STAR Note # 205
3/15/95
Revision: 0

STATEMENT OF WORK FOR STAR SVT PROTOTYPE BERYLLIUM DETECTOR AND FEE SUPPORT FABRICATION

1 Introduction

Silicon Vertex Tracker (SVT) of Solenoidal Tracker at RHIC (known as STAR) consists of 36 similar carrier assemblies to integrate silicon drift detectors (SDD) and front end electronics (FEE). These carrier assemblies provide three concentric super-layers around the beam pipe of the accelerator. Each carrier assembly includes a detector carrier (SDD's and a support), two electronics carriers (FEE's and supports), and interconnection elements. The support structure for FEE also serves as a water cooling channel to the electronics. The mass of the support structures should be as small as possible to minimize the absorption and scattering of nuclear particles propagating through the detector.

The prototype support carrier assembly is the one located on the inner layer of SVT. Beryllium structures are the main structures of the supports. Further fabrications and assemblies to the Beryllium structure, using other materials, will be done by the Buyer.

2 Scope

The followings outline the minimum requirements for material procurement, fabrication, inspection, quality assurance, documentation and shipping of the beryllium prototype detector and FEE supports for the STAR silicon vertex tracker.

The Seller shall:

1. Procure all materials necessary to fabricate, handle, and safely transport the beryllium material. It is the Seller's responsibility to assure that all material used conform to the appropriate standard and specification.

2. Design, procure and/or fabricate all toolings, jigs, and fixtures required for beryllium fabrication.

3. Fabricate the product in strict accordance with the appropriate drawings and standards listed therein, and the Buyer approved Seller Manufacturing Plan.

4. Provide and operate all inspection and testing equipment needed to satisfy the specification specified in the drawings.
5. Deliver one Beryllium Detector Support Structure "A" (SVT028), two Cooling Support & Tube assembly -1 (SVT038) as specified to the Buyer.

3 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 process of work called for by this statement of work. The Seller shall assist and facilitate inspection visits of the Buyer.

4 Documents and Standards

4.1 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.

4.1.1 Buyer approved drawings (see attachments 1 to 4)

4.1.2 American National Standards Institute:

ANSI Y14.5-1982	Dimensioning and Tolerancing for Engineering Drawings

4.1.3 American Society for Testing and Materials:

ASTM E439-88	Standard Test Methods for Chemical Analysis of Beryllium
ASTM E 1032-92	Standard Method for Radiographic Examination of Weldments
ASTM E 8-91	Standard Test Methods of Tension Testing of Metallic Materials
ASTM E 831-86	Standard Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis
ASTM E 1225-87	Standard Test Method for Thermal Conductivity of Solids by Means of the Guarded Comparative-Longitudina Heat Flow Technique

4.1.4 American Welding Society

AWS B2. 1-84	Welding Procedure and Performance Qualification, Standard for
AWS B2. 2-91	Brazing Procedure and Performance Qualification, Standard for
AWS A2.4	Symbols for Welding and Nondestructive Testing
AWS A3.0	Welding Terms and Definitions
AWS D1.1	Structural Welding Code
AWS D10.9	Qualification of Welding Procedures and Welders for Piping and Tubin

4.2 Conflicts

In the event of conflict among this Statement of Work, the appropriate drawings, the standards listed herein, Seller proposed and Buyer approved document, the Seller shall immediately notify the Buyer. The Buyer in each instant 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.

4.3 Interpretation

All documentation submitted by the Buyer to the Seller will be in “US. Customary” English units. Dimensions in S.I. units are for reference only and not for fabrication purposes. All dimensions and tolerances provided in drawings shall be interpreted in accordance with ANSI Y14.5M-1982. Any and all standards shall be only those applicable, section 4.1, to this document. It is the responsibility of the Seller to prove equivalency of any proposed standards and obtain Buyer approval by means of a Deviation Request.

4.4 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.

5 Fabrication Requirements

5.1 Material Requirements

The Seller shall submit to the Buyer a certified report of chemical compositions and mechanical properties, including the yield strength, the tensile modulus, density, thermal conductivity and the coefficient of thermal expansion of the beryllium material.

5.1.1 Chemical compositions

The minimum content of beryllium is 98.5

5.1.2 Mechanical properties

Mechanical testing of the material shall be performed and reported for the beryllium material used in accordance to the standards ASTM E8-91, ASTM E 831-86, and ASTM E1225-87. to determine the required properties.

5.1.3 Surface Finishes

All parts shall be thoroughly cleaned and degreased and shall be protected from environmental contamination and moisture.

5.1.4 Dimensional Inspection

The Seller shall develop a dimensional inspection procedure to assure that all completed components and/or parts are within the tolerance limits specified on Buyer approved drawings. A written inspection report recording actual dimensions (at 70 degrees Fahrenheit), including the dimensions of SVT040 before welding, shall be submitted to the buyer for approval prior to shipping and/or acceptance of any parts. The Buyer reserves the right to observe, and/or independently perform, any and all tests and inspections prior to shipping and/or acceptance.

5.1.5 Welding or Brazing

All weld or brazing joints, in accordance to the procedures described in AWS B 2. 1-84 and AWS B2. 2-91, are specified on Buyer approved drawings and shall blend into adjacent base metal in gradual smooth curves. The fusion zone shall be as narrow as possible. 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 and welding procedures shall be in accordance with AWS D1.1 and AWS D10.9. The final welded products should be able to withstand a proof pressure as specified in the drawings (de-ionized water shall be used) without leakage. All welded or brazed joints shall perform radiographic inspection per ASTM E1032-92 before shipping. The Seller shall notify the Buyer of all weld inspection for Buyer witness points. The Seller shall have all inspection records available to the Buyer.

