drawings. Weld the reinforcement angles to the duct by 1-inch-long fillet welds equally spaced and staggered on alternate sides of the angle. Weld leg size to be at least equal to the sheet metal thickness. Number of welds required on each stiffener angle are to be as indicated above. The round duct reinforcement angles to be rolled to the nominal duct diameter and be made continuous by butt-welding together the angle ends.
4. Round ductwork elbows to have a minimum inside turning radius equal to the duct diameter and be either die stamped with butt-welded seams or gored with butt-welded joints and seams.
 - a. Fabricated 72-degree to 90-degree gored elbows to have five gores.
 - b. 37-degree to 71-degree elbows to have three gores.
 - c. 0-degree to 36-degree elbows to have two gores.
5. Round duct fittings to have butt-welded joints and seams. Tee connections to be of the conical type.
6. Install instrument test ports as indicated on drawings.

D. Off-site welding activities are to be in accordance with Division 18, Section 18100A, "General Welding Requirements for Target Building Systems."

2.3 DUCTWORK AND ACCESSORIES

A. Heavy-duty Round Control Damper:

1. Dampers shall be butterfly type consisting of circular blade, mounted to axle within formed flanged frame. Frames shall be constructed of 304 Stainless Steel channel and shall have full circumference blade stop located in air stream. Damper shaft shall be continuous, solid-cold rolled Stainless Steel extending through the entire diameter of damper and beyond damper bearing a minimum of 6 inches. Axle shall be supported and sealed, relubricable ball bearings mounted to damper frame. Press fit bearings are not acceptable. Damper frame and blade shall be fabricated from Stainless steel.
2. Damper leakage shall not exceed 35 total CFM (or 1.4% of the maximum airflow) with blade seals based on a 48" diameter damper unit at 1" W.G.
 - a. Maximum pressure drop across a 48" diameter damper shall be less than 0.01" W.G. at 10,000 CFM.
 - b. Submittal shall include published performance data on a complete range of damper sizes developed from testing in accordance with AMCA Standard 500 in an AMCA registered laboratory.
 - c. Damper shall be Ruskin model CDR92, or equal.

B. Round Control Damper (MUA dampers in the SCE area):

1. Control Dampers shall be butterfly type consisting of circular blade, mounted to axle within formed flanged frame. Design pressure shall withstand 4.0" W.G. maximum static pressure at 250°F maximum temperature.
 - a. Frames shall be constructed of 16 gage x 8" deep to 18" diameter size and 12 gage x 8" deep 304 Stainless Steel channel 18" and above.
 - b. Flange shall be constructed of: 12 gage x 1 1/2 "304 Stainless Steel
 - c. Blade shall be constructed of 304 Stainless Steel. Blade shall be constructed of "Double-skin" with blade seal, using 18 gage SS plate to 26" blade diameter size or "Single skin", using 16 gage SS with retaining ring for 26" diameter blade size and above. Provide blade stiffeners as required.
 - d. Blade stop shall be full circumference neoprene sponge with pin angle stop.
 - e. Damper shaft shall be continuous; solid-cold rolled 304 Stainless Steel extending through the entire diameter of damper and beyond damper bearing a minimum of 6 inches. Axle shall be supported and sealed. Shaft size shall be of manufacturer's standard for specific damper sizes.
 - f. Bearings shall be ball type, mounted to damper frame. Press fit bearings are not acceptable.
 2. Control Damper air leakage shall not exceed 11.30 CFM total (or 0.45% of maximum airflow) with continuous blade seals for a 48" diameter damper unit at 2,500 FPM maximum system velocity.
 - a. Submittal shall include published performance data on a complete range of damper sizes developed from testing in accordance with AMCA Standard 500 in an AMCA registered laboratory.
 - b. Damper shall be Ruskin model CDRS82, or equal.
- C. Control damper (Valves)
1. Where valves are scheduled for control damper application, see Division 18, Specification Section 18100A "General Welding Requirements for Target Building Systems".
- D. Air-Flow Measuring Stations
1. Provide where indicated, airflow measuring stations capable of continuously monitoring the fan or duct capacities (air volumes) they serve. Each airflow measuring station shall contain multiple total and static pressure sensors positioned at the center of equal area of the station cross-section and interconnected by their respective averaging manifolds. For stations of 4 square feet or less, one total and one static pressure sensor shall be present for every 16 square inches of station area respectively. For stations of larger area, one total and one static pressure sensor shall be present for every 36 square inches of station area respectively.
 2. The airflow measuring station shall be fabricated of a minimum of 14 ga. All stainless steel, welded casing in 8" depth with 90° connecting flanges in a configuration and size equal to that of the duct it is to be mounted into. Each station shall be complete with an open parallel cell air straightener or air equalizer honeycomb mechanically fastened to the casing, total and static pressure sensors located on an equal area basis and connected to symmetrical averaging manifolds, internal stainless steel piping, and external pressure transmitter ports. An identification label shall be placed on each station casing listing model number, size, area, and specified airflow capacity.
 3. The maximum allowable pressure loss through the station shall not exceed .015" wc at 1,000 fpm, or .085" wc at 2,000 fpm. Each station shall be capable of measuring the airflow rate within an accuracy of 2 percent as determined by U.S.G.S.A. certification tests. The stations shall have a self-generated sound rating of less than NC 40, and the sound level within the duct shall not be amplified, nor shall additional sound be generated.
 4. The airflow measuring stations shall be manufactured by Air Monitor or approved equal.

