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July 1980

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DOE/SF/10499-T19 REV
(STMPO-212)

10 MWe Solar Thermal
Central Receiver Pilot Plant

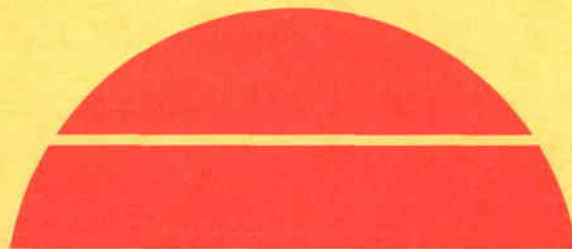
SOLAR FACILITIES DESIGN INTEGRATION

PLANT SUPPORT SUBSYSTEM
PROCUREMENT DOCUMENTATION
(RADL ITEM 7-44A)

UPDATE: AUGUST 1980
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WORK PERFORMED UNDER CONTRACT
DE-AC03-79SF10499

STEARNS-ROGER ENGINEERING CORP
4500 CHERRY CREEK DRIVE
P.O. BOX 5888
DENVER, CO 80217



U.S. Department of Energy



Solar Energy

10 MWe Solar Thermal
Central Receiver Pilot Plant

SOLAR FACILITIES DESIGN INTEGRATION

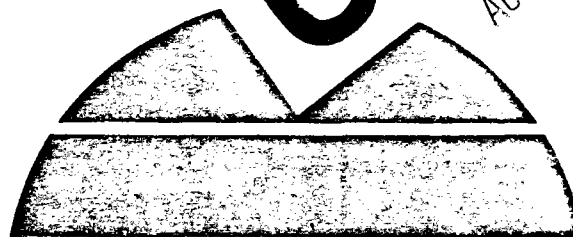
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Solar Energy

**10 MWe Solar Thermal
Central Receiver Pilot Plant
Solar Facilities Design Integration**

**PLANT SUPPORT SUBSYSTEM
PROCUREMENT DOCUMENTATION
(RADL ITEM 7-44A)**

July 1980

DISCLAIMER

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**STEARNS-ROGER ENGINEERING CORP
4500 CHERRY CREEK DRIVE
P.O. BOX 5888
DENVER, CO 80217**

**PREPARED FOR THE
U.S. DEPARTMENT OF ENERGY
SOLAR ENERGY
UNDER CONTRACT DE-AC-03-79SF10499**

PREFACE

This document is provided by McDonnell Douglas Astronautics Company (MDAC) in accordance with Department of Energy Contract Number DE-AC03-79SF10499, Reports and Deliverables List (RADL), Item 7-44A. The information contained was provided by Stearns-Roger Engineering Corporation under MDAC Subcontract Number 78012035.

The procurement documentation contained herein (purchase specification and purchase orders) are for those long lead materials necessary for the Collector Field Electrical Construction Package 11A.

This document is a partial submittal of all PSS Long Lead Hardware Procurement Documentation. Long lead material procured for the remaining construction packages, i.e., Construction Packages 9 and 11, will be submitted later.

Questions concerning this report should be directed to R. J. Perkins at (714) 896-3073.

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I SCOPE

This document contains the procurement documentation prepared by the SFDI (Stearns-Roger) for the long lead material required to be procured in support of the Collector Field Electrical Construction Package 11A for the 10 MWe Solar Pilot Plant being constructed at Daggett, California.

II PURCHASE SPECIFICATIONS

The purchase specifications included herein define the technical requirements for the specific long lead items to be procured. They represent the final specification as conformed for purchase. The hardware was grouped into four (4) categories for this procurement effort as follows:

- A. Heliostat Interface Load Interrupter Switchgear and Interface Control Cabinets, identified as Specification Stearns-Roger F233.3, DOE 40E500-3S, dated 26 February 1980 (for Purchase).
- B. 5000-Volt and 600-Volt Power Cable (Collector Field), identified as Specification Stearns-Roger F010.1, DOE 40E500-4S, dated 27 February 1980 (for Purchase), including Revision 1, dated 21 March 1980.
- C. Coaxial Cable (Collector Field), identified as Specification Stearns-Roger F010.2, DOE 40E500-8S, dated 13 March 1980 (for Purchase).
- D. Heliostat Power Centers, identified as specification Stearns-Roger F230.6, DOE 40E500-6S, dated 15 April 1980 (for Purchase).

The detail technical specification for each of these procurement packages are included in Appendix I.

III PURCHASE ORDERS

The purchase orders issued by Stearns-Roger for each of the procurement packages noted in Section II are included herein to provide a detailed listing of each procurement. As noted in each purchase order, the material is planned for direct delivery to the jobsite, i.e., 10 MWe Solar Pilot Plant, Daggett, California. A copy of the purchase order for each package is included in Appendix II

IV HARDWARE DELIVERY SCHEDULE

The need dates established for each of the various items of hardware is identified in the purchase specification and on the purchase orders. The SFDI has prepared and maintains a hardware delivery status log to track the subject hardware. This information is provided to STMPO and Townsend & Bottum, Inc., on a regular basis in order to maintain a current status with respect to projected on-site deliveries.

V REFERENCES

The material identified herein was referenced in the Technical Specifications as prepared by the SFDI for the Collector Field Electrical Construction Package 11A, which is identified as follows:

- ° Technical Specification DOE 40E500-2S, under cover of
SAN/0499-35, MDC G8173 (RADL Item 7-41), dated February 1980.

The above specification was included in the invitation for bid prepared by Townsend & Bottum, Inc., as follows:

- ° 10 MWe Solar Pilot Plant, Invitation for Bids,
TB-FB-96-80-JC50003, Collector Field Electrical, distributed
on 21 February 1980.

APPENDIX I

PURCHASE SPECIFICATIONS
FOR
COLLECTOR FIELD ELECTRICAL
CONSTRUCTION PACKAGE 11A

LONG LEAD MATERIAL

February 26, 1980
(For Purchase)

SPECIFICATION

S-R F233.3

D. O. E. NO. 40 E 500 - 3S

for

**HELIOSTAT INTERFACE
LOAD INTERRUPTER SWITCHGEAR
AND
INTERFACE CONTROL CABINETS**

for

10 MW_e SOLAR PILOT PLANT

SOLAR - ONE

DAGGETT, CA.

Prepared by:

Stearns-Roger
ENGINEERING CORP.

PROJECT NO. C-21700

SPECIFICATION FOR
HELIOSTAT INTERFACE LOAD
INTERRUPTER SWITCHGEAR
AND
INTERFACE CONTROL CABINETS

PROJECT NO. C-21700

10 MWe Solar Pilot Plant
Solar-One
Daggett, Ca.

Specification No. F233.3
STEARNS-ROGER ENGINEERING CORPORATION

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ADDITIONAL DOCUMENTATION REQUIREMENTS

Documentation shall be in accordance with Specification No. FJ50.50 and the following:

- A. Item 1A of Engineering Standard No. FJ60.60 shall include equipment weights.
- B. Item 1F of Engineering Standard No. FJ60.60 shall include:
Elementary Diagrams
- C. Item 1G of Engineering Standard No. FJ60.60 shall include:
 - a. Connection diagrams
 - b. Nameplate data

DETAILED SPECIFICATION
FOR
HELIOSTAT INTERFACE LOAD
INTERRUPTER SWITCHGEAR
AND
INTERFACE CONTROL CABINET

1. SCOPE

A. General

The equipment to be furnished and delivered shall consist of one (1) assembly of 5 kV Heliostat Interface Load Interrupter Switchgear, complete from incoming line terminals to outgoing feeder terminals and accessories as specified, and two (2) Heliostat Interface Control Cabinets as specified.

B. Definitions

Engineer: Shall mean Stearns-Roger Engineering Corporation.

2. SUPPLEMENTS

The following supplements are included with and form a part of this Specification.

A. Specification No. FJ50.50, Documentation, dated 11/3/76, 7 pages.

B. Engineering Standard No. FJ60.60, Documentation Requirements, dated 7/16/79, 1 page.

C. Engineering Standard No. JF18.15.02, dated 12/30/76, 1 page (Page 3)

D. Sketch No. SK-E46, One Line Diagram, dated 10/24/79, 1 page.

3. EQUIPMENT TO BE FURNISHED

Major components of equipment to be furnished under this Specification consist of the following:

A. One (1) outdoor, nonwalk-in, weatherproof type metal-enclosed load interrupter switchgear assembly with two (2) nonfused interrupter switch feeder units (cubicles), incoming line cubicle if required, main bus, and accessories specified or required for complete and operational switchgear.