5.2 Material Sources

Any recycled or scrap beryllium used in the fabrication shall not contain any radioactive material. Radioactive material includes any material which has become activated beyond ambient levels.

6 Submissions and Approvals

6.1 Seller Manufacturing Plan

Thirty (30) calendar days after receipt of order the Seller must submit for Buyer approval a complete Manufacturing Plan detailing all fabrication activities, including the schedule and the cost. It must cover all aspects of:

(a) Material procurement, including the material sources.
(b) Engineering methods, welding and machining procedures
(c) Shop fabrication routing
(d) Machine tool capacities/calibration and facilities
(e) Tooling and fixture design
(f) Integration with subcontractors
(g) Packaging and crating for shipment
(h) deliverable documentation

6.2 Production Report

The Seller shall develop a procedure for schedule tracking of a detailed production schedule and fabrication travelers. These production reports will be updated every month for Buyer review and approval and will begin upon receipt of order. If the production report is modeled on a computer software program, an electronic media copy of the updated report shall be submitted along with a hard (paper) copy.

6.3 Submissions

All submissions shall be sent to SVT Project Office, Wayne State University, Physics Department, 666 West Hancock, Detroit, Michigan 48201, USA. A copy of such submissions shall also be sent to the Cognizant Engineer in Brookhaven National Laboratory, Bldg. #510C, Upton, New York 11973, USA.

7 Quality Assurance

7.1 General Requirements

The Seller shall prepare and implement, within thirty (30) calendar days after receipt of the order, a Quality Assurance (QA) program that is consistent with the requirements of BNL-QA-101 attachment. The Sellers existing QA program may suffice if it adequately implements the quality requirements in this attachment. The Buyer will review and approve the QA program, monitor QA activities, and perform audits and/or surveillance to assure compliance.

7.2 Acceptance Test Plan

Thirty (30) days after receipt of order the Seller must submit for Buyer approval a complete Acceptance Test Plan detailing all testing and inspection activities. It is the responsibility of the Seller to formulate an Acceptance Test Plan that achieves this goal, and as a minimum must cover all aspects of:

(a) Detailed test and inspection procedures

(b) Report procedures and forms

(c) Buyer witness points and audit

(d) Inspector qualification

(e) Equipment and calibration

(f) Integration with manufacturing plan

8 Test Specimen

The Seller shall provide the Buyer with a test specimen taken from the beryllium material used for fabrication. The dimensions of the test specimen are 2" $\times$ 1" $\times$ .07".

9 Attachments

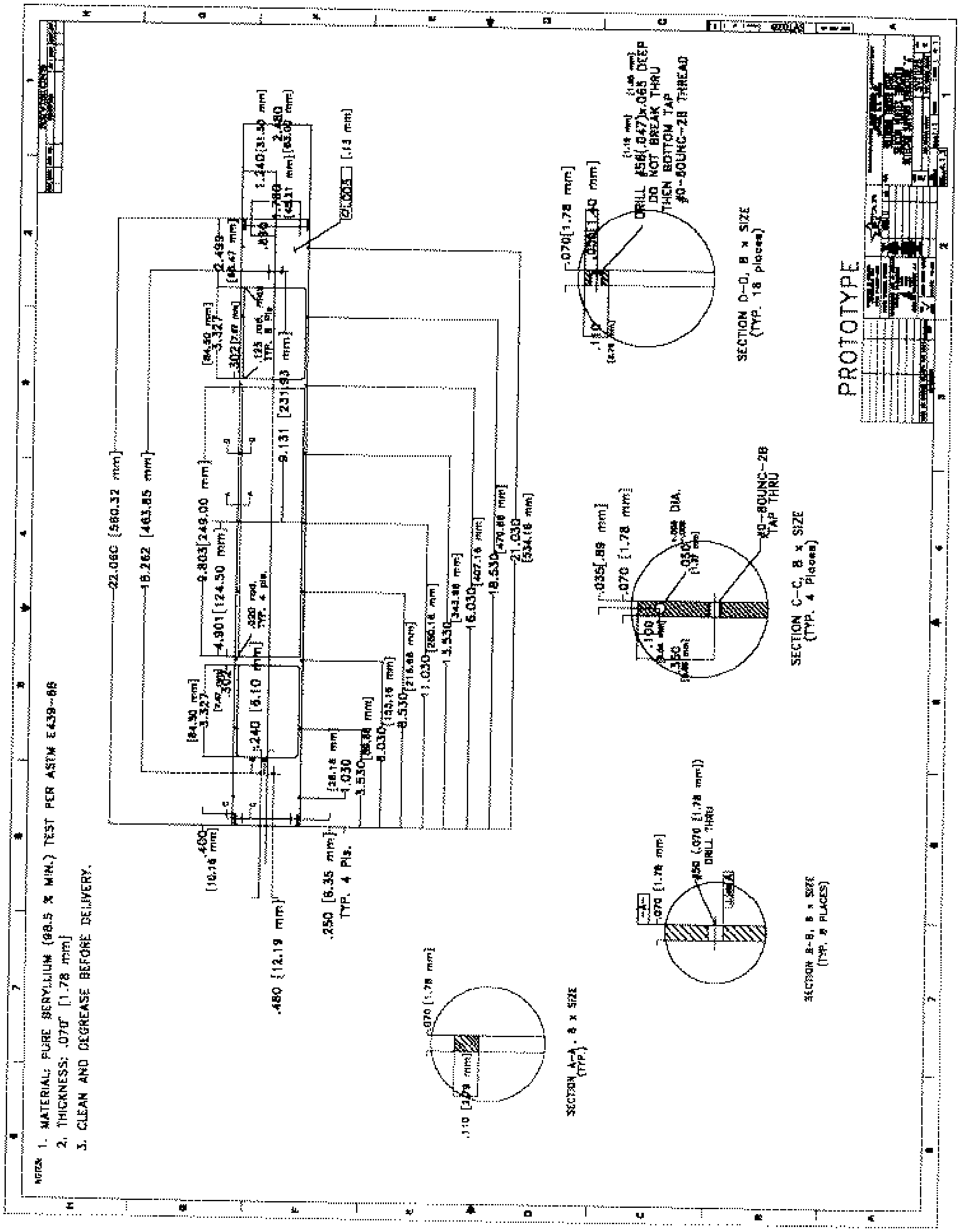
(a) SVT038: Cooling Support & Tube Assembly-1