E. Air-Flow Meters

1. AMSS-TA-01 Secondary Confinement Exhaust (SCE) system airflow meter.
Air Flow Meter shall be thermal dispersion type, suitable for negative static pressure operations of -15" WC at 100 °F maximum.
All sensor-wetted materials shall be constructed of 316 Stainless Steel.
Location, type, size and capacity range shall be as designated on drawings.
Meter shall be "Insertion" configuration threaded end connections.
Measurement range: 200 to 20,000 SCFM mass flow capacity measurements and traceable NIST calibration.
Electrical characteristics: 24 VDC input power and 4 to 20 ma output power.
Meter accuracy shall be ± 0.75% of reading +0.5% of full scale.
Meter shall be complete with an integral NEMA 4X electronics enclosure.
2. AMSB-INJ-01 Beam Dump Secondary Confinement (BDSC) Exhaust system meter. (at the Ring Injection Dump)
Air Flow Meter shall be thermal dispersion type, suitable for negative static pressure operations of -15" WC at 100 °F maximum.
All sensor-wetted materials shall be constructed of 316 Stainless Steel.
Location, type, size and capacity range shall be as designated on drawings.
Meter shall be "Insertion" or "In-line" configuration, threaded or 150 lbs. flanged end connections.
Measurement range: 15 to 4,000 SCFM mass flow capacity measurements and traceable NIST calibration.
Electrical characteristics: 24 VDC input power and 4 to 20 ma output power.
Meter accuracy shall be ± 0.75% of reading +0.5% of full scale.
Meter shall be complete with an integral NEMA 4X electronics enclosure.

F. Fire dampers

1. General: Labeled to UL 555.
2. Fire Rating: Three (3) hours.
3. Frame: SMACNA Type B, curtain type with blades out of airstream; fabricated with roll-formed, 0.034-inch- (0.85-mm-) thick Stainless Steel; with mitered and interlocking corners.
4. Mounting Sleeve: Factory- or field-installed Stainless Steel sheets.
 - a. Minimum Thickness: 0.138 inch (3.5 mm) thick as indicated, and length to suit application.
 - b. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.
5. Mounting Orientation: Vertical or horizontal as indicated on drawings.
6. Blades: Roll-formed, interlocking, 0.034-inch- (0.85-mm-) thick, Stainless Steel sheet. In place of interlocking blades, use full-length, 0.034-inch- (0.85-mm-) thick, Stainless Steel blade connectors.
7. Horizontal Dampers: Include a blade lock and Stainless Steel closure spring.
8. Fusible Link: Replaceable, 212 deg F (100 deg C) rated unless otherwise indicated on drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that openings for the installation of the duct system are of the size and in the location shown on the drawings, that openings are clear of obstructions, which might interfere with the installation of the ductwork or accessories, and no other interferences exist in the routing of ductwork. Notify the CM of conflicts. The CM will review to determine a resolution.

