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DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
SPECIFICATION

DESIGN AND FABRICATION OF ANTENNA SUPPORT TOWERS

1. SCOPE

1.1 Scope.- This specification sets forth requirements for the design and fabrication of self-supporting and guyed antenna support towers and the associated tower concrete foundations.

2. APPLICABLE DOCUMENTS

2.1 FAA documents.- The following FAA Drawings of the issues in effect on the date of the invitation for bids or request for proposals form a part of this specification and are applicable to the extent specified herein.

2.1.1 FAA drawings

D-5058	VHF/UHF Antenna Support Type ASB - Model 1
D-5059	VHF/UHF Transmitting and Receiving Antennas for Steel Towers Erection of ASB - Model 1 Bracket.

2.2 Military and Federal publications.- The following Military and Federal publications of the issues in effect on the date of the invitation for bids or request for proposals, form a part of this specification.

2.2.1 Military Specification (Mil. Spec.)

MIL-M-17194 Metal, Expanded, Steel

2.2.2 Federal Specifications (Fed. Spec.)

RR-G661 Grating-Bar Type

RR-S-001301 Safety Equipment, Climbing

2.2.3 Occupational Safety and Health Administration (OSHA) Standards.- Occupational Safety and Health Standards, Title 29, Part 1910.

2.3 Other publications.- The following publications of the issues in effect on the date of the invitation for bids or request for proposals, form a part of this specification.

2.3.1 American Society for Testing and Materials (ASTM) Specifications.-

A 36	Structural Steel
A 53	Pipe, Steel Black and Hot Dipped Zinc-Coated Welded and Seamless Steel Pipe
A 123	Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips
A 153	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A 307	Low-Carbon Steel Externally and Internally Threaded Standard Fasteners
A 325	High Strength Bolts for Structural Steel Joints including Suitable Nuts and Plain Hardened Washers
A 385	Providing High Quality Zinc Coatings (Hot-Dip) on Assembled Products
A 440	High Strength Structural Steel
A 441	High Strength Low Alloy Structural Steel
A 490	Quenched and Tempered Alloy Steel Bolts for Structural Steel Joints
A 501	Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
A 570	Hot Rolled Carbon Steel Sheet and Strip, Structural Quality
A 572	High Strength Low Alloy Columbium-Vanadium Steels of Structural Quality

A 611	Steel, Cold Rolled Sheet, Carbon Structural
A 615	Deformed, and Plain Billet Steel Bars for Concrete Reinforcement
A 618	Hot Formed, Welded and Seamless H. S., Low Alloy Structural Tubing

2.3.2 American Institute of Steel Construction (AISC) Specifications.- Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, with Commentary.

Specification for Structural Joints Using ASTM A 325 or A 490 Bolts (RCRBSJ).

2.3.3 American Iron and Steel Institute (AISI) Specification.- Specification for the Design of Light Gage Cold-Formed Steel Structural Members.

2.3.4 American National Standards Institute (ANSI) Standard.-

B 27.2	Plain Washers

2.3.5 Electronic Industries Association (EIA).-

RS-222-C	Structural Standards for Steel Antenna Towers and Antenna Supporting Structures

2.3.6 American Concrete Institute (ACI) Building Code

2.3.7 American Welding Society (AWS).- Welding Handbook

(Information on obtaining copies of Fed. Specs. may be obtained from General Services Administration Offices in Washington, D.C., Seattle, San Francisco, Denver, Kansas City, Mo., Chicago, Atlanta, New York, Boston, Dallas, and Los Angeles).

(Information on obtaining copies of ASTM Specs. may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103).

(Copies of Mil. Specs. may be obtained from the Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pa. 19120).

(Copies of AISC Spec. and RCRBSJ Spec. may be obtained from the American Institute of Steel Construction, 101 Park Avenue, New York, N.Y. 10017).

(Copies of AISI Spec. may be obtained from the American Iron and Steel Institute 150 East Forty-Second Street, New York, N.Y. 10017).

(Copies of the ANSI Standard may be obtained from Electrical Testing Laboratories Inc., 2 East End Avenue, New York, N.Y. 10021).