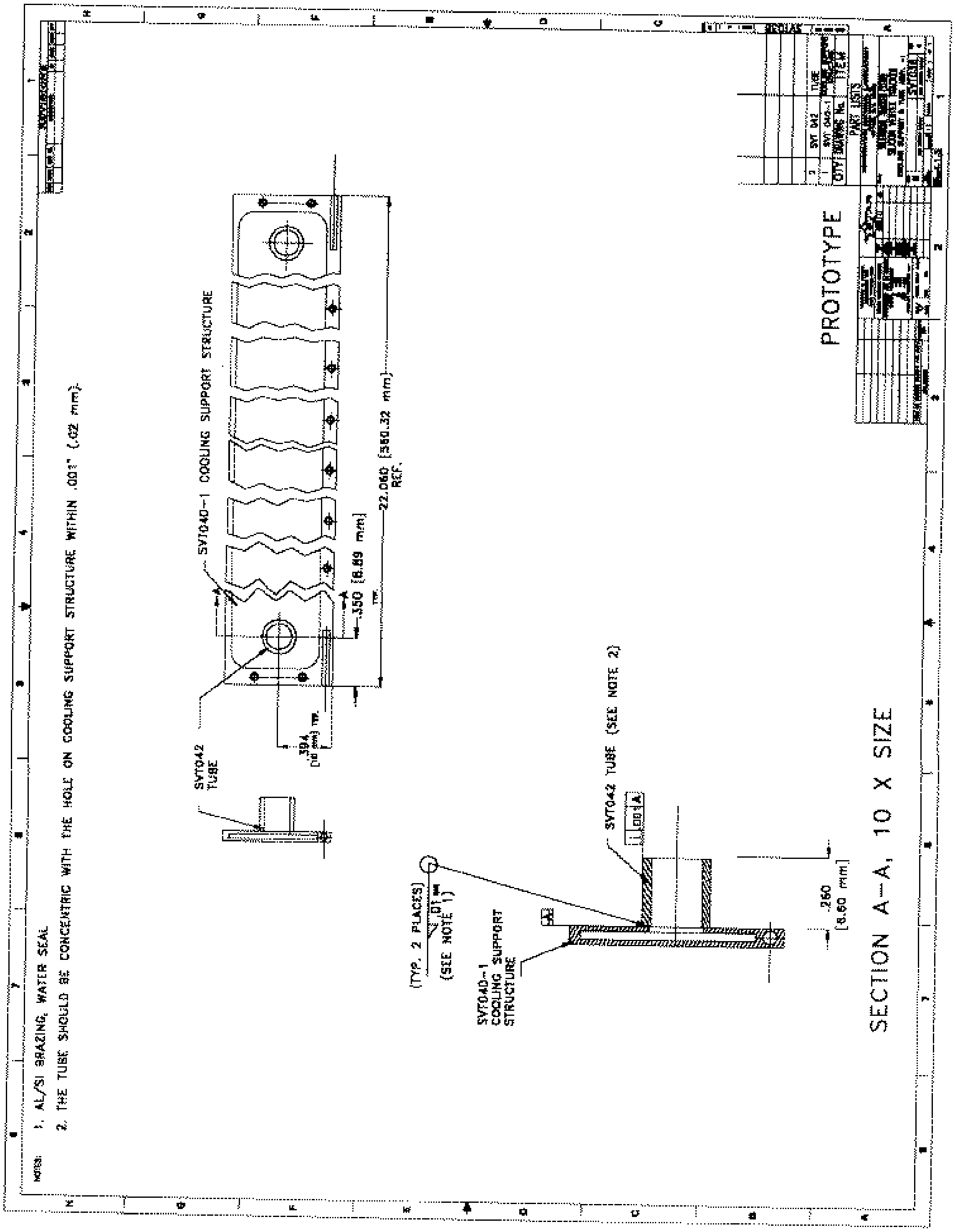
(b) SVT028: Detector Support Structure "A"

