

BROOKHAVEN NATIONAL LABORATORY

UPTON, NEW YORK 11973

SPEC. NO.0007

August 12 1999

SPECIFICATION

FOR

FERRITE INDUCTOR RINGS

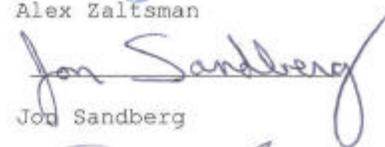
FOR THE SNS RF cavities

Prepared by:



Alex Zaltsman

Approved by:



Jon Sandberg

Quality Assurance:



Dave Passarello

QA Category A-2

## A. GENERAL INFORMATION

This document is the specification for ferrite rings needed for the SNS RF cavities. After a careful evaluation of RF system parameters, we determined that the best ferrite material to match our requirements is Phillips's 4M2.

One of the major limitations of operation in the cavities is power dissipation in the ferrite. Radio frequency power delivered to the ferrites must be removed by water cooled discs placed between the ferrite rings. To keep thermal heating within reasonable limits, the quality factor ( $\mu Qf$  product) of the material should be high. Additionally, the loss characteristics of the material shall display only a small dependence on temperature over the operating range of 20°C to 50°C.

Excellent planarity and surface finish of the ferrite rings are needed, to give optimal thermal contact to their cooling rings. The ferrite rings must be free of cracks, voids or inclusions which could lead to mechanical destruction under thermal stress.

## B. MECHANICAL SPECIFICATIONS

The ferrite material is to be furnished by the Vendor in one piece toroidal rings of rectangular cross-section. The dimensions of the rings shall be:

B.1 Outside Diameter:	500.0 mm	+/- 0.2mm
B.2 Inside Diameter:	250.0 mm	+/- 0.2mm
B-3 Thickness:	27.2 mm	+/- 0.1mm

The thickness of rings shall be determined using micrometer.

The following specifications apply to each ring:

B.4 Flatness and Parallelism: The plane surfaces of each ring shall be flat within .1 mm, total indicator reading, and parallel within 0.1 mm.

B.5 Concentricity: The inner and outer cylindrical surfaces shall be concentric within 0.2 mm.

B.6 Physical Defects: Ferrite rings shall be free of cracks, voids and inclusions. Visible cracks, voids or inclusions in a ring will be cause for rejection of that ring. Any other physical defect, such as

edge chips, which in the opinion of the Purchaser will adversely affect performance of any ring, will be cause for rejection of that ring.

B.7 Marking: Vendor shall clearly mark each ring with a serial number and with the Vendor's material type identification. Such marking will be applied only to the outer cylindrical surface of the ring.

B.8 Small Evaluation Samples: For each production run, the Vendor shall produce and supply a quantity of 4 evaluation test rings. These rings, of common outer diameter ( $10\text{cm} < d_o < 12\text{cm}$ ) shall be  $27 \pm 0.2\text{mm}$  thick, shall be ground parallel on the plane faces, and have a 2:1 aspect ratio of outer diameter to inner diameter. These rings are to be of material from the production run mix, and are to be furnace-processed together with the production rings. The manufacturer will endeavor to ship the test rings to BNL for evaluation prior to shipment of the full size rings. Acceptance of the production rings will depend on the tests on the evaluation rings.

#### C. ELECTRICAL SPECIFICATIONS:

The following specifications shall apply with the ferrite in the temperature range of 20C to 50C.

Remanence is defined herein as the state of a ferrite ring after a dc magnetization of 1500 ampere-turns has been applied to it and reduced monotonically to zero.

It is understood that dc magnetization is always to be applied in the same sense to a given ring.

C.1 Permeability: Incremental permeability at remanence shall be nominally 130, but may lie in the range  $130 \pm 25$ , when measured at 1.2 MHz frequency with, rf excitation of less than 2 volts rms per turn.

C.2 Tuning: Application of dc magnetization of not more than 1,500 ampere turns shall monotonically reduce the mean incremental permeability of each ring to below 25% of the value at remanence.

This specification shall apply when rf excitation is less than 2 volts rms per turn, at 1.2 MHz, starting with the ferrite at remanence.

C.3 Dielectric Properties: In the frequency range from dc to 2.4 MHz, and in the absence of dc magnetic bias field, the volume resistivity of each ring shall be at least  $10^5$  ohm-cm.

C.4 Average Power Dissipation: Under conditions of sinusoidal rf excitation by a voltage loop, the average dissipated power per unit volume for each ring should not exceed  $.28 \text{ W/cm}^3$  at a frequency of 1.2 MHz and rf magnetic field of 350 Gauss.

C.5 See attached table for additional specifications.

#### D. ACCEPTANCE TESTS

All ferrite rings delivered to the Purchaser will be inspected and tested by Purchaser at his facilities, for conformance to this Specification and to the attached data sheet.