(Copies of the EIA Standard may be obtained from Electronic Industries Association, 2001 Eye Street N.W., Washington, D.C. 20006).

(Copies of OSHA Standards may be obtained from Commerce Clearing House, Inc. 4020 W. Glenlake Avenue, Chicago, Ill. 60646).

(Copies of AWS Codes may be obtained from American Welding Society, 2501 N.W. 7th Street, Miami Florida 33125).

3. REQUIREMENTS

3.1 General Requirements.- Each tower furnished by the Contractor shall be complete in accordance with all specification requirements including anchor bolts, safety climbing device rail, and all other hardware essential for erecting the tower. The contractor shall provide all materials, supplies, equipment, and services necessary to design, fabricate, and prepare for delivery all items listed in the contract schedule.

3.2 Description.- The tower shall be a self-supporting type (no guy wires) or guyed steel structure with a platform at the top for mounting and servicing antennas. The tower shall be designed to be shipped knocked down and to be erected in the field using structural bolts only. The tower shall be fabricated in 20 foot plus or minus tower sections except that a 10 foot section shall be provided when required to obtain the required height (i.e. 30 feet, 50 feet, etc.). The tower members shall be fabricated from pipe, angular, or solid stock. The tower platform shall be large enough to permit installation of 6 antennas with 8 ft. minimum separation. This can be accomplished by providing a hexagonal platform with retractable support arms similar to those shown on Drawing D-5059 as shown on Figure #1 or with a square or rectangular platform with retractable arms in appropriate lengths and locations to provide 8 ft. antenna separation. The minimum area for the tower platform shall be 42 sq. ft. Access to the platform shall be gained through a suitable hinged trap door with provision for being padlocked from the bottom. The weight of the trap door shall be 30 lbs. or less and it shall be designed to remain open without being held when opened to a fully open position. It shall be possible to fully open and close the trap door when entering or leaving the platform without disengaging from the safety climbing device.. The minimum clear climbing side opening in the platform shall be 1' - 3" each way from the ladder centerline and 2' - 6" clear opening from the ladder rung to the back of the opening. The platform shall be fabricated of angle framing members and the floor of the platform shall be fabricated from either expanded metal grating or bar type grating. The floor shall be secured to the framing. The platform shall be provided with guard rail, composed of vertical posts with top and intermediate rail components located 45 inches and 23 inches respectively above the platform floor. The perimeter framing members shall support the rail as well as the required antenna mounting brackets.

3.3 Design Requirements

3.3.1 Live Load.- The floor of the platform shall support a 250 lb. concentrated load over any one sq. ft. area in addition to a live load of 20 lbs. per sq. ft. over the entire platform. In addition to the live load on the platform, the tower and ladder shall be designed to support a minimum 500 lb. concentrated load at any point on the ladder.

3.3.2 Wind Load.- The tower shall be designed for a Zone B wind load per EIA Standard RS-222-C (40 psf) to support the platform with 45 inch high handrail plus the following:

(a) Six VHF and UHF antennas having a projected area of 2 sq. ft. each, mounted around the platform handrail.

(b) One junction box having a projected area of 2 sq. ft. mounted on platform.

(c) Seven antenna cables, each with one inch diameter routed up one side of the tower.

(d) Climbing ladder, face mounted (or interior if there is adequate space) for the full height of the tower, with safety climbing device.

3.3.3 Tower Legs.- The tower legs shall be fabricated of steel pipe, structural angles, or plates having a minimum yield strength of 36,000 lbs. per sq. in. per ASTM A-36 for angles and plates or 33,000 lbs. per sq. in. per ASTM A-53 or A-501 for pipe. Legs fabricated from steel having a minimum yield strength of 50,000 lbs. per sq. in. shall conform to ASTM A-618 Grade 3 for pipe or ASTM A-440 for angles or plates. ASTM A-441 shall be used in lieu of A-440 where welding is required.

3.3.4 Tower Braces.- Tower angle braces shall have a minimum yield strength of 36,000 lbs. per sq. in. per ASTM A-36. Solid rod braces shall have a minimum yield strength of 33,000 lbs. per sq. inch.