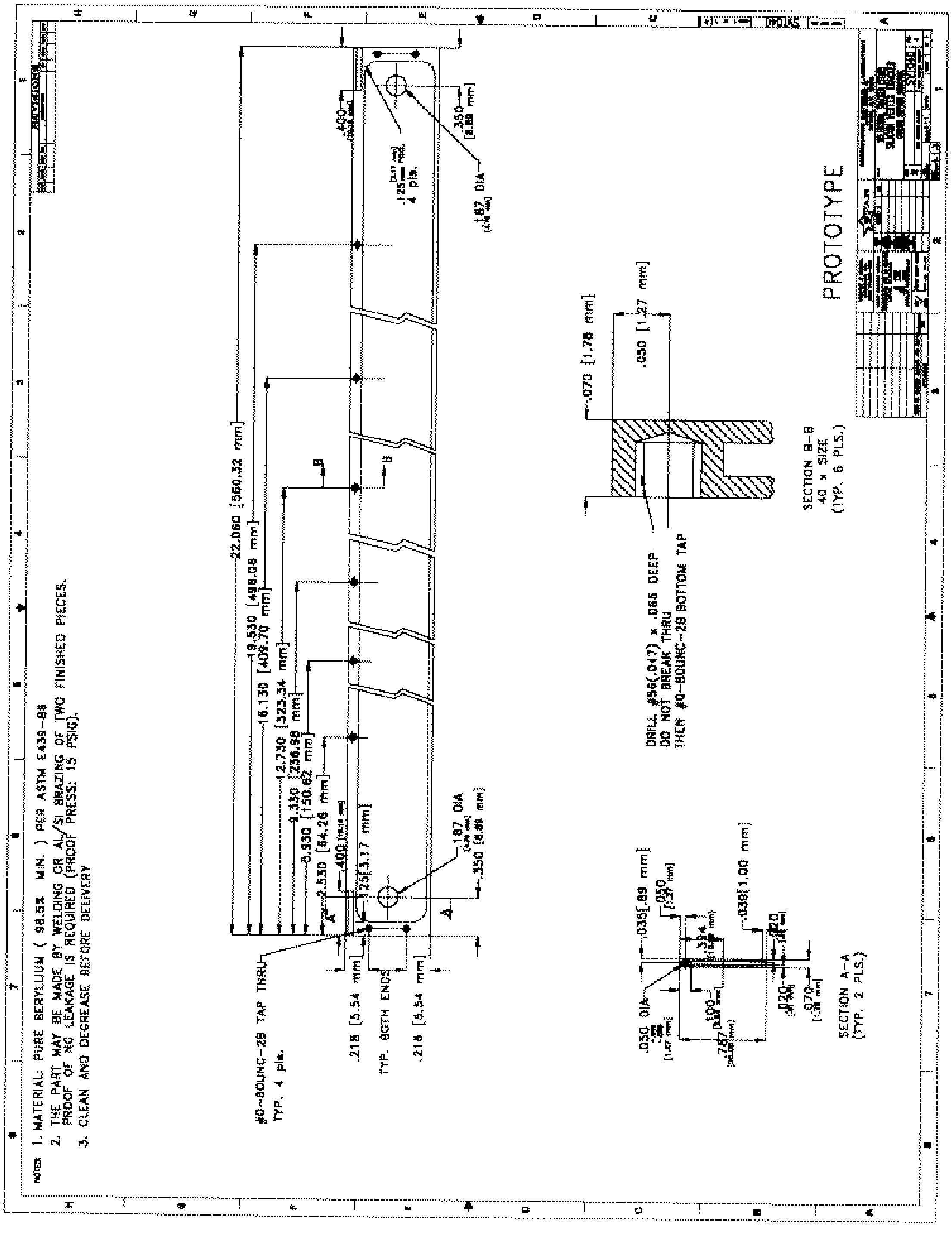
(c) SVT040: Cooling Support Structure

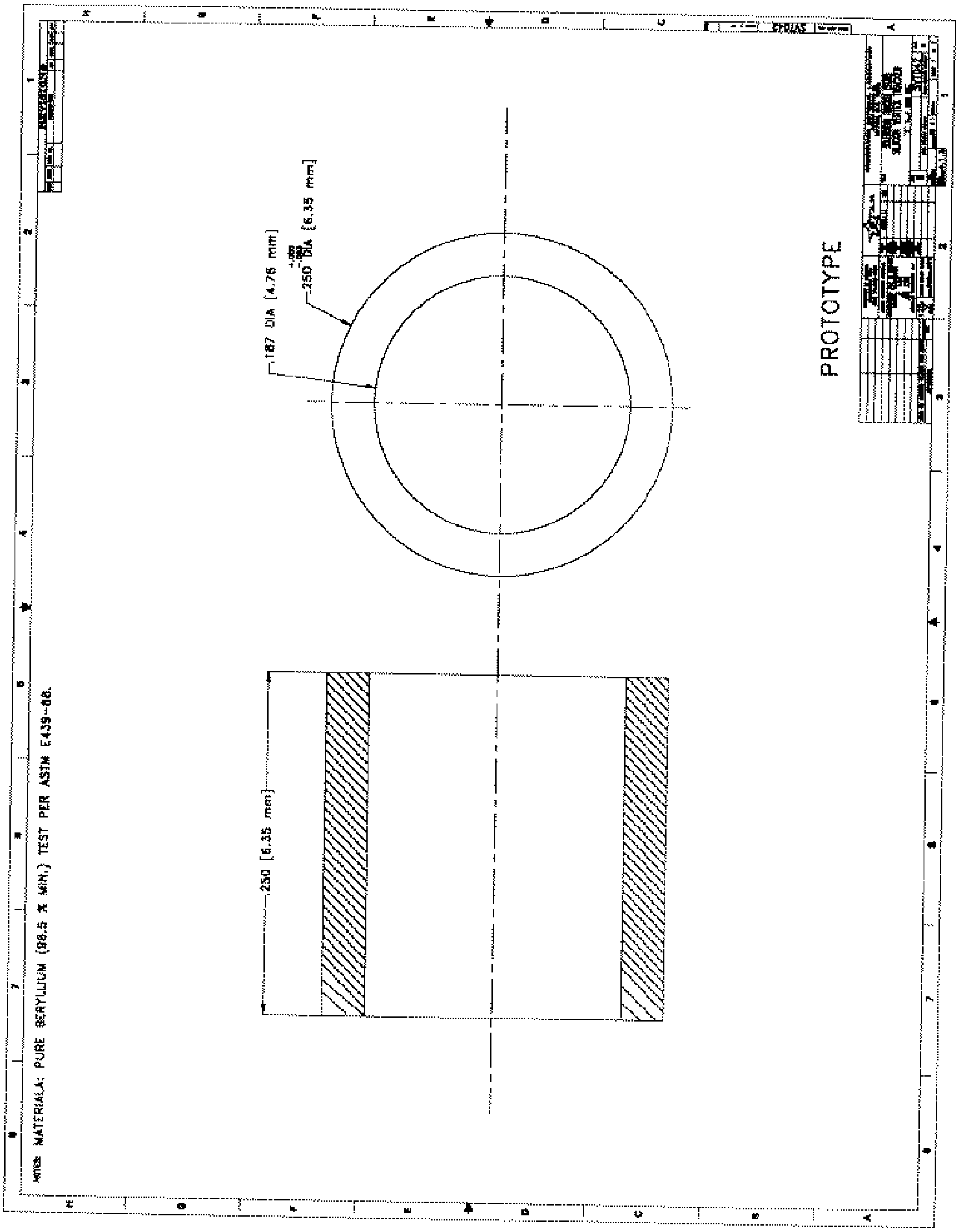
(d) SVT042: Tube

(e) BNL-QA-101


NOTES: 1. MATERIAL: PURE BERYLLIUM (98.5 % MIN.) TEST PER ASTM E439-88
2. THICKNESS: .070" [1.78 mm]
3. CLEAN AND DEGREASE BEFORE DELIVERY.
SECTION A-A, 8 x SIZE (TYP.)
SECTION B-B, 8 x SIZE (TYP. 8 PLACES)
SECTION C-C, 8 x SIZE (TYP. 4 Places)
SECTION D-D, 8 x SIZE (TYP. 18 places)
DRILL #58(.047)x.065 DEEP DO NOT BREAK THRU THEN BOTTOM TAP #0-80UNC-2B THREAD
PROTOTYPE


NOTES:
1. AL/SI BRAZING, WATER SEAL
2. THE TUBE SHOULD BE CONCENTRIC WITH THE HOLE ON COOLING SUPPORT STRUCTURE WITHIN .001" (.02 mm)
SVT040-1 COOLING SUPPORT STRUCTURE
SVT042 TUBE
22.060 [560.32 mm] REF.
.350 [8.89 mm] TYP.
.394 [10 mm] TYP.
SVT042 TUBE (SEE NOTE 2)
(TYP. 2 PLACES)
(SEE NOTE 1)
SVT040-1 COOLING SUPPORT STRUCTURE
.260 [6.60 mm]
SECTION A–A, 10 X SIZE
PROTOTYPE
PART LISTS


NOTES: 1. MATERIAL: PURE BERYLLIUM (98.5% MIN.) PER ASTM E439-88
2. THE PART MAY BE MADE BY WELDING OR AL/SI BRAZING OF TWO FINISHED PIECES. PROOF OF NO LEAKAGE IS REQUIRED (PROOF PRESS: 15 PSIG).
3. CLEAN AND DEGREASE BEFORE DELIVERY
#0-80UNC-2B TAP THRU
TYP. 4 pls.
TYP. BOTH ENDS
22.060 [560.32 mm]
DRILL #56(.047) x .065 DEEP
DO NOT BREAK THRU
THEN #0-80UNC-2B BOTTOM TAP
SECTION B-B
40 x SIZE
(TYP. 6 PLS.)
SECTION A-A
(TYP. 2 PLS.)
PROTOTYPE


NOTES: MATERIALS: PURE BERYLLIUM (98.5 % MIN.) TEST PER ASTM E439-08.
.187 DIA [4.76 mm]
.250 DIA [6.35 mm]
.250 [6.35 mm]
PROTOTYPE

BNL P.R./P.O. NO. ______________

BNL-QA-101
September, 1993

BROOKHAVEN NATIONAL LABORATORY
SELLER QUALITY ASSURANCE REQUIREMENTS
(BNL Personnel only — Refer to form BNL F 3022 for guidance)

1.0 SCOPE