Rings damaged in transit will be rejected. Rejected rings will be returned to Vendor at Vendor's expense, for replacement with acceptable units.

The Vendor shall submit to Purchaser a detailed outline of mechanical and electrical, test procedures for Purchaser's approval.

The Purchaser shall witness tests of each new material production run.

#### E. QUALITY ASSURANCE

The Vendor shall comply with the following paragraphs of the attached BNL-QA-101 including special requirements 3.1.2, 4.1, 4.5, 4.6, 4.10, 4.10.4, 4.18, 4.18.2, 4.18.4, 4.19, 4.22.

ATTACHMENT  
TO  
SNS RF CAVITY FERRITE  
SOLE SOURCE JUSTIFICATION

□

The radio frequency proton accelerating cavities in the SNS require ferrite material which must meet stringent specifications. The quantity of ferrite used is limited by the available straight section length and the maximum diameter to which the ferrite ring can be fabricated. Additional parameters which are fixed are: the peak voltage per cavity, frequency range of operation, duty cycle, the vacuum chamber diameter and the accelerating gap capacitance.

Given these specifications, one can define ferrite requirements which will allow the ferrite to be cooled without a thermal runaway effect. The first step in selecting a ferrite is to determine those manufacturers which produce a material meeting the loss and permeability requirements as determined above. If satisfactory small samples are tested and found to have the properties desired, the manufacturer must demonstrate the capability to translate his fabrication processes from small sample size (1" diameter) to the very large rings required by the SNS (about 20" diameter).

The fabrication of ferrites is a combination of science and art and the change from small to large pieces involves the technology of pressing equipment, ovens, large grinding machines, intricate firing cycles; this necessitates a very large and complex facility. The capability to produce large pieces, after making the small samples, is not always present. The time scale to develop these capabilities is often measured in months or years. In addition, the manufacturer must be able to fill this order with ferrite rings which are uniform, are within specifications, and with timely delivery.

For the SNS RF cavities which operate in two frequencies 1.19 MHz and 2.38 MHz ferrites are required to operate in a stable manner with an rf magnetic field of at least 350 Gauss. Furthermore, the dissipated power in the ferrite material must remain below .3 watt/cc, to allow proper cooling of the ferrite material.

Over the last year measurements of ferrite properties have been carried out for small test samples and full sized rings of several ferrite candidate materials supplied by manufacturers in the United States, The Netherlands and Japan.

To date, only one fabricator has satisfied all of our requirements: PHILIPS of the Netherlands. They supplied accelerator ferrites to AGS Booster, ISIS, KEK and CERN with 4M2 material which proved itself as the best candidate for the SNS job.

Alex Zaltsman  
Derek Lowenstein

*Alex Zaltsman*  
*Thomas Alford 8/10/79*  
*T. B.W. Kirk*  
*ALD-HEUP*

**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.***

**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 ap-

proval. 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 **Source Inspection/Surveillance:** 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 **Chemical and Physical Test Report:** 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 **Certificate of Conformance:** 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 **Report with Each Shipment:** Superseded by paragraph 4.10.

- 4.18 **First Article Acceptance:** 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 **Notification of Change to Design, Methods, or Processes:** 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 **Age/Shelf Life and Storage Control:** 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 **Serial Numbers:** 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 **Lot or Batch Numbers:** 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 **Material Traceability:** 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 **Shipment Destination Other than BNL:** 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 **Heat Treat Bars:** 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.



# PHILIPS

## Philips Components

August 10, 1999

To: ALEX ZALTSMAN, PHYSICIST, ACELLERATOR DIVISION  
**BROOKHAVEN NATIONAL LABORATORIES**

Cc: Andrew Read, Product Manager, NP & S

From: Herb Listemann, Sales Engineer

No. of pages: 4

Ref: 99071601

SUBJECT: QUOTATION FOR LARGE RINGS IN 4M2 MATERIAL

Dear Alex,

Philips Components is pleased to quote large rings as follows:

PHILIPS P/N	QTY.	PRICE (each)
T500/250/27.2-4M2	190	\$1850.00 (CIF, Upton, N.Y.)
"	400	\$1800.00 (CIF, Upton, N.Y.)

Leadtime: 17 to 20 weeks **ARO**. The factory is closed the last 3 weeks  
Of July, 1999.

Terms: Net 30 days.

All other Philips Components terms and Conditions apply.