B. Two (2) outdoor type, weatherproof interface control cabinets as specified herein.

C. Special tools and devices required for operation and maintenance.

4. EQUIPMENT AND SERVICES FURNISHED BY OTHERS

The following will be furnished by others:

- A. Receiving, unloading, installation, and field inspection and testing.
- B. Concrete foundation and anchor bolts for switchgear assembly.
- C. 5 kV power cable for incoming lines and outgoing feeders.
- D. 120-Volt, single-phase, 60 hertz power for space heaters.

5. OPERATING CONDITIONS

A. Environmental

The equipment furnished shall incorporate all features necessary for satisfactory operation under the following environmental conditions:

- a. Location: Outdoors
- b. Plant elevation above mean seal level: 1950 feet (13.72 psia).
- c. Ambient temperature range: 9 F to 117 F
- d. Seismic loads: The plant is located in Uniform Building Code Seismic Zone 3.

B. Service Conditions

The interrupter switches will be used to feed pad-mounted 4160-208Y/120 volt distribution transformers providing power to heliostats in the collector field. The switches will be used to provide power from an alternate 4160-volt, 1000 KVA power source in case of loss of normal power from a unit auxiliary transformer through 4160-volt switchgear circuit breakers.

In addition, the main bus will temporarily provide 4160-volt construction power to a pad-mounted, 4160-480 volts transformer.

6. DESIGN AND CONSTRUCTION

A. General

The equipment to be furnished hereunder shall have a service life of thirty (30) years. The equipment shall consist of essentially standard design and quality which meets or exceeds the requirements of this Specification. Materials shall be in accordance with ASTM requirements, be new and of first quality, and shall be free of all defects which could affect performance or service life of the equipment, or which would cause unsightly or unworkmanlike appearance.

The switchgear shall meet the requirements of ANSI C37.20 for metal-enclosed interrupter switchgear.

B. Codes, Standards and Regulations

All equipment specified herein shall be manufactured and tested in accordance with the latest applicable Standards and requirements of the following:

- a. ANSI - American National Standards Institute
- b. ASTM - American Society for Testing and Materials
- c. AWS - American Welding Society
- d. IEEE - Institute of Electrical and Electronic Engineers
- e. NEMA - National Electrical Manufacturers Association
- f. OSHA - Occupational Safety and Health Act
- g. UBC - Uniform Building Code

If there is a conflict between any of the requirements of this Specification and the requirements of the Williams-Steiger Occupational Safety and Health Act of 1970, Part 1910, "Occupational Safety and Health Standards," as amended, the state of California OSHA Standards and/or any other applicable statute, ordinance or code, then the requirement which is most stringent or has governing jurisdiction shall apply. Seller shall not be liable for factors which it has no control, e.g., incorrect installation, operation and maintenance.

C. Ratings and Design Features for Interrupter Switchgear

- a. Maximum design voltage, kV 5
- b. Nominal system voltage, kV 4.16
- c. Main Bus
 - (1) Continuous current rating, amperes 600
 - (2) In all other respects, the main bus shall have fault current ratings equal to or greater than the interrupter switches.
- d. Interrupter Switches
 - (1) Type Manually operated,
quick-make, quick-break
with stored energy
operation.

(2)	Maximum voltage rating, kV	5
(3)	Phase	3
(4)	Frequency, hertz	60
(5)	BIL, kV	60
(6)	Minimum continuous current rating, amperes	600
(7)	Minimum interrupting rating, amperes	600
(8)	Minimum momentary current rating, switch closed, 10 cycles, amperes asymmetrical	40,000
(9)	Minimum fault close current rating, amperes asymmetrical	20,000

e. Space Heaters

Interrupter switch enclosure space heaters shall be rated 230 volts and connected to operate on 120 volts ac. The 120 volt ac power will be supplied by others.

f. Cable Terminators

Power terminal connectors shall be the two (2) hole compression type suitable for the specified cable and shall be rated to carry the full load of the cable being terminated. The terminal connectors shall be located to give sufficient space for terminating 5 kV copper power cable conductors with ethylene propylene rubber. The terminal connections shall be capable of terminating cables as follows:

- (1) Incoming cables for connection to the main bus will be two (2) 350 MCM cables per phase.
- (2) Outgoing feeder cables for connection to each interrupter switch will be two (2) No. 2/0 AWG cables per phase.

g. Structures

- (1) The metal-enclosed switchgear shall consist of an assembly of individual, dead-front, free-standing, vertical, sheet-metal structural units. Each unit enclosure shall contain an interrupter switch. The switchgear assembly enclosure shall be of the outdoor, weatherproof, nonwalk-in type.

- (2) Each interrupter switch unit enclosure shall have a formed sheet-metal, hinged door interlocked with the switch so that the door must be closed before the switch can be closed. Means shall be provided for padlocking the door and interrupter switch to prevent unauthorized opening or closing. A high impact type inspection window with safety barrier as required shall be provided for viewing the switch contacts.
- (3) The main horizontal bus compartment shall be located at or near the top of the switchgear assembly. The entire bus and unit structure shall be constructed and braced to withstand short circuit stress equal to the momentary current rating of the interrupter switch.

h. Buses

- (1) Buses shall be high conductivity copper or aluminum and shall be sized for the rated continuous and momentary currents within allowable temperature rise. Bus joints shall be all welded or high pressure bolted. For bolted aluminum bus joints, silver-plated copper ring bolt holes, flash butt welded to the bus, are preferred. All bolted joints shall be silver or tin surfaced. Bolted unplated aluminum bus joints are not acceptable. Bolts shall be nonmagnetic, where required, and of corrosion-resistant material. Belleville type spring washers shall be used on all aluminum-to-aluminum bus joints made up with nonaluminum bolts.
- (2) Insulating barriers shall be provided where main bus passes from one unit to another.
- (3) A continuously silver-plated copper ground bus extending the entire length of the switchgear assembly shall be furnished in accordance with the applicable Standards, and shall be furnished with a compression-type terminal at each end for No. 4/0 AWG external cable connections. The ground bus shall be accessible from each cable compartment without removing or going through any barriers. The minimum size of the ground bus shall be 1 inch by 1/4 inch. The ground bus shall have a momentary current rating not less than the momentary current rating of the main bus. The ground bus splice joints shall not be coincident with bolts which support the bus. Bolted connections to the ground bus shall be separate from the support and splice joint bolts.

i. Basis of Temperature Rise

The total temperatures of the buses, insulating materials and the cable connections in the enclosed assembly shall not exceed the limits specified in ANSI C37.20, as last revised, for the

environmental conditions specified. The temperature rise of noncurrent carrying parts of the structure shall not increase the temperature rise of the current carrying parts specified above. The temperature rise of other devices which may be used as a part of the switchgear shall not exceed that permitted by the applicable Standards for the device.

j. Insulation

Insulation used in the switchgear and interrupter switches shall be selected to ensure continuity of service under the specified service conditions. The insulation shall have maintained dielectric strength under conditions of high humidity, temperature and aging and shall have high resistance to tracking, high flame retardance, low moisture absorption, high mechanical strength and dimensional stability. Porcelain insulation shall be used wherever practicable, but consideration will be given to glass polyester and epoxy compounds having proven characteristics.

k. Cable Terminating Compartments

The cable terminating compartments shall be located within the supporting structure and shall provide adequate space for installing and terminating the power cables. Cable entrance shall be from the bottom for incoming and outgoing cables. If required, an incoming line cubicle shall be provided.

l. Kirk Key Interlocks

Kirk Key interlocks shall be provided in accordance with Sketch No. SK-E46 and as follows:

- (1) Key interlock units shall be installed for the two interrupter switches for locking both switches in the open position when either or both feeder circuit breakers in the 4160-volt metal-clad switchgear are being used to feed the collector field distribution transformers.
- (2) Two (2) key interlock units, each including a double-pole auxiliary switch, shall be furnished unmounted to be installed by others at the two feeder circuit breakers in the 4160-volt metal-clad switchgear. The key interlocks shall provide for locking both circuit breakers in the open position before either of the two interrupter switches can be closed.
- (3) Two (2) sets of the required keys shall be provided for the key interlocks.

D. Interface Control Cabinets

The two (2) interface control cabinets furnished by the Seller shall be as follows:

- a. The cabinets shall each consist of a standard single-door, wall-mounted NEMA Type 4 enclosure and shall be a Hoffman Catalog No. A-36H30BLB enclosure with a Hoffman A-36P30 panel, or Engineer-approved equal. Terminal blocks shall be General Electric Company Type CR-151B, or Engineer-approved equal. Enclosure dimensions, number of terminals, and number and mounting of terminal blocks shall be as shown for Item 9 of Engineering Standard No. JF18.15.02. Interior finish shall be white enamel. Exterior finish shall be as specified in Paragraph PAINTING hereinafter to match the interrupter switchgear.
- b. The cabinets shall be furnished unmounted and without provisions for conduit entrance.
- c. The cabinets shall each be furnished with a 1-inch by 3-inch nameplate as specified in Paragraph NAMEPLATES hereinafter.