1.1 This document, when invoked by purchase order or contract, establishes quality assurance requirements to which sellers to Brookhaven National Laboratory (BNL) shall conform during the performance of work required by the purchase order, or contract.

1.2 This document contains two main sections. Section 3.0 covers the general requirements that are applicable to all sellers. Section 4.0 contains special quality assurance requirements that are applicable only when specifically invoked by the purchase order.

2.0 DEFINITIONS

2.1 The term *Purchase Order* means the purchase order, contract, subcontract or other written agreement with the Seller (supplier) in which the requirements of this document are incorporated by reference.

2.2 The term *Buyer* means Associated Universities, Inc. operating Brookhaven National Laboratory, acting by and through its Division of Contracts & Procurement issuing the purchase order.

2.3 The term *Seller* means the legal entity which is the contracting party with the Buyer with respect to the purchase order.

2.4 The term *article* or *item* means a product and/or a service.

3.0 GENERAL REQUIREMENTS

Unless otherwise specified in the purchase order, the following General Requirements apply:

3.1 Seller Quality Assurance Program/Inspection System

The Seller shall have and maintain an effective quality assurance program or inspection system that will, as a minimum, comply with all of the requirements of the specification designated below:

☐ 3.1.1 MIL-Q-9858 "Quality Program Requirements" or ISO 9001 "Quality Systems- Model for Quality Assurance in Design/Development, Production, Installation, and Servicing" (Latest revision as of the date of purchase order issuance).