3.2 INSTALLATION / APPLICATION / ERECTION

- A. Install and support ductwork in accordance with the SMACNA HVAC Duct Construction Standards - Metal and Flexible.
- B. Install access doors at fire dampers (for servicing spring latches and fusible links), at both the air-entering and the air-leaving sides of cooling and heating coils, at air-entering side of multi-blade balancing dampers, and at locations indicated on the drawings. Install and seal access doors to the ductwork in accordance with the manufacturer's instructions. Brace the door openings to prevent vibration and distortion during system operation.
- C. Cut and assemble field joints in accordance with the SMACNA HVAC Duct Construction Standards details.
- D. Install flexible connections as close as possible to the equipment being isolated in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, Fig. 2-19.
- E. Install rectangular and/or round ductwork instrument test ports in the general locations shown on the drawings either on the top, bottom, or sides of the duct to permit insertion of a Pitot tube across the entire duct section without interference. Install ports in accordance with ES-5.11-1 for rectangular ductwork and ES-5.11-5 for round ductwork. Clear opening through the duct wall to be equal to the port inside dimension.
- F. Apply sealant to joints and seams in accordance with manufacturer's recommendations. Clean and dry joints, seams, and openings of oil, grease, and dirt before application of sealant.

3.3 FIELD QUALITY CONTROL

- A. Duct Leakage Tests:
 - 1. Prepare leakage test procedures following the outlines and classifications in the SMACNA HVAC Air Duct Leakage Test Manual.
 - 2. Leak test ductwork at the 2-in. w. g. pressure class or at design pressure, if less than 2 in. w. g. Duct system to be SMACNA Seal Class B and Leakage Class 12.
 - 3. The amount of air- leakage shall not to be exceeded by the calculated amount for the pressure class, or the allocated amount for that portion of the system, whichever is applicable.
 - 4. If a portion of the system fails to pass the leakage test, modify to bring it into compliance and retest it until acceptable leakage is demonstrated.
 - 5. Complete tests and necessary repairs. Verify in writing. Notify CM for inspection prior to concealment of ductwork.
- B. After the ductwork is installed, verify by inspection and document that:
 - 1. Dampers are installed in the proper configuration and location shown on drawings.
 - 2. Instrument test ports are installed, in the correct positions, and the opening through duct wall is full inside port dimension.
 - 3. Duct interiors are free of debris.
 - 4. Ductwork joints and seams are sealed.

| Table 15897-1 | | RECTANGULAR DUCT METAL GAGE AND REINFORCEMENT | | | | | | | | |
|---|------------------|---|---------------------------------|------------|------------|------------|------------|------------|------------|------------|
| | | Greatest Duct Width, Inches | | | | | | | | |
| Duct Pressure Class in. W.G. (positive or negative) | Sheet Metal Gage | Maximum Stiffener Spacing ft | thru 12 | 13 thru 24 | 25 thru 36 | 37 thru 48 | 49 thru 60 | 61 thru 72 | 73 thru 84 | 85 thru 96 |
| | | | Acceptable Stiffener Angle Type | | | | | | | |
| 2 | 16 | 6 | R2 | R2 | R2 | R3 | R4 | R4 | R5 | R6 |
| | 14 | 7 | R2 | R2 | R2 | R3 | R4 | R5 | R6 | R7 |
| 4 | 16 | 5 | R2 | R2 | R2 | R3 | R4 | R5 | R6 | R7 |
| | 14 | 6 | R2 | R2 | R2 | R3 | R4 | R6 | R7 | R8 |
| 6 | 16 | 4 | R2 | R2 | R2 | R3 | R4 | R6 | R7 | R8 |
| | 14 | 5 | R2 | R2 | R3 | R4 | R5 | R6 | R7 | R8 |
| | 12 | 7 | R2 | R2 | R3 | R5 | R6 | R7 | R8 | R9 |
| 8 | 16 | 3 | R2 | R2 | R2 | R3 | R4 | R5 | R6 | R7 |
| | 14 | 4 | R2 | R2 | R3 | R4 | R5 | R6 | R7 | R8 |
| | 12 | 6 | R2 | R2 | R3 | R5 | R6 | R7 | R8 | R10 |
| 10 | 14 | 3 | R2 | R2 | R3 | R4 | R5 | R6 | R7 | R8 |
| | 12 | 5 | R2 | R2 | R3 | R5 | R6 | R7 | R9 | R10 |
| | 11 | 6 | R2 | R2 | R4 | R5 | R7 | R8 | R9 | R11 |
| 12 | 14 | 3 | R2 | R2 | R3 | R4 | R5 | R6 | R7 | R8 |
| | 12 | 4 | R2 | R2 | R3 | R5 | R6 | R7 | R8 | R9 |
| | 11 | 5 | R2 | R2 | R4 | R5 | R7 | R8 | R9 | R11 |
| 16 | 12 | 3 | R2 | R2 | R3 | R5 | R6 | R7 | R8 | R9 |
| | 10 | 4 | R2 | R2 | R4 | R5 | R7 | R8 | R9 | R10 |
| | 3/16 | 6 | R2 | R3 | R5 | R7 | R8 | R9 | R10 | R11 |
| 20 | 11 | 3 | R2 | R2 | R4 | R5 | R6 | R8 | R9 | R10 |
| | 10 | 3 | R2 | R3 | R4 | R5 | R6 | R8 | R9 | R10 |
| | 9 | 4 | R2 | R3 | R4 | R6 | R7 | R9 | R10 | R11 |
| | 3/16 | 5 | R2 | R3 | R5 | R7 | R8 | R9 | R10 | R11 |