3.3.5 Base Section.- The base section of all self-supporting towers shall be fixed base utilizing load bearing plates drilled to receive anchor bolts cast in reinforced concrete foundations or it may be a short section or integral part of the first tower increment. If a separate short section is used it shall be cast in the concrete foundation and similar in construction to the other tower increments. Base sections of guyed towers may be fixed base as above or hinged base with a load bearing assembly cast in the concrete foundation or attached with anchor bolts cast in the concrete foundation.

3.3.6 Bolted Connections.- All bolts for structural joints shall be high strength per ASTM A-325. Secondary connections where bolts are under 1/2 inch may be of lower quality, if conditions permit. All nuts shall have locknuts.

3.3.7 Ladder.- The ladder shall be face-mounted (interior or exterior) for the full height of the tower and extend a minimum of 4 ft. 0 in. above the platform. The ladder design shall conform to OSHA standards including clearances and shall have a minimum 6 in. wide foothold between each inside face of the ladder rail and any component of the tower or the safety climbing device. The mounting devices which attach the ladder to the tower shall not extend beyond the rail edges on the climbing side of the ladder.

3.3.8 Tower Foundation Designs.- Two foundation designs shall be provided for each height of tower. One design shall be based on a safe soil bearing pressure of 2000 psf (pounds per square foot) and one on a safe soil bearing pressure of 4000 psf. Concrete strength shall be based ona 28 day compressive strength of 3000 PSI and maximum slump of 4 inches. Reinforcing steel shall be intermediate grade billet ASTM A-615 Grade 40 deformed bars. The foundation designs shall be oriented toward economical construction based on the costs of labor and materials at the time of the design. The anchor bolts shall be furnished with the tower.

3.3.9 Design and Drawings

3.3.9.1 Work Required.- The contractor shall furnish design, fabrication, and erection drawings for the heights of structures being procured under this contract. The contractor shall also furnish design calculations and design drawings for concrete foundations for the various tower heights. The design of the towers and foundations shall be approved by a registered professional engineer.

3.3.9.2 Work Preparation.- Drawing preparation and design shall be performed by the contractor to the extent required herein. Design shall be in accordance with established engineering practice and the ACI, AISC, AISI or EIA specification as applicable. Design drawings shall show control dimensions, member sizes and other details as necessary for the developement of shop and erection drawings. Erection drawings shall indicate anchor bolts, member location, bolt sizes and number and all other information to clearly depict requirements for field erection. A parts list showing the member number, size, and length shall be provided in the erection drawings. Erection drawings and a parts list will be shipped with each tower.

3.3.9.3 Submittals.- Design, fabrication, and erection drawings shall be submitted in accordance with the contract schedule. Design drawings may be legible prints. Erection and fabrication drawings must be on reproducible sepia.

3.4 Materials.- Unless otherwise indicated, materials shall conform to the specifications and other requirements indicated below. Where no specification is indicated, the materials shall be good commercial quality suitable for the government's intended use and shall be subject to the approval of the Contracting Officer. Unless otherwise provided by the Invitation to Bid, the contractor shall furnish all materials and items required for the complete structure, and in addition shall furnish nuts, bolts, washers, and other minor items in an amount 10% in excess of the quantity required for erection.

3.4.1 Structural Steel Plate, Shapes, and Bars.- Structural steel plates, shapes, and bars shall conform to ASTM Specification A-36.

3.4.2 Strip Steel.- Strip steel shall conform to ASTM Specification A-570 of the appropriate grade.

3.4.3 High-Strength Bolts, Including Nuts and Washers.- High strength bolts, nuts, and washers shall conform to ASTM Specification A-325 or A-490.

3.4.4 Bolts and Nuts, Other Than High Strength.- Bolts and nuts other than high strength shall conform to ASTM Specification A-307, Grade A.

3.4.5 Plain Washers, Other Than Those in Contact With High-Strength Bolts, Heads and Nuts.- Plain washers shall conform to ANSI Standard B27.2, Type B.

3.4.6 Locknuts.- A jam nut shall be used on each bolt beneath the full nut. Self-locking nuts intended for use on exterior bolted connections with any associated lock washers may be submitted for approval as a substitute for the regular nut and jam nut.