☐ 3.1.2 MIL-I-45208 "Inspection System Requirements" or ISO 9002 "Quality Systems- Model for Quality Assurance in Production and Installation" (Latest revision as of the date of purchase order issuance).

In the "MIL" specifications designated above add "Brookhaven National Laboratory" wherever the word "Government" appears.

☑ 3.1.3 Conformance to Manufacturer's Specifications.

☐ 3.1.4 Other: Refer to requirements stated on P.R./P.O. documentation.

Note: In the event that Requirement 3.1.1 or 3.1.2 is specified, and the Seller's quality assurance program or inspection system does not comply with the specified requirement, the Seller shall submit with his quotation a description of his existing quality assurance program or inspection system that will apply to this order. The description will be evaluated by the Buyer prior to award.

BNL F 3023

3.2 Audit by Buyer

The Seller's Quality Assurance Program or Inspection System shall be subject to audits by the Buyer's Representative(s) for conformance with the requirements of the purchase order.

3.3 Conformance to Requirements

All items furnished to the Buyer shall conform with all requirements of the purchase order. No change(s) shall be made to any Buyer requirements without the prior written approval of the Buyer.

3.4 Responsibility for Subcontractors

It is the responsibility of the Seller to impose applicable quality assurance requirements upon their subcontractors. Additionally, the Buyer reserves the right to approve, in writing, any subcontractor.

3.5 Responsibility for Conformance

Neither audits, surveillance, inspection and/or tests made by the Buyer or its representatives at either the Seller's or Buyer's facility, nor the Seller's compliance with all applicable Quality Assurance Requirements shall relieve the Seller of the responsibility to furnish items which conform to the requirements of the purchase order.

3.6 Protection of Material and Equipment

The Seller shall employ procedures which assure adequate protection of material and equipment during shipment and while in storage. Such protection shall include special environmental packaging, as necessary.

3.7 Certification of Conformance

By making shipment under this purchase order, the Seller automatically certifies that the articles shipped, the materials (except when the materials are furnished by the Buyer) used in the articles shipped, and the processes applied to such articles comply with the applicable drawings, specifications and requirements of the purchase order. The Seller agrees to retain objective evidence, including records, of the inspections and tests performed in the course of manufacturing, testing, inspecting, preserving, packaging, and preparation for shipment of said articles. These records shall be made available to the Buyer's representative for review upon request.

3.8 Measuring and Test Equipment Calibration

The Seller shall establish and maintain a documented system for the calibration of measuring and test equipment used in the fulfillment of the purchase order requirements. As a minimum, the Seller shall calibrate measuring and test equipment against certified standards which have known valid relationships to national standards. The calibrations shall be performed at established periods to assure measuring and test equipment accuracy at the time of use.

4.0 SPECIAL REQUIREMENTS

The following Special Requirements are applicable only when specifically invoked by purchase order, or as indicated by check mark hereon.

☑ 4.1 **Q.A. Program or Manual:** The Seller shall submit a copy of his Quality Assurance Program or Manual with his proposal for review and evaluation.

☑ 4.2 **Configuration Control System:** The Seller shall establish and maintain a system to assure that all end items (including spares) are of the proper configuration, and that all approved configuration changes are incorporated at the specified effectivity points. Records shall be maintained verifying the configuration of each item.

☑ 4.3 **Process Sheets, Travelers, etc.:** The Seller shall maintain a system of process sheets, shop travelers, or equivalent means to define the sequence of manufacturing, inspection, installation and test activities to be performed. Flow sheets, or equivalent, shall provide for sign-off by designated inspection personnel at specified inspection and test points, to assure completion as well as proper sequencing of required operations.

☑ 4.4 **Manufacturing/Inspection/Test Plan:** Sixty (60) days prior to fabrication the Seller shall prepare and submit for the Buyer's review and approval a manufacturing/inspection/test plan for the item(s) to be produced, which satisfies the following:

☑ 4.4.1 Identification of parts and subassemblies showing integrated flow into end item(s).

☑ 4.4.2 Identification of critical manufacturing operations as well as inspection and test checkpoints.

☑ 4.4.3 The Plan may be a single document, or may make use of existing "travelers", or other suitable planning and control documents.

☑ 4.4.4 Revisions or changes to the Buyer approved Plan must be submitted for the Buyer's review and approval prior to implementation.

☑ 4.5 **"Witness" Points:** The Buyer reserves the right to designate selected manufacturing, inspection, and/or test operations as "witness" points. The Seller shall provide the Buyer with five (5) working days notice in advance of reaching such witness points during the manufacturing and test cycle of each item.

☑ 4.6 **Test and Inspection Procedures:** Test and inspection procedures required to demonstrate satisfactory completion of purchase order requirements shall be prepared by the Seller and submitted to the Buyer for review and approval sixty (60) days prior to use of such procedures.

☑ 4.7 **Special Process Procedures:** Special processes (e.g. welding, brazing, bonding, plating, chemical machining, chemical coating, chemical cleaning, precision cleaning, heat treating, radiographic inspection, ultrasonic testing, pressure or leak testing) shall be performed in accordance with detailed written procedures. These procedures shall specifically describe the exact manner in which the processes are to be performed.

☐ 4.7.1 Copies of special process procedures shall be available for review by the Buyer's representative upon request.

☑ 4.7.2 At least sixty (60) days prior to use on items deliverable to the Buyer, the Seller shall submit to the Buyer copies of all applicable process procedures for review and approval. Revisions or changes to Buyer approved special process procedures must be submitted to the Buyer for review and approval prior to implementation.

☑ 4.8 **Qualification of Special Process Procedures, Facilities and Equipment:** The Seller shall, prior to use, qualify the procedures/specifications, facilities and equipment that will be used for the performance of special processes. Records of such qualification shall be available to the Buyer's representative upon request.