7. NAMEPLATES

- A. Nameplates shall be furnished for the front of each switchgear unit, for the switchgear assembly, and for the interface control cabinets. Nameplates shall be subject to approval by the Engineer and as specified on Sketch No. SK-E46 attached as a supplement.
- B. Nameplate material shall be 1/16-inch thick black and white laminated phenol resin. The engraving shall extend through a semimatte black surface to give white letters of adequate readability. Size of letters and figures shall be approximately 1/8 inch for component nameplates and 7/16 inch for switchgear unit and interface cabinet nameplates. Gothic letters shall be furnished with a weight to height ratio of 1 to 8. Switchgear unit nameplates shall be 1 inch high and 3 inches wide. The switchgear assembly nameplate shall be 1-1/2 inches high by 6 inches wide with 3/8 inch letters. Nameplate mounting screws shall be of the pan-head, self-tapping type.

8. FACTORY TESTS

- A. The switchgear shall be completely assembled in the factory and subjected to all routine tests. The interrupter switches and operating parts shall be completely adjusted for proper operation.
- B. The buses and interrupter switches shall undergo a one-minute, 60-hertz dielectric withstand test.

9. PAINTING

Steel surfaces shall be thoroughly cleaned by a phosphatizing process, followed by one coat of rust-resistant primer and one coat of finish color paint. Preferred finish color is light gray, ANSI Z55.1 No. 70. Extra paint shall be provided for field touch up.

10. SPECIAL TOOLS AND DEVICES

One (1) complete set of new and unused special tools and devices required for operation and maintenance of the equipment shall be furnished and delivered with the equipment, in a separate container clearly identified with the name of the equipment.

11. PREPARATION FOR SHIPMENT

- A. The equipment shall be shipped to the jobsite in the smallest practical number of shop fabricated and assembled sections.
- B. Each section shall be sealed to prevent entrance of water and dust during shipment. Each box, crate and shipping section shall be marked for identification and to indicate contents to permit orderly field assembly.
- C. Openings and terminal connections shall be protected by covers or wood guards. Wherever applicable, parts shall be factory boxed, crated or otherwise suitably prepared to prevent shipping and weather damage.
- D. Each assembly of switchgear units shipped as a section shall be provided with a suitable means for lifting the complete section.

12. GUARANTEES

- A. The Seller shall guarantee that the equipment furnished conforms to the requirements set forth and to the specified Codes, Standards and Regulations and that all specified tests have been satisfactorily completed.
- B. The foregoing shall not be construed in any way to limit or negate any other standard guarantee or portion thereof which may provide a more comprehensive guarantee than those required by this Specification.

13. SCHEDULE

Delivery shall be as follows:

6/5/80

EQUIPMENT BID DATA

NAME OF BIDDER

Powell Elect. Mfg. Co.

In addition to other data and descriptive material furnished with Bidder's Proposal, Bidder shall fill in all spaces of the following Bid Data Section:

1. WEIGHTS, POUNDS

- A. Complete interrupter switch feeder unit with interrupter switch 1,000
- B. Complete load interrupter switchgear assembly 2,000
- C. Interface control cabinet, each 130
- D. Heaviest shipping section 2,000

2. DIMENSIONS, INCHES

- A. Interrupter switch feeder unit, h x w x d 101" x 40" x 60"
- B. Load interrupter switchgear assembly
 - a. Maximum length 80"
 - b. Maximum height 101"
 - c. Maximum depth 60"

3. COMPONENT INFORMATION

- A. Interrupter switch manufacturer Westinghouse
- B. Terminal block manufacturer G.E.

4. BUS INFORMATION

- A. Bus Material Copper
- B. Type of bus plating (if any) Silver

EQUIPMENT BID DATA (CONTD)

5. SPECIAL TOOLS

List all special tools required and included for operation, maintenance and repair of the equipment.

NONE

Stearns-Roger

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Project No. C-21700

Spec. No. FJ50.50

November 3, 1976

SPECIFICATION

NO. FJ50.50

FOR

DOCUMENTATION

FOR

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STEARNS-ROGER ENGINEERING CORP.
DENVER, COLORADO

PROJECT NO. C-21700

Project No. C-21700Spec. No. FJ50.50DOCUMENTATION1. SCOPE

- A. This Specification outlines the requirements for, and the procedures associated with, the preparation and exchange of documentation for the work, equipment and/or materials specified in the Contract or Specification to which this Specification is a supplement.
- B. This Specification supplements requirements in Engineering Standard No. FJ60.60.
- C. This Specification also supplements requirements, where specified, in Paragraph DOCUMENTATION of the Contract or Specification to which this Specification is a supplement.
- D. This Specification and supplementary references specified in the foregoing paragraphs cover minimum requirements for documentation and are not intended to limit the amount of additional documentation which may be required for the engineering coordination, use or maintenance of the work, equipment and/or materials being furnished. Such additional documentation shall be provided by Seller or Contractor.
- E. All references to "Seller" herein shall apply to Seller or Contractor. All references to "Buyer" herein shall apply to the Buyer or the Owner. All references to "Engineer" herein shall apply to Stearns-Roger Incorporated.

2. TYPE, QUANTITIES AND QUALITY OF COPIES

The type and quantities of copies for required documentation are specified on Engineering Standard No. FJ60.60. Quality requirements shall be as follows:

A. Reproducible Drawings

All reproducible drawings submitted to Engineer shall be furnished on ozalid vellum, auto-positive vellum or Mylar, black line on vellum, or other Engineer-approved medium, each to be suitable for legible reproduction by the diazo copy process. Reproducible drawings shall be rolled, not folded, and enclosed in mailing tubes when mailed to Engineer or otherwise handled.

B. Prints

Where designated by the word "Prints" on Engineering Standard No. FJ60.60, it shall be understood to mean suitable "blueline print/copy," "blueprint," or other Engineer-accepted reproduction of an original Seller-prepared tracing or sepia.

Project No. C-21700Spec. No. FJ50.50**2. TYPE, QUANTITIES AND QUALITY OF COPIES (CONTD)****C. Other Documentation**

Where designated by the word "Copies" on Engineering Standard No. FJ60.60, applicable documentation shall be submitted on legible, black on white, 8-1/2-inch by 11-inch pages.

3. DOCUMENTATION BY SELLER**A. General**

- a. Required types of documentation are specified on Engineering Standard No. FJ60.60. Where this Standard does not fully describe individual categories of documentation that are required, such detailed categories are specified in Paragraph DOCUMENTATION of the Contract or Specification to which this Specification is a supplement.
- b. Where equipment for Units 1 and 2 is identical, or where equipment is common to Units 1 and 2, one (1) set of documentation shall be furnished. If equipment is identical, Seller shall certify, on each document, that it is applicable to both Units 1 and 2. Where equipment is neither identical nor common to Units 1 and 2, two (2) complete, individual sets of documentation shall be furnished, appropriately identified.
- c. The title block of each drawing shall denote the applicability of the drawing either to "Unit 1," "Unit 2" or "Units 1 and 2." Other documentation submitted by Seller shall carry similar identification.
- d. The following information shall be included in each drawing:
 - (1) Buyer's Name.
 - (2) Engineer's Project Number.
 - (3) Plant or station name.
 - (4) Unit number (if applicable).
 - (5) Buyer's Purchase Order Number.

Other documentation submitted by Seller shall carry similar identification.

- e. Unless specifically approved by the Engineer, "typical" or "similar" documentation is not acceptable for review.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)A. General (Contd)

- f. "Standard Hardware Items" are defined as standard commercial items, such as air and hydraulic cylinders and operating valves, gear reducers, small motors, instruments, etc. For such items, review drawings are not required. Certified sheets showing exact mounting dimensions, overall dimensions, cross-sectional arrangement, parts nomenclature and material designation shall be submitted. Details of parts shall be furnished when requested by Buyer.
- g. Within 30 days after written notice of award, Seller shall submit a complete Definitive Drawing List, by drawing and title, of all drawings that will be submitted to Engineer. On this list, each drawing shall be identified by its appropriate category as defined in Items 1 or 2 on Engineering Standard No. FJ60.60, and as supplemented in Paragraph DOCUMENTATION of the Contract or Specification. Any drawing that does not fall under these predefined categories shall be identified on the list as "Miscellaneous." This list shall include proposed submittal dates for each drawing. This drawing list and schedule, together with any subsequent modifications, shall be subject to Engineer's review and comments.