3.4.7 Grating

(a) Bar Type. Federal Specification RR-G-661.

(b) Expanded Metal Type. Military Specification MIL-M-17194.

3.5 Fabrication.- Fabrication shall be in accordance with the AISC Specification. Members shall have no sharp edges which will be hazardous during handling or other irregularities which will interfere with erection. The contractor shall be responsible for correction of all fabrication errors and for correct fitting of the fabricated members.

3.5.1 Marking.- Each separate member, except bolts, washer and similar items shall be clearly marked by stamping into the steel in the mark shown on the erection drawings. Marks shall be a minimum of 1/2 inch high. All like parts shall be marked in the same relative position. Marks shall be stamped into the steel before galvanizing and shall be clearly visible in the erected structure.

3.5.2 Galvanizing.- All ferrous parts shall be hot dip galvanized after fabrication in conformance with ASTM A-123 and A-385. Hardware (nuts, bolts, washers and other minor items) shall be galvanized by the hot dip method in conformance with A-153. The interior of any pipe used shall be galvanized. Anchor bolts shall be galvanized only in the area which will extend above the concrete foundation.

3.5.3 Safety Climbing Devices.- A rigid (Type 1), Safety Climbing Device Rail conforming to interim Federal Specification RR-S-001301 including all mounting attachments shall be furnished for each ladder on towers with platforms over 20 feet above ground. Safety climbing device belt assemblies shall conform to interim Federal Specification RR-S-001301. Each belt assembly shall be intended for use with the rigid rail furnished and shall be complete with safety belt, lanyard, safety sleeve, instruction manual and parts list.

3.5.4 Antenna Mounting Brackets.- Antenna mounting brackets (Items F2 and F7 on Dr. D-5059) shall be furnished with each antenna support. The hole sizes and spacing on the vertical face of the bracket assembly shall be identical to those shown on the drawing; other bracket details may vary depending on the support arm design. Retractable support arms or fixed supports adequate for mounting six antennas with 8 ft. separation and accessible from the platform shall be furnished with each tower.

3.6 Replacement of Damaged Parts.- Parts damaged after acceptance of the shipment shall, when requested, be replaced by the fabricator at a reasonable cost and time schedule.

4. QUALITY ASSURANCE PROVISIONS

4.1 Quality Control.- Quality Control shall be in accordance with the American Institute of Steel Construction Specification. Unless otherwise specified in this specification or in the contract, all tests and inspections to determine compliance with the requirements of the contract specifications shall be made by the contractor and shall be subject to government inspection. The Contracting Officer shall be notified by the contractor ten (10) days prior to shipment of required towers to allow the Government Representative to inspect towers to be shipped.

5. PREPARATION FOR DELIVERY

Preparation for Delivery.- The complete system shall be packed to insure carrier acceptance and safe delivery at destination in containers complying with rules and regulations applicable to the mode of transportation.

6. NOTES

6.1 Note on Information Items.- The contents of this Section 6 are only for the information of the initiator of the procurement request and are not a part of this specification. They are not contract requirements nor binding on either the Government or the contractor. In order for these terms to become a part of the resulting contract, they must be specifically incorporated in the schedule of the contract. Any reliance placed by the contractor on the information in these subparagraphs is wholly at the contractor's own risk.

6.2 Height.- The height of the tower referred to in bidding documents shall be the height of the top rail of the platform above the top of the concrete footing plus or minus 2 feet.

6.3 Typical Design.- Figure 1 and Drawings D-5058 and D-5059 portray typical assemblies but are not requirements of this specification. These drawings are furnished only as a matter of information to the contractor, to assist him in visualizing a typical design. The government does not represent or guarantee that conformance thereto will insure that the resulting product will meet specification requirements. Any reliance which the contractor places on the figure and the drawings is wholly at his own risk and shall not relieve him of his contractural obligation to comply with all requirements of this specification.

6.4 Safety Climbing Device.- It is expected that two safety climbing device belt assemblies will be furnished at each site at which towers over 20 feet high are installed for each type of rigid rail at the site regardless of the number of towers installed with each type of rigid rail.

