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Associated Universities, Inc.
STAR Collaboration

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Title: STAR MAGNET POLE TIP SUPPORT CARRIAGE SPECIFICATION

QA Category:____A2

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REVISION RECORD

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Star Magnet Pole Tip Support Carriage Specification

1.0 General.

1.1 Scope.

This specification defines the minimum requirements for materials, fabrication, inspection, assembly, testing, quality assurance, and documentation, of the Pole Tip Support Carriage for the STAR detector. Additional requirements are presented in the accompanying STAR Note 288, "Statement of Work for Star Magnet Pole tip support Carriage Fabrication and Assembly", and the applicable documents and standards listed herein. Included are the following operations:

a) Fabrication by rolling, forging, casting, forming and machining.
b) Sand blasting, polishing, painting and other surface finishing.
c) Cleaning
d) Inspection
e) Assembly
f) Testing
g) Documentation

1.2 Access.

Designated representatives of the Buyer shall be allowed access to the Seller's facilities, and, if applicable, the Seller's subcontractor facilities during the progress of work called for by this specification. The Seller shall assist and facilitate inspection visits of the Buyer.

2.0 Documents and Standards.

2.1 Applicable.

The following documents, drawings, and/or standards form a part of this attachment to the extent specified herein. The issue date on standards shall be the one in effect on the date of request for proposal.

2.1.1 STAR Note 288, "Statement of Work for Star Magnet Pole Tip Support Carriage Fabrication & Assembly", and the Seller proposed and Buyer approved documents.

2.1.2 Buyer approved drawings.

All fabricated and purchased parts that are to be supplied by the Seller are listed in the parts list on Pole Tip Carriage Assembly Drawing, MAG476.

2.1.3 American National Standards Institute:
ANSI Y14.5M-1982 Dimensioning and Tolerancing for Engineering Drawings.

2.1.4 Materials are listed on each drawing and are:
ASTM A36 which is the predominate steel used.
ASTM A633 Grade D with a minimum yield strength of 45 ksi.
AISI 4130 with a minimum yield strength of 120 ksi
AISI 4330 castings with a minimum yield strength of 60 ksi
All bolts are to be SAE J429 Grade 8.

2.1.5 American Society for Testing and Materials:
A6, General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use.
A27, Steel Castings, Carbon, for General Application.
A781, Castings, Steel and Alloy, Common Requirements, for General Industrial Use.
A788, Steel Forgings, General Requirements.
A668, Steel Forgings, Carbon and Alloy, for General Industrial Use.
A711, Steel Forging Stock
A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products.
A751, Standard Test Methods, Practices, and Terminology for Chemical Analysis of Steel Products.
A388, Standard Practice for Ultrasonic Examination of Heavy Steel Forgings.
A435, Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates.
A609, Standard Practice for Castings, Carbon, Low-Alloy, and Martensitic Stainless Steel, Ultrasonic Examination Thereof.
A802, Standard Practice for Steel Castings, Surface Acceptance Standards, Visual Examination.
E94 Guide for Radiographic Testing.
E446 Reference Radiographs for Steel Castings Up to 2 in. in Thickness.
E186 Reference Radiographs for Heavy-Walled (2 to 4.5 in.) Steel Castings.
E280 Reference Radiographs for Heavy-Walled (4.5 to 12 in.) Steel Castings.

2.1.6 American Society for Nondestructive Testing:
ASNT-TC-1A, Recommended Practice for Non-Destructive Testing Personnel Qualification and Certification.

2.1.7 American Welding Society

AWS A2.4, Symbols for Welding and Nondestructive Testing.
AWS A3.0, Welding Terms and Definitions.
AWS D1.1, Structural Welding Code-Steel.
AWS QC-1-88, Certification of Welding Inspectors.

2.2 Conflicts.

In the event of a conflict between this Specification and STAR Note 288, "Statement of Work for Star Magnet Pole Tip Support Carriage Fabrication & ssembly", the appropriate drawings and standards listed herein, and a Seller proposed and Buyer approved document, the Seller shall immediately notify the Buyer. The Buyer in each instance shall determine which document takes precedence and advise the Seller accordingly. Failure of the Seller to so notify the Buyer in any given instance shall not relieve the Seller of the obligation to comply with the Buyers determination of precedence at no additional cost to the Buyer.