B. Progress Reports

Seller shall furnish Engineer monthly progress reports and schedule status reports. These reports and schedules shall cover the complete status and progress of engineering, documentation, fabrication, materials, labor and shipment.

C. Review and Comment

- a. Entries in the column "WEEKS AFTER AWARD" on Engineering Standard No. FJ60.60 designate maximum time spans for Seller's submittal of documentation for review after the date of Buyer's written notification of award, whether such notification be in the form of a Purchase Order, a Letter of Intent or similar written authorization.
- b. All documentation to be certified and submitted by Seller for interface coordination shall show sufficient details of design so that the Engineer may proceed with his overall project design where interrelated with Seller's design.
- c. All documentation submitted in the correct and complete form to Engineer for his review and comment will be processed and a copy sent to Seller within 5 weeks after receipt of Seller's submittal. If more than 5 weeks review time is necessary, Engineer will advise Seller in writing as to his review schedule for such data. Seller shall then advise Engineer in writing what effect the extended review schedule has on the scheduled delivery of Seller's materials and equipment.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)C. Review and Comment (Contd)

- d. Drawings and data will be returned to Seller marked either "REVIEWED/NO COMMENTS," "REVIEWED/SEE COMMENTS" or "REVISE PER COMMENTS AND RESUBMIT FOR REVIEW."
- e. When the documentation is returned marked "REVIEWED/NO COMMENTS" or "REVIEWED/SEE COMMENTS," final certified submittals incorporating the noted changes shall be furnished, unless otherwise authorized by Engineer in writing, within 3 weeks from the time of receipt of copy by Seller or at least 3 weeks before the scheduled delivery of Seller's work, whichever is earlier. Where Engineering Standard No. FJ60.60 stipulates that drawing review is required before release for fabrication, "REVIEW/SEE COMMENTS" shall constitute such release.
- f. When the documentation is returned marked "REVISE PER COMMENTS AND RESUBMIT FOR REVIEW," the documentation with the noted revisions incorporated shall be resubmitted for review and comment within 3 weeks from the time of receipt of copy by Seller. The review and comment and final submittal schedule shall be as specified in Sub-paragraphs 3.C.c. and 3.C.e. above.
- g. The documentation submittal schedules shall be adhered to by Seller, unless otherwise authorized by Engineer in writing. In any case, final submittals shall be furnished at least 3 weeks before the scheduled delivery of Seller's work.
- h. When reviewed information is subsequently revised by Seller, or is subsequently found to be deficient because of Seller's error or omission, additional Seller submittals shall be made to Engineer as developed. Any Engineer's design changes and any changes in equipment or construction by others which are required to make such subsequent revisions an integral part of the overall project shall be made at Seller's expense.
- i. Fabrication or shipment shall be at Seller's risk, whether or not Engineer has reviewed Seller's drawings as specified on Engineering Standard No. FJ60.60.
- j. Seller will be notified of review by a stamped copy of Stearns-Roger Form 02.145 or TRMSR05A stating "Supplier: As to all Drawings/Data listed on this transmittal: PROCEED TO FABRICATE." All Seller drawings which are submitted as final shall be stamped "Final." Where specified on Engineering Standard No. FJ60.60, final drawings shall be certified for construction.
- k. Neither review of, nor comment or revision on drawings by Engineer relieves Seller or Contractor from compliance with Specifications or with all other requirements of Purchase Order or Contract, nor shall the procedures outlined herein be cause for delay of equipment deliveries, except as otherwise specified herein.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)C. Review and Comment (Contd)

1. Notations made during the review of drawings shall not be construed to authorize contractual changes in price or delivery of equipment or materials furnished by Seller. If the scope of work has been changed as a result of such notations, Seller shall request a change in Purchase Order price and/or delivery date(s). Seller shall make the request in writing to Engineer before proceeding with the work.

D. Operation and Maintenance Manualsa. General

- (1) Seller shall furnish Operation and Maintenance Manuals which shall be complete for all equipment and systems furnished by Seller and by Seller's suppliers. Any differences between equipment supplied for Unit 1 and Unit 2 with regard to operation and maintenance shall be clearly defined in these Manuals.
- (2) Manuals shall be forwarded four (4) weeks prior to complete delivery of equipment in accordance with Engineering Standard No. FJ60.60.
- (3) If the publication of a subassembly manufacturer does not contain a complete operation, maintenance and parts breakdown meeting the intent of this Specification, then it shall be the responsibility of Seller to include such information in the Operation and Maintenance Manual.
- (4) All necessary precautions and warnings relative to the safety of life and equipment shall be included.

b. Operation

As a minimum, the Operation Section of the Manual shall contain the following:

- (1) Starting instructions, including, as applicable, instructions for initial startup, normal starting, starting after overhaul and startup after emergency trip.
- (2) Operating instructions, including trouble-shooting procedures.
- (3) Shutdown instructions, for both normal and emergency shutdown.
- (4) Design data for all equipment and systems, specifying horsepower, kilowatts, voltage, amperage, pressure, temperature, revolutions per minute, flow, etc.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)D. Operation and Maintenance Manuals (Contd)c. Maintenance

As a minimum, the Maintenance Section of the Manual shall contain the following:

- (1) Disassembling and reassembling instructions.
- (2) Preventive maintenance and lubrication information.
- (3) Description and identification of special maintenance tools.
- (4) Settings, clearance and adjustment data.

d. Parts Breakdown

The Parts Breakdown Section of the Manual shall contain:

- (1) A list of replacement parts, including drawings and data for all equipment assemblies and subassemblies. The material shall cover all information required for ordering replacement parts such as part name, part number, equipment serial number, supplier, address and normal delivery time.
- (2) Complete instructions for procuring replacement parts. Recommended forms for tabulating replacement part information and instructions for returning material to the factory shall also be included. Special storage, handling or packaging procedures required for any particular parts shall be noted.

E. Bills of Material

Detailed Bills of Material are required to facilitate identification by constructors of the items received. Shipment, therefore, shall be preceded by submittal of Bills of Material in accordance with Engineering Standard No. FJ60.60, Item 4 C.

4. DRAWINGS BY ENGINEER

- A. For applicable equipment, prints of drawings prepared by Engineer for use by others in constructing foundations, building components and major piping and wiring requiring coordination with the work associated herewith will be furnished to Seller for review as soon as possible after Engineer's receipt from Seller of the certified equipment drawings and design information necessary for their preparation.
- B. Where material, locations, etc., are marked HOLD on Engineer's Drawings, that material, location, etc., shall not be detailed or fabricated by Seller until the HOLD is removed by Engineer.

Project No. C-21700
Spec. No. FJ50.50

4. DRAWINGS BY ENGINEER (CONTD)

- C. Within 30 calendar days after the date of transmittal to Seller, Seller shall return to Engineer two (2) copies of each of these drawings marked to indicate Seller's review thereof either without change, or with any corrections or necessary changes clearly marked thereon in red or other contrasting color.
- D. After making such corrections or changes as shown on the review copies returned by Seller, Engineer will release these drawings for construction. Subsequent changes or corrections to foundations, building components, wiring or piping fabricated or installed in accordance with drawings corresponding to the review copies approved by the Seller, such changes having been necessitated by Seller-initiated modifications, shall be done in a manner satisfactory to Buyer and at Seller's expense.

5. TRANSMITTALS

When transmitting documentation, Seller shall:

- A. Prepare original and four (4) copies of transmittal letters to accompany each submittal of documentation. Drawing transmittal letters shall identify the purpose of the transmittal (drawings for review, revised drawings, final drawings), the piece of equipment or material involved, and shall list the drawing numbers with applicable revision numbers or dates.
- B. Identify each letter and parcel with Buyer's Project Name, Engineer's Project Number, Purchase Order Number and Seller's Shop Order Number, and transmit it by air mail or first class mail. Each parcel shall contain an enclosed copy of the transmittal letter.
- C. Stamp each document to be submitted with reproduction date and purpose of the transmittal, e.g., "For Review," "Revised," "Final," etc.

6. SPECIAL CONSIDERATIONS

- A. It is understood that upon delivery of Seller's documentation without any restrictive notations concerning such work, they shall become Buyer's property and may be used in any manner desired for obtaining replacements, repairs and spare parts.
- B. Seller's final invoice will not be paid by Buyer until all materials and/or equipment governed hereunder have been received complete at the delivery point, and final certified submittals of all specified documentation have been received by Engineer.

