

### NATIONAL RADIO ASTRONOMY OBSERVATORY

The National Radio Astronomy Observatory is a Facility of the National Science Foundation Operated Under Cooperative Agreement by Associated Universities, Inc.

# PURCHASE ORDER

PAGE NO.	1
DATE	12/06/99
ORDER NO.	57514
DEPT. NO.	

V INNOTECH SYSTEMS INC N 320 MAIN ST. O PORT JEFFERSON NY 11777 R		S H P T O	H ASSOCIATED UNIVERSITIES INC NATIONAL RADIO ASTRONOMY OBS 2015 IVY ROAD				
DATE ORDERED	12/06/99	REFERENCE					
DATE REQUESTED	09/01/00	TAKEN BY					
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INVOICES N. TO P. St	O. BOX 0 DCORRO, NM 8	ASTRONOMY OBSERV		(505) 835-7000 (505) 835-7030 (505) 835-7030	Fax-Accou	asing	
STOCK NO. DESC	RIPTION	Q	UANTITY U/M	UNIT PRICE		EXTENDED PRICE	
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	LSO INCLUDED A ITACHMENT A - ITACHMENT B - ITACHMENT C - ITACHED APPENL	NICH IS MADE A PAR ARE THE FOLLOWING: THE ALMA CORRELAT FIGURES 1-12 FOR SHEET 1 - THE ALM SHEET 2 - THE ALM DICES REPRESENTATI NTS, AND SMALL BUS	OR ASIC SPEC ATTACHMENT : IA CHIP PINO IA CHIP SERLI CONS, CERTIF:	CIFICATION A JT AL PROGRAM WORD ICATIONS AND			
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# 1. Detailed Design

<u>Design Methodology</u>: Complete turnkey ASIC development for ALMA 4096 Lag Correlator ASIC, based on schematics and specification attachments A, B and C of RFP 99-ALMA-1. Design will be done for the 0.25um 3LM CMOS foundry which is planned for use in the Prototype Fabrication phase (TBD).

NRAO's Responsibilities: Clarification of spec and schematic details as needed, review and sign-off approval of simulation results.

<u>ISI's Responsibilities</u>: ASIC specific circuit development; circuit design, test plan, schematic/HDL entry, circuit simulation, test generation, layout and verification.

Layout Implementation Method: ASIC top level will use an auto-routed standard cell methodology. One or more full custom layout blocks (needed to meet the power dissipation requirement of less than 2 watts) will be treated as standard cells in the top level chip route.

<u>Project Engineering Overview</u>: All work will be performed at our Boston Design Center. The following members of our staff will do the development work, by task:
Circuit design, simulation & test plan - Louis J. Morales - BSEE, 20 years of full custom, standard cell and gate array design. ISI principal.
Layout (custom blocks & chip routing) - Lina Morales - MSMS, 15 years experience, including CMOS process design & fabrication.
Schematic/HDL entry & test generation - Wasim Altaf - BSEE, 2 years experience as ASIC Design Engineer

<u>Deliverables</u>: Design netlist in the form of schematics and/or VHDL code down to the logic gate level, test vectors, transient simulation (i.e. SPICE) results, packaging information (ASIC pad size, spacing and locations, bonding diagram(s), physical package information), power dissipation estimate, cell library function and timing information.

Procedure / Statement of Work: November 1999 estimated start

DESIGN START Agreement on specification, design approach, and schedule. Design technology and foundry are chosen. Work begins.	NRAO/ISI
CIRCUIT DESIGN Design logic from existing schematics and specification. Custom multiply/add/accumulate block is designed. Add test logic. Calculate estimated device lifetime based on foundry process data and bias conditions. Begin initial simulations.	ISI