2.3 Interpretation.

All documentation submitted by the Buyer to the Seller will be in "U.S. Customary" English units with dimensions and tolerances provided in inches. Dimensions in S.I. units are for reference only and not for fabrication purposes. Any and all standards shall be only those applicable, sec. 2.1, to this specification. It is the responsibility of the Seller to prove equivalency of any proposed standards and obtain Buyer approval by means of a Deviation Request.

2.4 Revisions.

Any and all specification and/or drawing revisions shall be documented and negotiated by both parties. Any cost differential shall be recorded and approved in writing by both parties. Work on any revision shall not proceed without Buyer written approval.

3.0 Fabrication Requirements.

3.1 Material Requirements

All components shall be fabricated from materials specified in Buyer approved drawings. All materials used in this fabrication shall have mill certification from the manufacturer as Certified Material Test Reports. Any materials that do not meet the requirements of this specification shall be identified in a Non conformance Report, tagged as such, and not used.

3.1.1 Analysis shall be performed and reported on all materials in accordance with ASTM A751 to verify a chemical composition. The Seller shall submit to the Buyer a certified report of each individual material analysis that includes residual elements.

3.1.2 Mechanical testing of the material shall be performed and reported on all materials in accordance with ASTM A370 to determine tensile properties.

3.1.3 Forming methods for steel components shall be in accordance with the following standards:

Forged:	ASTM A788, A668, A711
Cast:	ASTM A27, A781
Rolled Plate:	ASTM A6

3.1.4 All component materials shall be ultrasonically inspected through their entire volume, in accordance with ASTM A388 (forgings), A435 (plates), and/or A609 (castings). Throughout these material volumes, all voids, non-metallic inclusions, flaws, and/or cluster indications shall be recorded. Individual flaw size shall not exceed 0.5 inch in any direction, and the total indicated material area loss in a 12 inch square shall not be greater than 1%. Repairs of such a non conformance shall be at the Sellers expense with Buyer approval. Any voids, non-metallic inclusions, and/or flaws which occur at a bolt hole, threaded hole, bearing surface, and pinning hole shall be a non conformance and repaired at the Sellers expense with Buyer approval.

3.1.5 Castings must also undergo visual examination in accordance with ASTM A802 and be free of expansion discontinuities, fusion discontinuities, gas porosity, linear discontinuities, and nonmetallic inclusions. Two castings, MAG455 & MAG457, that do not lend themselves to ultrasonic inspection, due to size or shape, must undergo radiographic inspection in accordance with ASTM E94 radiographic testing standards. Acceptance shall be as per ASTM E446, E186, E280 and evaluated at severity (1).

3.2 Material Storage

All component materials used in this fabrication shall be marked and stored in such a way as to prevent accidental substitution and allow immediate identification in a Quality Assurance audit.

3.3 Material Sources

Any recycled or scrap steel used in the production of billets for use in component materials shall not contain any radioactive material. Radioactive material includes any material which has become activated beyond ambient levels.

3.4 Surface Finishes.

All parts and/or components shall be thoroughly cleaned of grease and oils. Threaded holes, bolt holes, bearing surfaces, and pinning holes of components shall not be painted, but shall be protected from environmental contamination and moisture. All other surfaces shall be primer painted after removal of dirt, scale, rust, and foreign matter. Sand blasting is recommended for surface preparation of non machined surfaces prior to painting. The type of primer coat should be an abrasive resistant red oxide paint with a dry film thickness not greater than 0.002 inch, which must be approved by the Buyer.

3.5 Lifting Attachments.

Lifting and handling attachment points required by the Buyer are shown on the approved drawings. If additional and/or alternative lifting attachment points are required by the Seller, for handling during the fabrication process, a Deviation Request shall be submitted for Buyer approval. Any and all lifting points, handling equipment, and lifting fixtures required for Seller fabrication are the design responsibility of the Seller. Temporary weld-on lifting lugs on any components must be approved by the Buyer.