| Table 15897-1 (cont) | | STIFFENER ANGLE DIMENSIONS | | | |
|----------------------|---------------------|----------------------------|---------------------|------|------------------|
| Type | Dimensions (in.) | Type | Dimensions (in.) | Type | Dimensions (in.) |
| R2 | 1-1/2 x 1-1/2 x 1/8 | R6 | 2-1/2 x 2-1/2 x 1/4 | R10 | 4 x 4 x 5/16 |
| R3 | 1-1/2 x 1-1/2 x 1/4 | R7 | 2-1/2 x 2-1/2 x 3/8 | R11 | 4 x 3-1/2 x 1/2 |
| R4 | 2 x 2 x 3/16 | R8 | 2 x 2 x 3/8 | | |
| R5 | 2 x 2 x 5/16 | R9 | 3 x 3 x 1/2 | | |

| Table 15897-2 | | | ROUND DUCT METAL GAGE AND REINFORCEMENT | | | | | | | | | | |
|--------------------------------|---------------------|------------------------------------|---|------------|------------|------------|------------|------------|----------------|------------|----------------|----|----|
| | | | Duct Diameter, Inches | | | | | | | | | | |
| Duct Pressure in. W.G. | Sheet Metal Gage | Minimum Stiffener Angle Type | thru | 13 thru | 19 thru | 25 thru | 31 thru | 37 thru | 43 thru | 49 thru | 55 thru | | |
| | | | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | | |
| Maximum Stiffener Spacing (ft) | | | | | | | | | | | | | |
| (-)2 | 14 | B | NR | NR | 20 | 17 | 14 | 10 | 6 | | | | |
| | 12 | C | DUCT IN THIS RANGE IS UNACCEPTABLE | | | | 20 | 18 | 16 | 14 | 12 | | |
| | 11 | D | | | | | 20 | 18 | 16 | 14 | | | |
| | 10 | E | | | | | 20 | 18 | 17 | 16 | | | |
| | 3/16 | G | | | | | | | | | 20 | 20 | |
| | | | | | | | | | | | | | |
| (-)4 | 16 | A | NR | NR | 18 | 14 | 8 | 6 | NOT ACCEPTABLE | | | | |
| | 14 | B | DUCT IN THIS RANGE IS UNACCEPTABLE | | | | 20 | 18 | 14 | 12 | 10 | | |
| | 12 | E | | | | | 20 | 18 | 17 | 15 | 13 | | |
| | 11 | E | | | | | 20 | 18 | 17 | 16 | | | |
| | 3/16 | None | | | | | | | | | 20 | 20 | |
| | | | | | | | | | | | | | |
| (-)6 | 14 | B | NR | 20 | 15 | 9 | 6 | 4 | NOT ACCEPTABLE | | | | |
| | 12 | D | NR | NR | 20 | 20 | 17 | 13 | 11 | 8 | | | |
| | 11 | E | DUCT IN THIS RANGE IS UNACCEPTABLE | | | NR | 20 | 20 | 18 | 16 | 14 | 12 | |
| | 10 | F | | | | 20 | 20 | 18 | 16 | 14 | | | |
| | 3/16 | G | | | | | | | | 20 | 18 | | |
| | | | | | | | | | | | | | |
| (-)8 | 14 | B | | | | NR | 18 | 12 | 7 | 4 | NOT ACCEPTABLE | | |
| | 12 | E | DUCT IN THIS RANGE IS UNACCEPTABLE | | | NR | 20 | 18 | 14 | 11 | 8 | | |
| | 11 | F | | | | 20 | 18 | 16 | 14 | 12 | 10 | | |
| | 10 | F | | | | | | | | 20 | 18 | 16 | 14 |
| | | | | | | | | | | | | | |
| No. of 1-in. Welds | | | None | 9 | 10 | 11 | 12 | 13 | 14 | 16 | 18 | | |