☑ 4.9 **Qualification of Special Process Personnel:** The Seller shall provide for the qualification of personnel, prior to their use, to ensure competence in the use of the special process procedures or specifications. Records of such qualification shall be available to the Buyer's representative upon request. Only those personnel who have been qualified to perform a specific special process shall be used to perform that process.

☑ 4.10 **End Item Documentation Package:** The Seller shall provide a documentation package for each shipment of the item(s) supplied, which consists of objective evidence of compliance with purchase order requirements. This documentation package shall be complete, legible, indexed, and traceable to the item supplied, and shall contain the following, as applicable:

☑ 4.10.1 Copies of reports of all required or necessary inspections, examinations and tests, properly validated by the Seller's authorized personnel.

☑ 4.10.2 A listing of the as-built configuration of each delivered item; this may be defined by the use of drawing numbers and revisions, unique parts lists or other such means of positive identification.

☑ 4.10.3 Copies of nonconformance reports dispositioned as "repair" or "use-as-is".

☑ 4.10.4 Copies of material test reports for specified materials, showing physical and chemical properties.

☑ 4.10.5 A Certification of Conformance (See 4.16).

☑ 4.11 **Release for Shipment:** The Seller shall provide the documentation package required in 4.10, for review by the Buyer's representative prior to release of the item for shipment.

☑ 4.12 **Shipment of Documentation Package to Buyer:** Three (3) copies of the documentation package shall be shipped to the Buyer with or prior to each shipment of the purchased items.

☐ 4.13 **Failure Reporting, Analysis and Corrective Action:** The Seller shall maintain a failure reporting, analysis and corrective action program to determine and report what reliability or safety problems may exist in the equipment, define their nature and cause, and recommend and implement the necessary corrective actions.

The Seller's failure reporting, analysis, and corrective action program shall, as a minimum, evaluate and analyze failures occurring during qualification, first article and end-item acceptance testing and inspection. To determine the true cause of failure, the analysis should include, as appropriate, the disassembly or dissection of the failed item(s). The results of all failure evaluations and analyses shall be documented and available for review by the Buyer.

☐ 4.14 <u>Source Inspection/Surveillance:</u> Items to be delivered under this purchase order require inspection, tests or surveillance by the Buyer's representative at the Seller's facility. Five (5) work days notice of acceptance inspections and tests shall be given by the Seller to the Buyer to permit scheduling of source inspection.

☑ 4.15 <u>Chemical and Physical Test Report:</u> One copy of actual chemical and physical test report(s) for each heat, batch or lot shall accompany each shipment. Test reports shall list the actual parameters tested, and shall contain the actual readings taken during test.

☑ 4.16 <u>Certificate of Conformance:</u> With each shipment of items covered by this purchase order, the Seller shall submit a certificate of conformance. In case of drop shipment, a copy of the certificate shall be submitted to the Buyer at the time of shipment. The certificate shall be signed by an authorized representative of the company, and shall constitute a representation by the Seller that:

A. Materials used are those which have been specified by the Buyer, and that the items delivered were produced from materials for which the Seller has on file reports of chemical or physical analysis, or any other equivalent evidence of conformance of such items to applicable specifications;

B. Processes used in the fabrication of items delivered were in compliance with applicable specifications forming a part of the purchase order, or Buyer approved procedures or specifications;

C. The items as delivered comply with all specifications and other requirements of the purchase order.

4.17 <u>Report with Each Shipment:</u> Superseded by paragraph 4.16.

☐ 4.18 <u>First Article Acceptance:</u> Buyer acceptance of first article(s) is required prior to the production run. The first article(s) shall be identified as such, including the purchase order number, part number and part name. The Seller is required to:

☐ 4.18.1 Submit the first article(s) to the Buyer's representative for test/inspection to be conducted at the Seller's facility by the Buyer's representative;

☐ 4.18.2 Submit the first article(s) to the Buyer for test/inspection by the Buyer at the Buyer's facility;

☐ 4.18.3 Submit the first article(s) to the Buyer together with documents showing data representing results of the Seller's first article(s) test/inspection, including the actual dimension or value for each specified characteristic;

☐ 4.18.4 After Buyer acceptance of first article(s), all of the remaining units required by the purchase order shall be produced by the Seller and the Seller's suppliers using the same design, materials, processes, methods and tooling that were used to manufacture the approved first article(s). Any changes must have prior approval from the Buyer.

☑ 4.19 <u>Notification of Change to Design, Methods, or Processes:</u> The Seller shall immediately notify the Buyer of any significant changes (those that may effect form, fit, function, reliability, safety or interchangeability) in product design, fabrication methods, material or processing from those used by the Seller at time of Seller's quotation or offer to the Buyer, which resulted in the purchase order.

☐ 4.20 <u>Age/Shelf Life and Storage Control:</u> The Seller shall have an effective storage and age control system for items whose acceptability is limited by the age or manner of storage of the item. The system must include a method of identifying the age of such items, and provisions for the rotation and purging of stock.

The Seller shall show on each container of materials having a limited or specified shelf life (both Seller's in-plant containers and containers in which material is delivered to the Buyer) the cure or manufacture date, expiration date, lot or batch number, and special storage and handling conditions applicable to the contents. This information shall be in addition to the normal identification requirements of name, part or code number, specification number, type, size, quantity, etc. If cure or manufacture date is coded, Seller shall provide decoding information. Special handling conditions shall be recorded on certifications and shipping documents covering the material delivered to the Buyer.

At the time of receipt, the material shall not have less than three-quarters of its shelf life remaining, without prior written approval from the Buyer for each shipment.