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ASIC CIRCUIT SIMULATION Circuit is simulated to verify functionality. Logic simulations are done using chosen prototype fab process information.	ISI
TEST DEVELOPMENT Production test vectors are written and simulated.	ISI
Vectors are evaluated to insure test coverage greater than 90%	151
INITIAL SIGN-OFF REVIEW Pre-route ASIC design review. NRAO approves all work done to date. Approval to proceed with chip physical design	NRAO/ISI
ASIC LAYOUT Custom blocks are laid out and checked. ASIC routing is done. Actual resistances and capacitances are extracted and used for final SPICE and logic simulations. Layout is checked against design rules and schematic connectivity using CAE software.	ISI
POST-LAYOUT SIMULATION Circuit timing is verified using actual capacitance loading from layout results. Circuit improvements are made. Final DRC and LVS checks are completed	ISI
DATABASE SIGN-OFF REVIEW NRAO reviews and approves all work done to date. Layout database and test vectors are ready for manufacturing.	NRAO/ISI

# Pricing:

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Item	Description	Total
1.1	Design Start	\$52,600.
1.2	Initial Sign-off Review	\$26,300.
1.3	Database Sign-off Review	<u>\$29,400.</u>
	DETAILED DESIGN TOTAL	\$108,300.

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## 2. Prototype Fabrication

<u>Methodology</u>: Turnkey ASIC prototype development for ALMA 4096 Lag Correlator ASIC, based work completed in the Detailed Design Phase. Design will be done for a 0.25um 3LM CMOS foundry.

<u>NRAO's Responsibilities</u>: Review and sign-off approval of simulation results, package choice, and part marking.

<u>ISI's Responsibilities</u>: Re-verify fab related assumptions made during the Detailed Design Phase. Co-ordinate test development, packaging, and fabrication schedules. Insure all elements are in place to produce prototypes that will pass the production test program and behave as simulated.

<u>Project Engineering</u>: All work will be performed at our Boston Design Center. The following members of our staff will do the development work, by task:
Layout re-verification - Lina Morales - MSMS, 15 years experience, including CMOS process design & fabrication.
Test issues - Wasim Altaf - BSEE, 2 years experience as ASIC Design Engineer
All other tasks - Louis J. Morales - BSEE, 20 years of full custom, standard cell and gate array design. ISI principal.

<u>Deliverables</u>: At least 100 prototype units which pass the production test program and conform to simulation results as approved at the conclusion of the Detailed Design Phase. See section 3. for discussion of additional prototype options.

Exception to Terms and Conditions: Under section 3., "Warranty", strike the phrase "...and for all expenses, inspection, and transportation incurred by the Buyer in connection with such goods and shall remove such goods at the Seller's risk and expense". Also, add the following sentence: "Seller's liability shall in no event exceed the price paid by the Buyer to the Seller."

Procedure / Statement of Work: October 2000 estimated start

# PROTOTYPE FABRICATION STARTAuthorization to proceed with prototype manufactureISI/NRAOis received from NRAO and accepted by ISI.ISI/NRAO

#### DESIGN RE-VERIFICATION

Most current versions of tech files, design rules and cell libraries are used to re-verify layout design and simulation timing. No changes to the layout or test vectors are anticipated.

ISI

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PROTOTYPE SIGN-OFF REVIEW Final design review before release to prototype fabrication. NRAO approves all work prior to ASIC prototype build. Exact number of prototypes to be manufactured is finalized.	ISI/NRAO
<b>PROTOTYPE FABRICATION START</b> Foundry paperwork, test vector acceptance, layout database acceptance, and packaging choices are formalized. ASIC prototype lot(s) are scheduled and started.	ISI/foundry
TEST DEVELOPMENT Simulation vectors are converted to test program for production tester. Test hardware is implemented and checked.	ISI/foundry
<b>PROTOTYPES</b> Prototypes are probe tested, packaged and final tested. Delivery of 100+ commercial ASIC prototypes.	ISI/foundry
<b>PROTOTYPE ACCEPTANCE</b> Completed prototypes are evaluated for conformance to specifications and system requirements. Prototypes are approved prior to production fabrication.	NRAO/ISI

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# Pricing:

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Item	Description	Unit Price	Qty	Total
2.1	Prototype Fabrication Start			\$131,000.
2.2	Test development			\$7,000.
2.3	Prototype units	\$140.	100 <sup>†</sup>	\$14,000.
2.4	Prototype Approval (within 45 days)			<u>\$26,000.</u>
	MANUFACTURING TOTAL			

† See section 3. for detailed information regarding additional prototypes

# **3. Additional Prototypes**

<u>Order placement</u>: Up to an additional 300 prototypes beyond the 100 prototypes shown as item 2.3 under "Prototype Fabrication" may be ordered. This order must be placed prior to the "Prototype Sign-off Review" milestone from section 2. Delivery is usually a few weeks after initial prototypes are finished.

<u>Description of prototype evaluation</u>: Prototypes will be treated in 2 stages which will be transparent to NRAO. However, I believe it is worthwhile reviewing the prototyping process we will be using.

After "Prototype Sign-off Review", we will schedule an appropriate number of additional wafers (beyond a standard prototype lot size of 2-6 wafers) in order to have enough material to meet your total prototype requirement. When the wafers get to metalization, we will hold most of the wafers and finish 2 wafers in order to get a few (10 or so) prototypes for our internal test and functional evaluation. This is done to allow for the possibility that something will be functionally wrong with the prototypes which can be fixed with metal layer changes only. This gives us further assurance that the 100-400 prototypes will not be wasted and that the program schedule will stay on track.

#### Pricing:

Item	Description	Unit Price	Qty	Total
3.1	Additional Prototype units	\$140.	Up to 300	\$42,000.

## **4. Production Run Fabrication**

Estimated start January 2002

<u>Basis of pricing</u>: Prices are based on fabrication quotes from 2 large pure-play foundries and 2 ASIC assembly and test houses. These bids have been further qualified by our knowledge of processed wafer costs and yields for the industry in general. Quotes are for 0.25um, 3 layer metal processes for production in 2001. Additional sample based testing will be done by ISI by our New York office. Production testing may be done entirely by ISI.

Exception to Terms and Conditions: Under section 3., "Warranty", strike the phrase "...and for all expenses, inspection, and transportation incurred by the Buyer in connection with such goods and shall remove such goods at the Seller's risk and expense". Also, add the following sentence: "Seller's liability shall in no event exceed the price paid by the Buyer to the Seller."

Production Pricing:<br/>ALMA 4096 Lag Correlator ASIC in 240 PQFP:<br/>10000 units (minimum)\$70/unit<br/>\$45/unitone time buy with one shipment<br/>one time buy with one shipment