| Table 15897-2 (cont) | | | ROUND DUCT METAL GAGE AND REINFORCEMENT | | | | | | | | | |
|------------------------|------------------|------------------------------|---|------------|------------|------------|----------------|----------------|----------------|------------|------------|----|
| | | | Duct Diameter, Inches | | | | | | | | | |
| Duct Pressure in. W.G. | Sheet Metal Gage | Minimum Stiffener Angle Type | thru 12 | 13 thru 18 | 19 thru 24 | 25 thru 30 | 31 thru 36 | 37 thru 42 | 43 thru 48 | 49 thru 54 | 55 thru 60 | |
| | | | Maximum Stiffener Spacing (ft) | | | | | | | | | |
| (-)10 | 14 | C | NR | 16 | 10 | 6 | 4 | NOT ACCEPTABLE | | | | |
| | 12 | E | DUCT IN THIS RANGE IS UNACCEPTABLE | NR | 18 | 16 | 13 | 10 | 6 | | | |
| | 11 | F | | 20 | 18 | 15 | 12 | 10 | 8 | | | |
| | 10 | G | | 20 | 17 | 16 | 14 | 10 | | | | |
| | 3/16 | H | | 20 | 20 | 18 | 16 | | | | | |
| | | | | | | | | | | | | |
| (-)12 | 14 | C | NR | 13 | 8 | 4 | NOT ACCEPTABLE | | | | | |
| | 12 | E | DUCT IN THIS RANGE IS UNACCEPTABLE | NR | 17 | 14 | 11 | 8 | | | | |
| | 11 | F | | 20 | 17 | 14 | 11 | 8 | 6 | | | |
| | 10 | G | | 18 | 16 | 14 | 12 | 10 | | | | |
| | 3/16 | H | | 20 | 20 | 18 | 16 | | | | | |
| | | | | | | | | | | | | |
| (-)16 | 12 | F | NR | 20 | 14 | 11 | 8 | 4 | NOT ACCEPTABLE | | | |
| | 11 | G | DUCT IN THIS RANGE IS UNACCEPTABLE | NR | 20 | 16 | 12 | 8 | 5 | | | |
| | 10 | H | | 18 | 16 | 14 | 11 | 9 | 7 | | | |
| | 3/16 | J | | 20 | 18 | 16 | 14 | 12 | | | | |
| | 1/4 | K | | 20 | 18 | 16 | 14 | | | | | |
| | | | | | | | | | | | | |
| (-)20 | 12 | F | NR | 16 | 11 | 8 | 5 | NOT ACCEPTABLE | | | | |
| | 11 | G | NR | 20 | 18 | 14 | 10 | 6 | 4 | | | |
| | 10 | H | DUCT IN THIS RANGE IS UNACCEPTABLE | 18 | 15 | 12 | 9 | 6 | | | | |
| | 3/16 | J | | 20 | 18 | 16 | 14 | 12 | | | | |
| | 1/4 | K | | 20 | 18 | 16 | 14 | | | | | |
| | | | | | | | | | | | | |
| No. of 1-in. Welds | | | | None | 9 | 10 | 11 | 12 | 13 | 14 | 16 | 18 |

| Table 15897-2 (cont) | | STIFFENER ANGLE DIMENSIONS | | | |
|----------------------|----------------------|----------------------------|----------------------|------|---------------------|
| Type | Dimensions (in.) | Type | Dimensions (in.) | Type | Dimensions (in.) |
| A | 1 x 1 x 1/8 | E | 2 x 2 x 3/16 | I | 3 x 3 x 5/16 |
| B | 1-1/4 x 1-1/4 x 3/16 | F | 2 x 2 x 1/4 | J | 2-1/2 x 2-1/2 x 1/2 |
| C | 1-1/2 x 1-1/2 x 3/16 | G | 2-1/2 x 2-1/2 x 1/4 | K | 3 x 3 x 1/2 |
| D | 1-1/2 x 1-1/2 x 1/4 | H | 2-1/2 x 2-1/2 x 5/16 | | |

END OF SECTION 15897