DIVISION USAGE						STEARNS-ROGER ENGINEERING STANDARD		STANDARD NUMBER	
MM	P	PP	SH	FI	SP			FJ 60.60	
APPROVALS: Des. Sec. <i>[Signature]</i> Sect. Supv. <i>[Signature]</i> Div. <i>[Signature]</i>						DOCUMENTATION REQUIREMENTS PROJECT: SOLAR ONE CONTRACT/REQUISITION NUMBER: F233.3 TITLE: HELIOSTAT INTERFACE LOAD INTERRUPTER SWITCHGEAR AND INTERFACE CONTROL CABINET		C-21700 ISSUED 7/16/79 REVISED	
TYPE OF DOCUMENTATION		TYPE OF COPIES	FOR REVIEW		FINAL		REVIEW REQ'D BEFORE FAB.**	CTFY. FINAL ISSUE ***	
			NO. OF COPIES	WEEKS AFTER AWARD*	NO. OF COPIES	"X" IF REQ'D			
<u>1-ENGINEERING DRAWINGS</u>		Repro-ducibles	4		4				
A-Outline, General Arrangement and Principal Dimensions		Prints	8	4	8	X	X	X	
B-Cross Sections									
C-Foundation Requirements, including Loadings & Anchoring Locations				4		X	X	X	
D-Physical Locations of Piping and/or Wiring Terminals				4		X	X	X	
E-Control Diagrams				4		X	X	X	
F-Electrical Schematic Diagrams				4		X	X	X	
G-Wiring Diagrams, Including Internal External and Interconnecting				4		X	X	X	
H-Standard Hardware Items				4		X	X	X	
<u>2-ERECTION OR INSTALLATION INFO.</u>		Repro-ducibles	4		4				
A-Shop Fabrication Drawings		Prints	8		8				
B-Erection or Installation Drawings				4		X		X	
C-Erection or Install. Instructions		Copies		4		X		X	
<u>3-SPECIAL DOCUMENTATION</u>									
A-Performance Data, including Curves		Copies			8	X		X	
B-Design Calculations		Copies							
C-Test Reports		Copies			8	X		X	
D-Code Papers and Certificates		Copies							
E-Shop Fab. and/or Welding Proced.		Copies							
F-Shop Fabrication Reports		Copies							
G-Welder's Qualification Reports		Copies							
H-Operating Certificates		Copies							
<u>4-MISCELLANEOUS</u>									
A-Operation and Maintenance Manuals		Manuals			8	X	(See FJ50.50 Para.3.D.a.(2))		
B-Recommended Spare Parts List for 1 Year's Operation, with Unit Prices		Copies			8	X		X	
C-Bills of Material		Copies			8	X#		X	
D-Definitive Drawing List		Copies			See FJ50.50, Para.3.A.g.				
*-Entries in the column "WEEKS AFTER AWARD" designate which types of review documentation are required. Blank spaces in this column denote that review documentation is not required. **-"X" in this column means drawing review req'd. before fabric. release. ***-"X" in this column means final issue must be certified for construction. #-At least 2 weeks before each shipment, detailed Bills of Material shall be sent to the plant site, c/o Stearns-Roger Resident Engineer, with 3 copies to Stearns-Roger Denver Office. This form supplements requirements, where specified, in Paragraph DOCUMENTATION in the Specification, and in Specification FJ50.50.								EXCEPT WHERE OTHERWISE SPECIFIED, SEND ALL DOCUMENTATION TO: Stearns-Roger Engineering P.O. Box 5888 Denver, Colorado 80217 Attn: Mr. R.K. Brushel	

DIVISION USAGE					
MM	P	PP	SH	FI	SP
X					

Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JF 18.15.02

PAGE 3 OF

APPROVALS
Des. Sect. *[Signature]*
Sect. Supv. *[Signature]*
Div. *[Signature]*

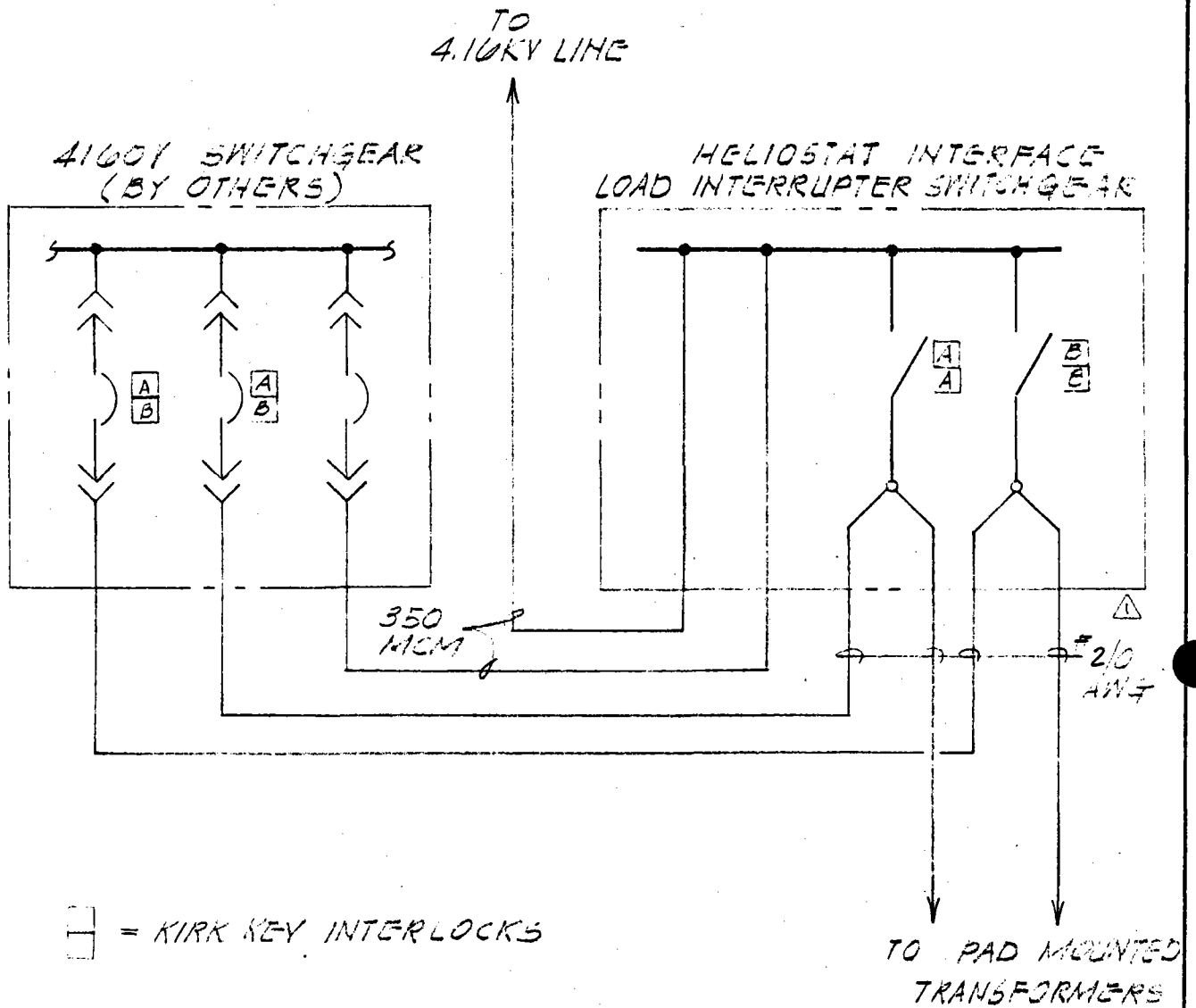
CONDUIT PLAN
JUNCTION BOXES

ISSUED 12/30/76
REVISED

NO OF TERMINALS		72			
FRONT VIEW					
		ITEM 9	ITEM 10	ITEM 11	ITEM 12
BOX	HEIGHT	36"	6"		
	WIDTH	30"	6"		
	DEPTH	8"	4"		
TERM BLK'S	NO	6-12 PT	1-4 PT		
NO OF TERMINALS					
FRONT VIEW					
		ITEM 13	ITEM 14	ITEM 15	ITEM 16
BOX	HEIGHT				
	WIDTH				
	DEPTH				
TERM BLK'S	NO				

Stearns-Roger

ELECTRICAL DEPARTMENT



NAMEPLATES:

1. JUNCTION BOX NAMEPLATES SHALL READ "COLLECTOR FIELD INTERFACE CONTROL CABINET A (B)"
2. SWITCHGEAR NAMEPLATE SHALL READ "HELIOSTAT INTERFACE LOAD INTERRUPTER SWITCHGEAR".
3. LEFT SWITCH CUBICLE SHALL READ "FEEDER NO. 1".
4. RIGHT SWITCH CUBICLE SHALL READ "FEEDER NO. 2".