* * * *

FOR FIGURE 1 SEE PAGE 10

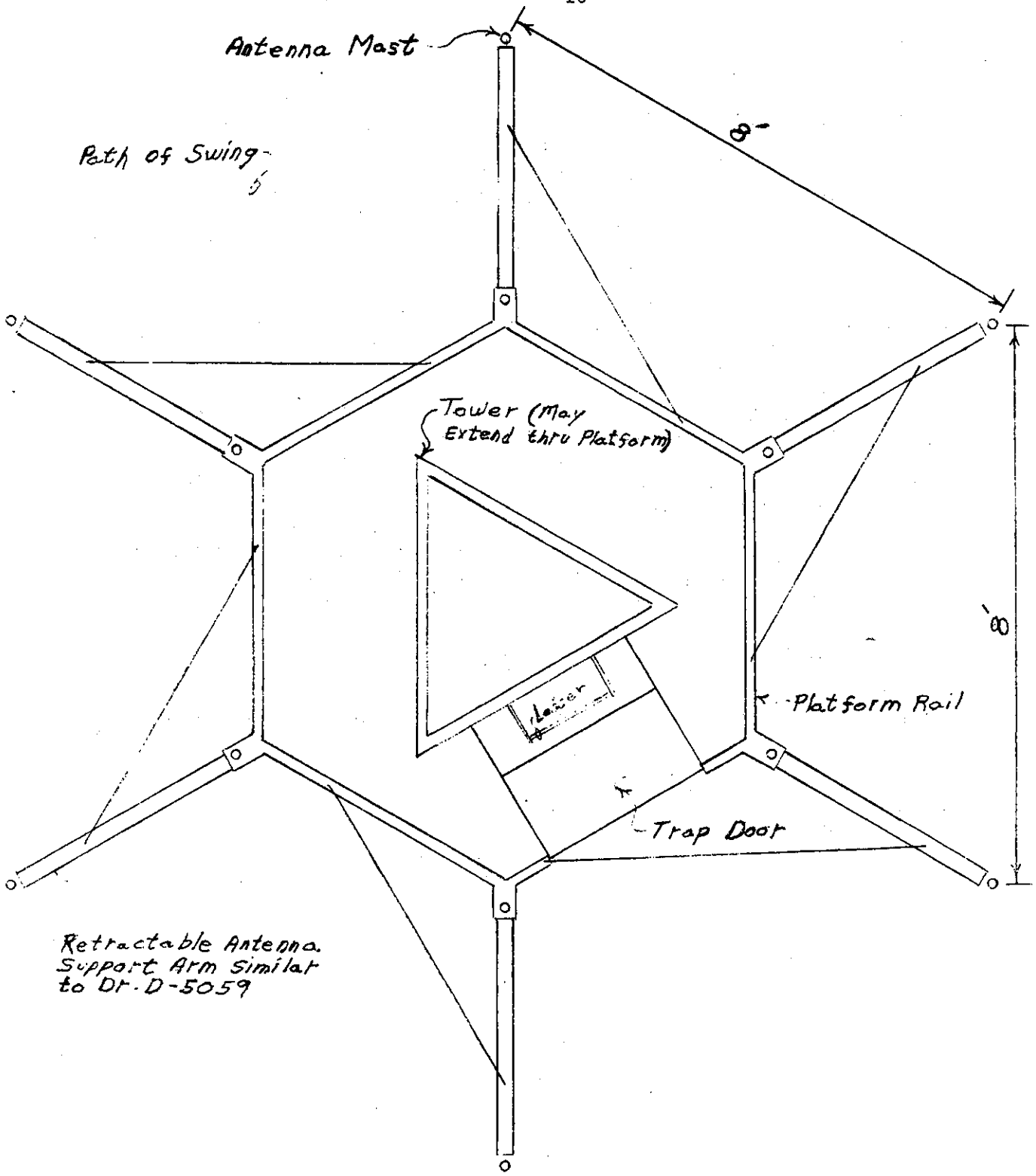

Figure #1

Antenna Platform & Supports

Not To Scale