Estimated delivery 18 weeks ARO

#### 12-6-99

#### ASSOCIATED UNIVERSITIES, INC.,/NATIONAL RADIO ASTRONOMY OBSERVATORY GENERAL TERMS AND CONDITIONS - PURCHASE ORDER

- ENTIRE AGREEMENT: This order, together with any original documents which may be incorporated herein by reference, constitutes the entire agreement between the parties and supersedes all previous communications, either oral or written. Changes to this order shall be valid only if issued in writing by an authorized representative of Associated Universities, Inc. (AUI), hereinafter called the Buyer.
- ACCEPTANCE: This order becomes a binding contract, subject to the terms and conditions hereof, when accepted by acknowledgement, commencement of the work, furnishing of any products or acceptance of any payment by the Seller.
- 3. WARRANTY: The Seller hereby warrants that all articles, materials, work and services furnished hereunder shall be of first class quality and shall accord in every respect with the description, specifications, drawings and/or samples elsewhere identified in this order. The Seller also warrants that all goods delivered hereunder shall be free from defects in design, material and workmanship. Any goods delivered by the Seller hereunder which do not conform to the foregoing warranty may be rejected by the Buyer before or within one year after final inspection. In the event of such rejection, the Seller shall reimburse the Buyer for the purchase price of any rejected articles, materials, or services paid for by the Buyer, and for all expenses, inspection and transportation incurred by the Buyer in connection with such goods and shall remove such goods at the Seller's risk and expense. Buyer may return such goods to the Seller at the Seller's risk and expense; or, at the option of the Buyer, the Seller shall, free of charge to the Buyer, repair all defects or replace the goods f.o.b. the buyer's premises with goods conforming to the requirements hereof. The Buyer's right specified in this paragraph shall be in addition to rights granted under Paragraph No. 6 (Delays Damages) and all rights and remedies granted by law for the Seller's breach of contract. Furthermore, the warranties provided for in this paragraph shall be in addition to other such warranties as may be specifically provided for elsewhere in this order.
- 4. TERMS OF PAYMENT: The terms of payments elsewhere stated in this order shall be effective upon the occurrence of all the following: (i) the delivery of the goods at the specified f.o.b. point (ii) if the f.o.b. point is not the Buyer's intended destination, upon the expiration of the time it would normally take for the actual transportation of the goods, by means of transportation permitted under this agreement and actually utilized, to the Buyer's intended destination, and (iii) upon the Buyer's receipt of property executed bills of lading (and other shipping papers) and invoices.
- 5. CHANGES: The Buyer may at any time by written order make changes within the general scope of this contract, in any one or more of the following: (i) drawings, designs or specifications, where the goods to be furnished are to be specially manufactured for the Buyer in accordance therewith; (ii) method of shipment or packing; (iii) place of delivery. If any such change causes an increase or decrease in the cost or the time required for, performance of any part of the work under this order, whether changed or not changed by any such order, an equitable adjustment shall be made in the contract price or delivery schedule or both, and the order shall be modified in writing accordingly. Any claim by the Seller for adjustment under this clause must be asserted within thirty (30) days from date of receipt by the Seller of the notification of change, or within such additional time as the Buyer in its discretion may agree in writing. Any failure to agree with regard to any adjustments under this paragraph shall be subject to the "Disputes" paragraph hereof but nothing provided in this paragraph shall excuse the Seller from proceeding with the contract as changed.
- 6. DELAYS DAMAGES: Shall be governed by the clause set forth in Federal Acquisition Regulation (FAR) Part 52.249-8 entitled "Default" as the said clause may be amended and in effect on the date of this order.
- 7. CONTRACT TERMINATION: The Buyer may terminate this order in whole or in part by written or telegraphic notice to the Seller. Upon termination for any reason other than default or insolvency of the Seller, the rights of the Buyer and Seller shall be controlled by and settlement made in accordance with the provisions of the "Termination" clause appearing in part 52.249-1 of the Federal Acquisition Regulation, as the said clause may be amended and in effect on the date of this order (see "Note", paragraph 22).
- 8. NO WAIVER: The Buyer's acceptance of the goods and its subsequent use thereof shall not constitute a waiver of any improper materials or workmanship, or of delayed deliveries, or of the buyer's rights and remedies with regard thereto.
- 9. TAXES: Except as may be otherwise provided in this order, the prices specified herein include all applicable Federal, State and local taxes and duties in effect on the date hereof, but do not include any State or local sales, use or other tax directly applicable hereto, nor any other tax from which the Seller or this transaction is exempt. Upon request of the Seller, the Buyer shall furnish a tax exemption certificate or similar evidence of exemption with respect to any such tax not included in the prices stated herein. For the purpose of this clause, the date hereof shall be the date of the Sellers quotation, or if no quotation, the date appearing on this purchase order. All applicable taxes shall be separately stated or shown on the Seller's invoices submitted for payment.

10. PATENTS: The Seller shall protect and indemnify the Buyer and the Government from and against any and all claims, damages, judgments, costs, expenses and loss arising from the infringement or alleged infringement of any United States patent by the manufacture, delivery, use or disposal of the goods delivered hereunder, other than infringement by reason of the use thereof in combination with other goods or material or in the operation of any process in the event of any suit or proceeding for patent infringement, the Buyer shall promptly notify the Seller thereof and the Seller thereupon shall assume the defense of such suit or proceeding at its own cost and expense.