NOTES:

SERVICE: ONE LINE DIAGRAM

DATE OCT 24, 1979

STATION:

ORDER NO C-21700

LAST REV 1/14/80 JRD

10 MW₂ SOLAR PILOT PLANT
DAGGETT, CALIFORNIA

SK-E46

February 27, 1980

(For Purchase)

Rev. 1 March 21, 1980

Rev. 2 August 28, 1980

SPECIFICATION

S-R F010.1

D.O.E. NO. 40 E 500 - 4 S

for

**5000 - VOLT AND 600 - VOLT
POWER CABLE
(COLLECTOR FIELD)**

10MW_e SOLAR PILOT PLANT

SOLAR - ONE

DAGGETT, CA.

Prepared by:

Stearns-Roger
ENGINEERING CORP.

PROJECT NO. C-21700

August 28, 1980

REVISION NO. 2

TO

PURCHASE SPECIFICATION S-R F010.1

D.O.E. NO. 40E500-4S

FOR

5000-VOLT AND 600-VOLT
POWER CABLE
(COLLECTOR FIELD)

TO

NUNN-ROYAL ELECTRIC SUPPLY CO.

1. Revision No. 2, is issued to purchase an additional quantity of 4/C #8 cable under the terms of this specification.
2. Remove cover and replace with cover marked Revision No. 2 attached hereto.
3. Remove page DS-15. Replace with corresponding page attached hereto. Changes to this page are denoted by Change Number 2 in the right hand margin opposite the items which have been changed or added.

STEARNS-ROGER
ENGINEERING CORPORATION

PROJECT No. C-21700

March 24, 1980

REVISION NO. 1

TO

PURCHASE SPECIFICATION S-R F010.1

D.O.E. NO. 40E500-4S

FOR

5000-VOLT AND 600-VOLT
POWER CABLE
(COLLECTOR FIELD)

TO

NUNN-ROYAL ELECTRIC SUPPLY CO.

1. Remove cover and replace with cover marked Revision No. 1 attached hereto.
2. Remove page DS-15. Replace with corresponding page attached hereto. Changes to this page are denoted by Change Number 1 in the right hand margin opposite the items which have been changed or added.

STEARNS-ROGER
ENGINEERING CORPORATION

PROJECT No. C-21700

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SPECIAL INSTRUCTIONS

An asterisk has been placed in the right-hand margins to denote changes made to the "For Bid" specification. The subject changes were made to conform this document to awardee's proposal and subsequent updating and/or negotiations.

All further changes to this "For Purchase" document shall be made by the issuance of a numbered revised copy.

DETAILED SPECIFICATION
FOR
5000-VOLT AND
600-VOLT POWER CABLE

1. SCOPE

A. General

The materials to be furnished and delivered consist of the following:

- a. One (1) lot of 5000-volt shielded metal-clad power cable
- b. One (1) lot of 600-volt metal-clad and unarmored power cable

The above cable will be installed by others in the Collector Field of the 10 MW_e Solar Pilot Plant near Daggett, California.

B. Definitions

Engineer: Shall mean Stearns-Roger Engineering Corporation

2. SUPPLEMENTS

The following supplements are included with and form a part of this Specification.

- A. Specification No. FJ50.50, Documentation, dated 11/3/76, 7 pages.
- B. Engineering Standard No. FJ60.60, Documentation Requirements, dated 7/16/79, 1 page.
- C. (Deleted) *

3. MATERIALS TO BE FURNISHED

- A. The 5000-Volt shielded metal-clad power cable to be furnished shall be as follows:

<u>Description</u>	<u>Base Total Quantity, Feet</u>
3/C - No. 2/0 AWG with ground	10,000

B. The 600-volt power cable to be furnished shall be as follows:

a. 600-Volt Metal-Clad Power Cable

<u>Description</u>	<u>Base Total Quantity, Feet</u>	
2/C - No. 10 AWG with ground	12,000	*
4/C - No. 10 AWG	105,000	*
4/C - No. 8 AWG	4,000	*
4/C - No. 6 AWG	11,000	*
4/C - No. 4 AWG	16,000	*

b. 600-Volt Power Cable

<u>Description</u>	<u>Base Total Quantity, Feet</u>
1/C - No. 10 AWG	7,000

4. EQUIPMENT AND SERVICES FURNISHED BY OTHERS

All handling equipment and labor required to unload, install, connect, inspect and test the electrical cable in the field will be furnished by others.

5. OPERATING CONDITIONS

A. Environmental

The materials furnished shall be suitable for installation and shall provide satisfactory operation under the following environmental conditions:

- a. Plant elevation above mean sea level: 1950 feet (13.72 psia).
- b. Ambient temperature range: 9 F to 117 F.
- c. Soil pH range 9.0 to 10.0.
- d. Endemic pocket gopher (*Thomomys* sp.) population. *

B. Service Conditions

- a. The cable shall be capable of operating continuously without exceeding rated temperatures at rated current, and without deterioration of insulating, protecting and jacketing materials under the conditions specified.
- b. The metal-clad cable will be direct buried in earth or installed in rigid steel conduit or in PVC conduit. The 600-volt unarmored power cable will be installed in junction boxes located outdoors.

6. DESIGN AND CONSTRUCTION

A. General

- a. The cable to be furnished hereunder shall have a design life of thirty (30) years. The cable shall consist of the manufacturer's standard design and first line quality which meets or exceeds the requirements of this Specification.
- b. All cables shall be suitable for circuits operating in wet or dry locations and shall have a continuous temperature rating of 90 C. All power cable shall have an emergency overload temperature rating of 130 C for periods not to exceed 100 hours per year and a short-circuit temperature rating of 250 C.
- c. Codes and Standards

All cable specified herein shall be manufactured and tested in accordance with the latest applicable requirements of the following Codes and Standards:

- (1) AEIC - Association of Edison Illuminating Companies
- (2) ASTM - American Society for Testing and Materials
- (3) IEEE - Institute of Electrical and Electronic Engineers
- (4) ICEA - Insulated Cable Engineers Association, Inc.
- (5) NEC - National Electrical Code
- (6) NEMA - National Electrical Manufacturers Association
- (7) UL - Underwriters' Laboratories, Inc.

B. Construction

- a. Construction of the 5000-volt shielded metal-clad power cables shall be as follows:
 - (1) The cable conductors shall be copper; Class B concentric or compact stranded in accordance with ASTM B8. The individual strands shall be soft or annealed copper wire with tensile and electrical properties in accordance with ICEA S-68-516, Part 2.
 - (2) The cable shall be a three-conductor shielded metal-clad cable with two No. 2 AWG bare, stranded alloy coated copper ground wires included. *
 - (a) Each conductor shall have an extruded semiconducting shielding material in accordance with Paragraph 2.4. of ICEA S-68-516 except that the average thickness of the shield shall be 15 mils and the minimum thickness shall be 12 mils. The semiconducting conductor shield shall be free-stripping from the conductor.

- (b) The conductors shall be insulated with a heat, moisture, and corona resisting ethylene propylene (EPR) type elastomer compound. The average wall thickness of conductor insulation shall be 110 mils. The minimum thickness of insulation at any point shall be not less than 90 percent of the specified average thickness. Conductor insulation shall meet or exceed the electrical and physical requirements of Table I herein, ICEA S-68-516 and Paragraph A.3. of AEIC No. 6-75. The conductor insulation shall be inseparably bonded to the semiconducting conductor shield.
- (c) The conductors shall have a shielding material over the insulation. The shielding material shall consist of an extruded semiconducting compound with a volume resistivity not in excess of 50,000 ohms per centimeter when tested in accordance with Paragraph 6.24.3 of ICEA S-68-516. The thickness of the extruded semiconducting shield shall be in accordance with Table D1 of AEIC No. 6-75. Peel strength of the extruded shield from insulation shall be between 4 and 25 pounds per 0.5 inch width when tested in accordance with AEIC No. 6-75. The compound shall have a minimum elongation of 100 percent after an air oven test at 121 C for 168 hours and a brittleness temperature not warmer than minus 30 C. The words "Semiconducting Material - Remove When Splicing or Terminating" shall be clearly printed on the semiconducting material at close, regular intervals.
- (d) Each conductor shall have a metallic shield tape over the insulation shielding material. The metallic shield tape shall consist of helically wrapped tin-coated copper tape with a minimum thickness of 5.0 mils. The copper shield tape shall otherwise conform to Paragraphs 4.1.1. and 4.1.1.2. of ICEA S-68-516.
- (e) The individual conductors shall be cabled together with two No. 2 AWG stranded alloy coated copper ground wires and non-hygroscopic fillers and a binder tape overall. The cable shall have an overall, close-fitting, impervious, continuous, corrugated aluminum sheath, with a minimum thickness of 35 mils. A flame-resistant PVC jacket shall be applied over the aluminum sheath.