☑ 4.21 <u>Serial Numbers:</u> The Seller shall assign a separate and distinct serial number to each end item furnished under this purchase order. Where impractical to stamp individual items due to size or shape, the serial number shall be stamped on identifying tags or the smallest unit package. No two items having the same part number are to be identified with the same serial number. Records of serial numbers for each part number must be maintained by the Seller.

☐ 4.22 <u>Lot or Batch Numbers:</u> For items furnished under this purchase order, the packing list, certifications and other applicable documents must be identified by manufacturing lot or batch number. Where impractical to stamp individual parts due to size or shape, the lot or batch number shall be stamped on identifying tags or the smallest unit package.

☑ 4.23 <u>Material Traceability:</u> Materials used must be identified by material type, applicable specification and revision number, and be traceable to their lot number(s) and heat number(s). Traceability records shall be available for review by the Buyer's representative.

☐ 4.24 <u>Shipment Destination Other than BNL:</u> The material ordered against this purchase order is to be shipped to other than the Buyer's facilities. Copies of the Quality Assurance data required by this order shall accompany the shipment; in addition, one copy of such data shall be mailed to the Buyer on the same day that shipment is made.

4.25 <u>Heat Treat Bars:</u> Superseded by paragraph 4.7.

☐ 4.26 Burn-in: Burn-in shall be performed on each completed item per the procurement specification. Records of the burn-in testing, repairs and test results shall be maintained, and shall be available to the Buyer's representative upon request.

4.27 Welding Procedures: Superseded by paragraph 4.7.

☑ 4.28 Weld/Braze Inspection Report: A report(s) shall be submitted that indicates the complete inspection of welds or brazes from the initial fitup stage through the final inspection. Inspection reports shall be accompanied by all radiographic films, filler metal reports, etc. The reports shall contain the signature or stamp, and title of an authorized Seller representative.

☑ 4.29 Radiographic Quality Requirements: Items requiring radiographic inspection shall be radiographed and processed in accordance with Seller special process procedures that satisfy design specifications, standards or other purchase-order requirements. Personnel reading and interpreting film shall have been subjected to examination and certification. Responsibility for this certification shall rest with the Seller, whether the Seller does the work or subcontracts to a specialized laboratory. Findings shall be reported on an appropriate form, including the name of the reader and the signature of a responsible representative. The radiographic film and a reproducible copy of the report shall accompany each shipment. An adequate method of identifying and cross referencing each film exposure, report, and item shall be provided. When parts are serialized, serial numbers shall appear on the report and the film.

☑ 4.30 Nondestructive Test Reports: All nondestructive testing shall be conducted in compliance with Seller special process procedures that satisfy the applicable provisions of the design specifications, or other purchase order requirements. Personnel and equipment utilized in performance of such tests shall have been evaluated and certified for the type of test performed.

Seller shall furnish with, or prior to, each shipment reports of such nondestructive examination of material or items furnished. These reports shall be identifiable to the respective item or material including the specific section, joints or views of the item furnished. These reports shall contain the signature and title of an authorized Seller representative. When items are serialized, the serial numbers shall appear on the reports.

☐ 4.31 Pressure or Leak Test Reports: Test reports shall be prepared for all pressure and leak tests. Such reports shall state the requirement, the Seller's test procedure number, and the observed result for each item, joint or connection tested. When items are serialized, the serial numbers shall appear on the report. The reports shall contain the signature and title of an authorized Seller representative, and shall accompany each shipment.

☑ 4.32 Cleaning Certification: Each shipment shall be accompanied by a certification which states that all Buyer requirements relative to cleaning and cleanliness have been completely satisfied. The certification shall reference the Seller's applicable cleaning procedure(s) identification number(s), and shall also contain the signature and title of an authorized Seller representative.

☑ 4.33 Calibration Certification: The Seller shall submit with each instrument/system a certification that the instrument/system has been calibrated and is ready for use. The certification shall contain, as a minimum, the identity of the instrument/system, the identification of the calibration procedure used, identification of the standards and/or equipment utilized for the calibration, and a statement that the calibration of the standards and/or equipment used is traceable to the National Institute of Standards and Technology (NIST) or some other recognized national standard. Detailed support data shall remain on file with the Seller and shall be available for review by the Buyer. The certification shall also contain the signature and title of an authorized Seller representative.

☐ 4.34 Operating-Maintenance Manual: Documentation containing operating procedures, maintenance instructions, spare parts lists, and handling procedures shall be submitted with the shipment of the first item.

☐ 4.35 Computer Software Configuration Management: The Seller shall develop and implement a software configuration management system that ensures an orderly development of software. The system shall establish requirements for placing software under configuration control, provide for the positive identification of software, and the control of all software baseline changes. The Seller shall submit a copy of his software configuration management procedure(s) with his proposal for review and evaluation.

☐ 4.36 Computer Software Design Control: The Seller shall develop written procedures describing the controls applied to the design of software, and the verification of the design through independent technical review. The procedures shall provide for documentation of review activities, including requirements for documenting comments and resolutions of comments. Seller software designs and review documentation shall be subject to review and approval by the Buyer.

☐ 4.37 Computer Software Verification Testing: The Seller shall test and verify computer software developed or modified to fulfill the requirements of the purchase order. The verification testing shall be accomplished by a comparison of test results with those from other verified software, or by a comparison with results from analytical solutions or Buyer approved alternatives.

☐ 4.38 Electrostatic Discharge Control: Items that are susceptible to electrostatic discharge shall be handled and packaged to protect them from damage. Items and/or packages shall be labeled to indicate the susceptibility to electrostatic discharge.