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- 11. ASSIGNMENT: No part of this order or any interest therein or claim thereunder shall be assigned, transferred or pledged by the Seller to any other party except as the Buyer may specifically authorize in writing. This order is assignable by the Buyer to the Government.
- 12. DISPUTES: Unless otherwise directed by the National Science Foundation (NSF) or otherwise specifically provided in this order, any controversy or claim arising out of or relating to this order, or the breach thereof, shall be settled by arbitration and in accordance with the rules of the American Arbitration Association and judgment upon the award rendered by the arbitrators may be entered in any court having jurisdiction thereof. Pending the final decision of any dispute under or in connection with this order that may arise prior to the completion of performance hereunder, the Seller shall diligently proceed with the performance of its undertakings.
- 13. OFFICIALS NOT TO BENEFIT: No member of or delegate to Congress shall be admitted to any share or part of this contract or to any benefit that may arise therefrom, but this provision shall not be construed to extend to this contract if made with a corporation for its general benefit.
- 14. EXAMINATION OF RECORDS:
  - (a) The Seller agrees that the Comptroller General of the United States and the National Science Foundation or any of their duly authorized representatives shall, until the expiration of three years after final payment under this order, have access to and the right to examine any directly pertinent books, documents, papers and records of the Seller involving transactions related to this order.
  - (b) The Seller further agrees to include in all its subcontracts hereunder a provision to the effect that the subcontractor agrees that the Comptroller General of the United States, the National Science Foundation or any of their duly authorized representatives shall, until the expiration of three years after final payment under this order, have access to and the right to examine any directly pertinent books, documents, papers and records of such subcontractor involving transactions related to the subcontract. The term "subcontract" as used herein excludes (1) purchase orders not exceeding \$10,000 or (2) subcontracts or purchase orders for public utility services at rates established for uniform applicability to the general public.
  - (c) Nothing in this order shall be deemed to preclude an audit by the U.S. General Accounting Office of any transaction under this order.
- 15. COVENANT AGAINST CONTINGENT FEES: The Seller warrants that no person or selling agency has been employed or retained to solicit or secure this order upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the Seller for the purpose of securing business. For breach or violation of this warranty the Buyer, at the request of the Government shall have the right to annul this order without liability or in its discretion the order price or consideration, or otherwise recover the full amount of such commission, percentage, brokerage or contingent fee.
- 16. EQUAL OPPORTUNITY: During the performance of this contract, the Seller agrees as follows:
  - (a) The Seller will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin. The Seller will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The Seller agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the government setting forth the provisions of the Equal Opportunity Clause.
  - (b) The Seller will, in all solicitations or advertisements for employees placed by or on behalf of the Seller, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex or national origin.
  - (c) The Seller will send to each labor union or representative of workers with which he has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Government, advising the labor union or workers representative of the Seller's commitments under this Equal Opportunity Clause, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.
  - (d) The Seller will comply with all provisions of Executive Order No. 11246, as amended, and of the rules and regulations of the Secretary of Labor.
  - (e) The Seller will furnish all information and reports required by Executive Order No. 11246, as amended, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the National Science Foundation and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