- (f) Cables shall be rodent resistant and shall be suitable for direct earth burial in accordance with NEC requirements.
- (3) The cable conductors shall be identified with a serial marker tape. The tape shall be placed over the extruded semiconducting material and under the copper shield tape. As a minimum, the information on the marker tape shall include the manufacturer and the year of manufacture number repeated at one foot intervals. The cable outer jacket shall be durably marked with the manufacturer's name, generic name of insulation, size of conductor, conductor material, rated voltage, year of manufacturer and sequential footage. This identification shall be repeated at regular intervals not exceeding 24 inches. Conductor phase identification shall be provided by color coding of individual conductors black, red and blue. Color coding shall be by permanently indelible colors, and shall be nonfading and color stable.
- b. Construction of the 600-volt power cables shall be as follows:
- (1) Conductors
- The conductors shall be stranded soft annealed copper wire. The tensile and electrical properties shall be in accordance with ASTM B33. The stranding shall be Class B in accordance with ASTM B8. The conductor resistance shall be in accordance with ICEA S-19-81, Paragraph 2.6.
- (2) Conductor Insulation
- (a) Material
- The conductor shall be insulated with a flame, heat, moisture and corona resisting cross-linked polyethylene compound. The insulation shall be free-stripping, shall conform to the applicable requirements of ICEA S-66-524 and shall have electrical and physical characteristics in accordance with Table II, herein.
- (b) Thickness
- The average insulation thickness shall not be less than specified in Table III. The minimum thickness at any one point shall not be less than 90 percent of the specified average thickness.

(3) 600-Volt Metal-Clad Power Cable

- (a) The 600-volt metal-clad power cable shall be constructed from stranded copper conductors Type MC individually insulated with cross-linked polyethylene. The two conductor cable shall include a stranded bare alloy coated copper ground wire equal in size to the two phase conductors. The four conductor cables shall not include a ground wire. The cable shall be assembled in accordance with Part 5 of ICEA S-19-81 using non-hygroscopic, flame retardant filler and binder tapes. The cable shall have an overall, close fitting, impervious, continuous, corrugated aluminum sheath. Sheath thickness shall be as required so that the conductivity of the sheath equals or exceeds the conductivity of the cable phase conductors. A flame resistant PVC jacket shall be applied over the aluminum sheath.
- (b) The cable shall be rodent resistant and be suitable for direct earth burial in accordance with NEC requirements.

(4) 600-Volt Power Cable

- (a) The 600-volt single-conductor power cable shall be constructed from a stranded copper conductor insulated with cross-linked polyethylene and with rated conductor temperature of 90 C (jacket not required).
- (b) Cable identification markings shall show manufacturer, number and size of conductors, voltage rating, temperature rating, cable/insulation type, and year of manufacture. Conductor phase identification shall be provided by color coding of individual conductors. Single conductor cable shall be black. The two conductor cables shall be color coded black and white. The four conductor cables shall be color coded black, white, red, and blue. Color coding shall be by permanently indelible colors, and shall be nonfading and color stable.

7. TEST REQUIREMENTS

A. 5000-Volt Power Cable

a. General

Test methods shall be in accordance with ICEA S-68-516, and AEIC No. 6-75.

b. Qualification Tests

Qualification tests shall be performed for the cable to show compliance with the electrical and physical requirements of Paragraph B. of AEIC No. 6-75, Items C.d. and C.f. of Table I herein.

c. Production Sampling Tests

Production sampling tests shall be performed to verify compliance with the electrical and physical requirements specified in Table I and in Paragraph E. of AEIC No. 6-75. These tests shall be performed on samples from cable purchased under this Specification. The number and length of samples to be taken shall be based on the quantity of cable purchased in accordance with Tables 6-1, 6-4 and 6-5 of ICEA S-68-516. The number of specimens to be prepared and tested shall be in accordance with Paragraph 6.52 of ICEA S-68-516.

d. Production Tests

Each length of completed cable shall be subjected to and shall pass the following tests.

(1) Partial Discharge Extinction Level Test

The cable shall be subjected to the Partial Discharge Extinction Level Test as described in Part 6 of ICEA S-68-516 and test results shall be in accordance with Paragraph 3.6.2.3 of ICEA S-68-516. In addition, the cable shall comply with Table F1 of AEIC No. 6-75 for Apparent Discharge Characteristic.

(2) Alternating Current Voltage Test

The cable shall be subjected to the Alternating Current Voltage Test as described in Paragraph 6.27.2 of ICEA S-68-516 and test results shall be in accordance with Table 3-1 of ICEA S-68-516.

(3) Insulation Resistance Test

The cable shall be subjected to the Insulation Resistance Test as described in Paragraph 6.28 of ICEA S-68-516. The cable shall show an insulation resistance of not less than that corresponding to a constant of 20,000 megohms per 1000 feet at 15.6 C (60 F) as required by Paragraph 3.6.2.2 of ICEA S-68-516.

(4) Direct Current Voltage Test

The cable shall be subjected to the Direct Current Voltage Test as described in Paragraph 6.27.3 of ICEA S-68-516 and test results shall be in accordance with Table 3-1 of ICEA S-68-516.

TABLE I
INSULATION PROPERTIES
ETHYLENE PROPYLENE RUBBER

A. Physical characteristics before aging:		
a. Minimum tensile strength, psi		700
b. Minimum elongation at rupture, percent		250
B. Physical characteristics after air oven aging of 7 days at 150 C:		
a. Minimum tensile strength, percent of unaged value		85
b. Minimum elongation at rupture, percent of unaged value		85
C. Accelerated water absorption, electrical method (EM-60) at 75 C:		
a. Dielectric constant after 24 hours, maximum		4.0
b. Increase in capacitance from 1 to 14 days, maximum		3.5
c. Increase in capacitance from 7 to 14 days, maximum		1.5
d. Dielectric constant after 52 weeks, maximum		5.0
e. Stability factor after 14 days, maximum		1.5
f. Stability factor after 52 weeks, maximum		1.2
g. Insulation resistance constant (K) after 52 weeks, minimum		4,000
D. Accelerated water absorption, Gravimetric Method:		
Absorption, mg per square inch, maximum		8.0
E. Insulation resistance constant at 60 F:		
K not less than		20,000
F. Cold bend per ICEA, 1 hour at minus 40 C		No cracks
G. Oxygen index per ASTM D2863, minimum		20

B. 600-Volt Power Cable

a. General

Test methods shall be in accordance with ICEA S-66-524 for cross-linked polyethylene insulated cable.

b. Performance Characteristics

- (1) Samples of completed cables shall be subjected to and pass a twenty-four (24) hour cold bend test at minus 25 C over an 8x mandrel followed by a wet voltage withstand test of 80 volts ac per mil.
- (2) Samples of completed cable shall be tested at elevated temperatures to demonstrate an extrapolated design life of 30 years continuous operation at 90 C.

c. Qualification Tests

Qualification tests shall be performed to verify compliance with the electrical and physical requirements specified in Table II, and above. These tests shall be performed on samples from cable purchased under this Specification. The number and length of samples to be taken shall be based on the quantity of cable purchased in accordance with Tables 6-1, 6-2 and 6-3 of ICEA S-19-81. The number of specimens to be prepared and tested shall be in accordance with Table 6-4 of ICEA S-19-81 except that the specified long term aging tests are required to be performed only once.

d. Production Tests

- (1) Production tests shall be performed on each complete length of cable.
- (2) On single conductor cables, the production tests shall consist of the following:

(a) Insulation Resistance Test

After not less than six hours immersion in water and while still immersed, an insulation resistance test shall be made on each cable. The insulation resistance constant (K) shall not be less than 40,000 when corrected to 60 F.