3.6 Dimensional Inspection.

The Seller shall develop a dimensional inspection procedure to assure that all the completed components and/or parts are within the tolerance limits specified on Buyer approved drawings. All dimensions and tolerances shown on Buyer approved drawings are based on a steady state material temperature of 70 degrees Fahrenheit. A written inspection report recording actual dimensions and material temperature shall be submitted to the buyer for approval prior to shipping and/or acceptance of any parts and/or components. The Buyer reserves the right to observe, and/or independently perform, any and all tests and inspections prior to shipping and/or acceptance.

3.7 Welding.

3.7.1 All weld joints are specified on Buyer approved drawings and shall blend into adjacent base metal in gradual smooth curves, using acceptance criteria consistent with AWS D1.1. Weld symbols on drawings shall be interpreted in accordance with AWS A2.4 and AWS A3.0. Any conflicts or questions related to application or interpretation of weld symbols should be directed to the Buyer for disposition and clarification. Welder qualification is required for each welder or welding operator, for each required welding process. All welder, welding procedures, and welding procedure specification shall be in accordance with AWS D1.1 and must be submitted to the buyer for approval prior to welding. For all multiple pass welds visual inspection shall be performed and recorded for each layer of weld and all weld discontinuities, cracks, porosity, undercut, inclusions, and unfilled craters shall be recorded and repaired before commencement of additional passes. All welds shall be visually inspected by an AWS Certified Weld Inspector. All final weld inspections shall take place after any straightening,

realignment, or stress relief of welded assemblies. All finished welds require magnetic particle examination to be performed in accordance with AWS D1.1. Radiographic inspection of multiple pass welds shall conform to AWS D1.1 acceptance criteria. The Seller shall notify the Buyer of any and all weld inspections for buyer witness points. The Seller shall have all inspection records available to the Buyer. Although AWS is the preferred standard of the Buyer, ASME Section IX code may be used if proven equivalent by the Seller and approved by the Buyer.

3.7.2 Two (2) weld test samples are to be made each consisting of two pieces 1" x 4" x 12" long from the A633 Grade D steel. One long face of each of these shall have a 45° double bevel for a full penetration butt weld to be performed between the two long faces. This weld sample piece will then be cut into standard ASTM tensile test specimens and tensile tested by the Seller to provide for a minimum tensile strength of 70 ksi.

3.8 Repairs.

The Seller shall notify the Buyer of any non conformance that occurs during the fabrication of any parts prior to any attempted repair. The Seller shall suggest methods of repair to the part but must not attempt any rework of the part without written approval of the Buyer. Failure to adhere to this shall require a new part to be fabricated at the Sellers expense.

3.9 Assembly

3.9.1 Thirty (30) days prior to assembly of the Pole Tip Support Carriage the Seller shall submit to the Buyer for approval a complete assembly procedure. The assembly shall provide for adjusting the thickness of various shim plates for positioning the vertical support weldment, MAG451, so that the bottom surface is 3.75" above the baseplate. In addition the pole tip attachment front and top bearing surfaces of the upper hinge castings, MAG455, shall be coplanar, and the front bearing surfaces vertical with all dimensions in conformance as shown in the Pole Tip Support Carriage Assembly drawing MAG476 sheets 1, 2, and 3.. The procedure shall explain in detail each step required and as a minimum provide a listing of the parts involved, tools/fixtures, rigging procedure, intermediate fabrication, inspection and Buyer witness points, bolt torque values and procedures, and action taken by assembly personnel. Assembly shall not begin until after fabrication and inspection of all parts and approval by the Buyer of the assembly procedure.

4.0 Acceptance

The two (2) Pole Tip Support Carriage Assemblies and associated end item documentation shall be inspected by the Buyer for conformance to the Statement of Work, Specification, and Drawings that are apart of this contract. Inspection of all parts and the assemblies, by the Buyer, shall be performed at the Sellers facilities with final acceptance by the Buyer after successful delivery of all end item documentation and the two (2) Pole Tip Support Carriage Assemblies to the Buyer facilities.