- (f) If the OFCCP determines Seller's noncompliance with the paragraph no. 16 (Equal Opportunity) or with any of the said rules, regulations, or orders, this contract may be canceled, terminated, or suspended, in whole or in part, and the Seller may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order No. 11246, as amended, and such other sanctions may be imposed and remedies invoked as provided in Executive Order No. 11246, as amended, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.
- (g) The Seller will include the provisions of paragraph (a) through (g) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order No. 11246, as amended, so that such provisions will be binding upon each subcontractor or vendor. The Seller will take such action with respect to any subcontract or purchase order as the National Science Foundation may direct as a means of enforcing such provisions, including sanctions for noncompliance: provided, however, that in the event the Seller becomes involved in, or is threatened with, litigation, with a Seller or vendor as a result of such direction by the contracting agency, the Seller may request the United States to enter into such litigation to protect the interests of the United States.
- 17. CONVICT LABOR: In connection with the performance of work under this order, the Seller agrees not to employ any person undergoing imprisonment except as provided by Public Law 18 USC 4082(c)(2) and Executive Order No. 11755, December 29, 1973.
- 18. COMPLIANCE WITH LAWS AND REGULATIONS: The Seller agrees to comply with all applicable Federal, State and local laws, including those applicable by reason of the fact that this order is issued under a cooperative agreement with the United States Government.
- 19. NOTICE OF LABOR DISPUTE: The Seller shall promptly notify the Buyer of any labor disputes which delay or threaten to delay the work hereunder.
- 20. MATERIALS AND PROPERTY FURNISHED:
  - (a) When Buyer furnishes materials, parts, tooling or other property, Seller's packing sheet and final invoice must contain this statement, "All materials, parts, tooling or other property furnished or acquired on this Purchase Order (except that which became normal industrial waste or was replaced at Seller's expense) have been furnished in the form of parts, unused material and tooling." Title and right of immediate possession of all materials and tooling furnished by the Buyer shall remain with the Buyer. If Buyer furnishes any material for fabrication hereunder, Seller agrees not to use any other material in such fabrication without Buyer's written consent. Buyer reserves the right to retain 10% of the total amount of Seller's invoices until all requirements of this clause have been fulfilled.
  - (b) Except as otherwise provided in this order, Seller shall return any Buyer or Government property furnished under this order in as good condition as when received, except for reasonable wear and tear for the utilization of the property in the requirements of this order.
- 21. EXTRAS: Except as otherwise provided in this order, no payment for extras shall be made unless such extras and the price thereof have been authorized in writing by the Buyer.
- 22. The following provisions of Federal Acquisition Regulations (FAR) are hereby incorporated and made part of this order by reference:
  - (a) Fair Labor Standards Act of 1938, as amended, (29 USC 201-219), FAR 52.222-41.
  - (b) Utilization of Concerns in Labor Surplus Areas, FAR 52.220-3.
  - (c) Utilization of Small Business Concerns, FAR 52.219-8.
  - (d) Notice and assistance regarding patent and copyright infringements, FPR 1-7.103-4.
  - (e) Walsh-Healy Public Contracts Act (41 USC 35-45), FAR 52.222-20.
  - (f) Affirmative Action for Veterans, FAR 52.222-35.
  - (g) Pricing of Adjustments, FPR Section 1-7.102-20.
  - (h) Contract Work and Safety Standards Act-Overtime Compensation,
  - (40 USC 327-333) FAR 52.222-4.
  - (i) Employment of the Handicapped, FAR 52.222-36.
  - (j) Clean Air and Water, FAR 52.223-2.
  - (k) Utilization of Women Owned Small Business FAR 52.219-13.

NOTE: References in clauses, cited in paragraphs 6, 7, and 22 to "Contracting Officer" or "the Government" shall be changed to read "Buyer", and "Contractor" shall be changed to read "Seller".

- 23. OCCUPATIONAL SAFETY AND HEALTH ACT: Seller agrees to comply with the provisions of the Occupational Safety and Health Act of 1970, and the standards and regulations issued thereunder. Seller certifies that all items furnished and all work performed hereunder will comply with said standards and regulations. Seller further agrees to indemnify and hold harmless Buyer for any loss, damage, fine, penalty, or any expense whatsoever as a result of Seller's failure to comply with the act and any standards or regulations issued thereunder.
- 24. TITLE TO MATERIAL AND SUPPLIES: Title to the materials and supplies purchased hereunder shall pass directly from Seller to Government at the point of delivery shown herein, subject to the right of AUI to inspect and reject, in accordance with the specifications and terms and conditions hereof.

Rev. 6/92