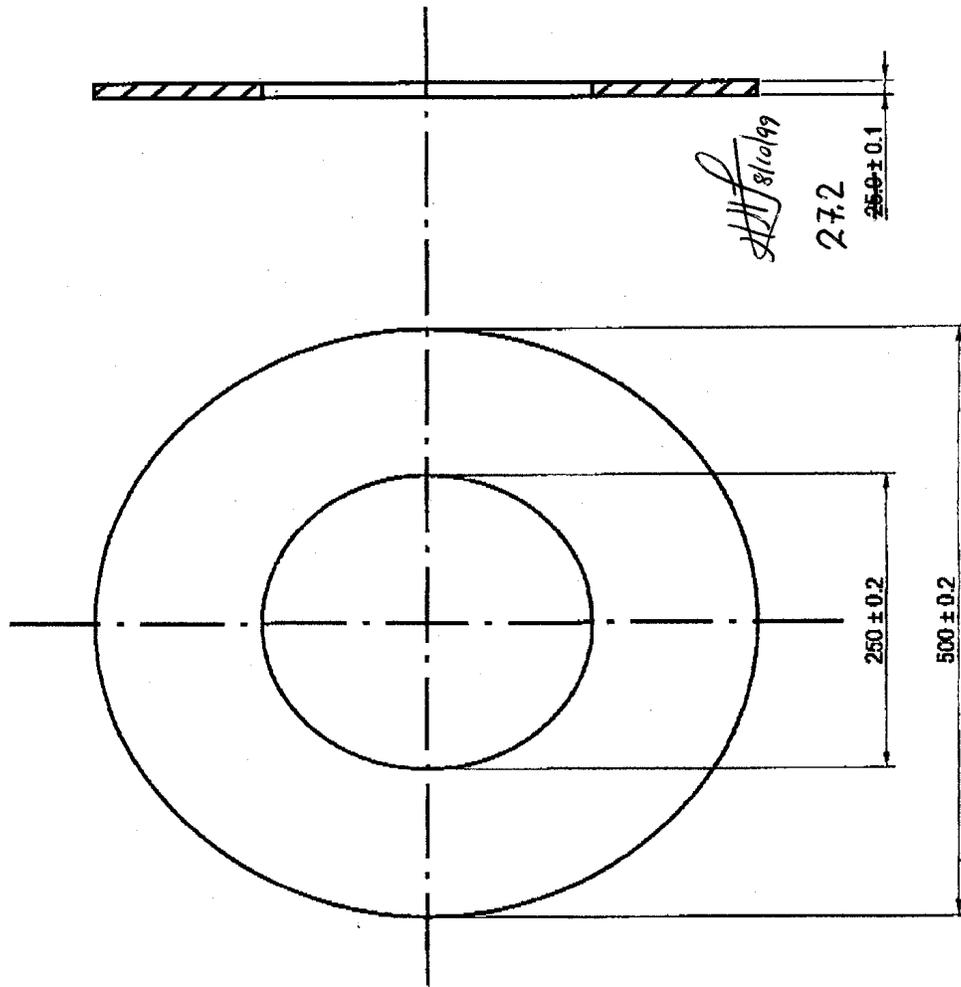
The material specification has not changed from your last purchase.  
See page 3 and 4. Ring dimensions per page 2.

If you have any other questions, please let me know. Looking forward  
to serving your ferrite needs during 1999 and beyond.

Sincerely Yours,

H. H. Listemann

# NEW PRODUCTS & SPECIALS



scale 1 : 50	T500/250/25-4M2	4322 020 93081		25-06-99
		112 - 001	10	
H. Ebus	(C) PHILIPS ELECTRONICS N.V.		EINDHOVEN - NEDERLAND	A4
KB				



PHILIPS

M.I.S.D.  
Electronic components and  
materials Division

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INFORMATION SHEET

F.V. ELCOMA I.G. MATERIALEN	SOFT MAGNETIC CERAMIC MATERIAL FERROXCUBE 4M2	ZT-K 1534 (10) -2- 62-02-09
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Unless otherwise stated, these properties are measured 24 hours after demagnetisation and apply to:

a relative humidity of : 45 - 75 %  
an atmospheric pressure of: 86 - 106 kPa

Note 1: Measured after application of a field of 2000 A/m.

Note 2: Measured after application of a field of 800 A/m.

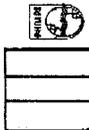
Note 3: Watt losses can be calculated as follows:

$$\text{Watt losses} = \frac{2.5 \times f \times B^2}{10^3} \text{ kW/m}^3 \quad (= \text{mW/cm}^3)$$

where  $f = \text{kHz}$   
 $B = \text{mT}$

Example: Watt losses at 1 MHz, 10 mT =

$$\frac{2.5 \times 1000 \times 10^2}{20 \times 10^3} = 12.5 \text{ kW/m}^3$$



NAME Coldennoff/AS	SUPERS	ZT-K 1534
Property of N.V. PHILIPS' GLOEILAMPENFABRIEKEN EINDHOVEN THE NETHERLANDS		