- (b) High Voltage AC Test *
- Immediately after the insulation resistance test above, and while still immersed, the cable shall withstand, without failure, a 5 minute ac test at the voltage specified in Table III. *
- (c) Conductor Resistance Test *
- The ac resistance shall be measured on each conductor and shall be in accordance with ICEA S-19-81, Paragraph 2.6. *
- (3) On multiconductor cables, the production tests shall consist of the following:
- (a) Preliminary Insulation Resistance Test
- Prior to the assembly of the cable and after not less than six hours immersion in water, an insulation resistance test shall be made on each conductor. The insulation resistance constant (K) shall not be less than 40,000 when corrected to 60 F.
- (b) Preliminary High Voltage AC Test *
- Immediately after the preliminary insulation resistance test and while still immersed, each conductor shall withstand without failure a 5-minute ac test at the voltage specified in Table III. *
- (c) Final Insulation Resistance Test
- After assembly of the cable is completed, a dry insulation test shall be performed on each conductor. The insulation resistance constant (K) shall not be less than 40,000 when corrected to 60 F.
- (d) Final High Voltage AC Test *
- Immediately after the insulation resistance test above, each conductor shall withstand without failure a 5-minute ac test at the voltage specified in Table III. *
- (e) Conductor Resistance Test *
- The ac resistance shall be measured for each conductor and shall be in accordance with ICEA S-19-81, Paragraph 2.6. *

TABLE II
INSULATION PROPERTIES
CROSS-LINKED POLYETHYLENE

A. Physical characteristics before aging:		
a.	Minimum tensile strength, psi	1800
b.	Minimum elongation at rupture, percent	300
B. Physical characteristics after air oven aging of 7 days at 150 C		
a.	Minimum tensile strength percent of unaged value	90
b.	Minimum elongation at rupture, percent of unaged value	90
C. Accelerated water absorption, electrical method (EM-60) at 75 C:		
a.	Dielectric constant after 24 hours, maximum	4.0
b.	Increase in capacitance from 1 to 14 days, percent, maximum	3.0
c.	Increase in capacitance from 7 to 14 days, percent, maximum	1.5
d.	Dielectric constant after 52 weeks, maximum	5.5
e.	Stability factor after 14 days, maximum	0.5
f.	Stability factor after 52 weeks, maximum	0.75
g.	Insulation resistance constant (K) after 52 weeks, minimum	5000
D. Accelerated water absorption, Gravimetric Method:		
	Absorption, mg per square inch, maximum	10
E. Insulation resistance constant (K) at 60 F:		
	Not less than	40,000
F. Cold bend per ICEA, 24 hours at minus 25 C (Mandrel diameter 8x), withstand, ac volts/mil		
		80
G. Oxygen index per ASTM D2863, minimum		
		22

*

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TABLE III
INSULATION THICKNESS AND
TEST VOLTAGES

600-Volt Power Cable

<u>Conductor Size</u>	<u>Insulation Thickness, Mils</u>	<u>AC Test Voltage, kV</u>	*
14 - 9 AWG	30	3.5	*
8 - 2 AWG	45	5.5	*

D. Certified Test Reports

Copies of complete certified test reports shall be furnished for all qualification tests and production tests made.

8. PREPARATION FOR SHIPMENT

- A. All cable shall be packaged on reels in such a manner that the cable will be protected for shipment and for outdoor storage. Each end of the cable shall be protected with watertight seals and shall be secured to the reel.
- B. All reels shall have heavy-duty wood lagging consisting of closely spaced boards held in place by nailing and by not less than two (2) steel bands circumferentially secured. The required clearance and bedding shall be provided between the outer layer of the cable and the inner surface of the wood lagging to prevent damage to the cable from crushing by impact up to the impact limits of the lagging.
- C. (Deleted) *
- D. The diameter of the reel flange shall not exceed 80 inches, unless special permission is granted by the Engineer to allow larger reels required by the cable length or construction.
- E. Each cable reel shall be marked on both flange sides with noncorrosive metal plates securely attached to the reel and legibly stating the Contract or Purchase Order Number, reel number, length of cable on the reel, number and size of conductors, voltage rating, temperature rating, gross shipping weight and net weight of the cable. A shipping tag containing the same information shall be attached to the outer end of the cable.

9. DOCUMENTATION REQUIREMENTS

- A. Prior to fabrication or delivery to the jobsite of materials to be furnished under this Specification, the Seller shall submit to the Engineer, for review and comment, the drawings and descriptive data called for in this Specification. Drawings and data submittals shall be in accordance with Specification No. FJ50.50 and Engineering Standard No. FJ60.60, both attached.

(STMPO requirements deleted) *

- B. Item 2C of Engineering Standard No. FJ60.60 shall include cable installation and application data, terminating instructions, maximum allowable pulling tensions and side-wall pressures, and minimum allowable bending radii.

10. GUARANTEES

- A. The Seller shall guarantee that the materials furnished conform to the requirements set forth herein and to the specified Codes and Standards, and that all required tests have been satisfactorily completed and passed.
- B. The Seller shall guarantee all physical and electrical properties tabulated in the Bid Data Section hereinafter.
- C. The foregoing shall not be construed in any way to limit or negate any other standard guarantee or portion thereof which may provide a more comprehensive guarantee than those required by this Specification.

11. SCHEDULE, REQUIREMENT DATES, AND LENGTHS

Cable Type	Reel Tag No.	Reel Length	Required at Destination Date	
5 kV, 3/C #2/0 Metal Clad with ground	1	2000'	June 15, 1980	1
	3	1200'	August 15, 1980	
	4	1200'	August 15, 1980	
	5	800'	August 15, 1980	
	6	800'	August 15, 1980	
	7	1000'	August 15, 1980	
	8	1000'	August 15, 1980	
	9	1000'	August 15, 1980	
	10	1000'	August 15, 1980	
	1/C #10, 600V	F1 thru F7	1000' ea	
2/C #10 with ground, 600V	A1 thru A6	2000' ea	July 7, 1980	
4/C #10, 600V	B1 thru B52	2000' ea	July 1, 1980	
	B53	1000'	July 1, 1980	
4/C #8, 600V	C1 and C2	1325' ea	April 1, 1980	2
	C3	1510'	April 1, 1980	
	C4	3140'	Sept. 26, 1980	
4/C #6, 600V	D1 thru D11	1000' ea	April 1, 1980	
4/C #4, 600V	E1 thru E7	1000' min.	April 1, 1980	

BID DATA

NAME OF BIDDER

Nunn-Royal

In addition to other data and descriptive material furnished with the Bidder's Proposal, Bidder shall fill in all spaces of the following Bid Data Section. The specifically listed data is in no way intended to limit the data submitted, and the Bidder is invited to submit any additional information he believes necessary to complete the description of his offering:

1. GUARANTEED PHYSICAL AND ELECTRICAL PROPERTIES (Okonite Cable)

	<u>Weight (lbs/ 1,000 ft)</u>	<u>Overall Cable Dia. (Inches)</u>	<u>Minimum Bend Rad. (Inches)</u>	<u>Maximum Pulling Force (Lbs)</u>	<u>Material Thicknesses</u>		
					<u>Insulation (Mils)</u>	<u>Metal Sheath (Mils)</u>	<u>Outer Jacket (Mils)</u>
A. Weights, dimensions and physical properties							
a. 5000-Volt Shielded Metal- Clad Power Cable (90 C)							
3/C - No. 2/0 AWG with ground	<u>3158</u>	<u>2.152</u>	<u>25.824</u>	<u>4259</u>	<u>115</u>	<u>25</u>	<u>60</u>
b. 600-Volt Metal- Clad Power Cable							
(1) 2/C - No. 10 AWG with ground	<u>263</u>	<u>.719</u>	<u>5.033</u>	<u>249</u>	<u>30</u>	<u>25</u>	<u>50</u>
(2) 4/C - No. 10 AWG	<u>325</u>	<u>.763</u>	<u>5.341</u>	<u>332</u>	<u>30</u>	<u>25</u>	<u>50</u>
(3) 4/C - No. 8 AWG	<u>477</u>	<u>.945</u>	<u>6.615</u>	<u>528</u>	<u>45</u>	<u>25</u>	<u>50</u>
(4) 4/C - No. 6 AWG	<u>640</u>	<u>1.033</u>	<u>7.231</u>	<u>839</u>	<u>45</u>	<u>25</u>	<u>50</u>
(5) 4/C - No. 4 AWG	<u>880</u>	<u>1.126</u>	<u>7.882</u>	<u>1335</u>	<u>45</u>	<u>25</u>	<u>50</u>
c. 600-Volt Power Cable							
(1) 1/C - No. 10 AWG	<u>40</u>	<u>.179</u>	<u>.716</u>	<u>83</u>	<u>30</u>	<u>N/A</u>	<u>N/A</u>

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BID DATA (CONTD)

NAME OF BIDDER

Nunn-Royal

B. Cable, insulation and jacket characteristics

5000-volt power cable

- a. Manufacturer Okonite
- b. Material description 5 KV Armored Cable
- c. Catalog description 5 KV Shielded CLX
- d. Continuous temperature rating, C 90
- e. Emergency overload temperature rating,
C/short circuit temperature
rating, C 130 / 250

<u>Insulation</u>	/	<u>Outer Jacket</u>
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- f. Physical characteristics before aging
 - (1) Tensile strength, psi 900 1500
 - (2) Elongation at rupture, percent 250 100
- g. Physical characteristics after air oven aging of 168 hours at 150 C for insulation and 168 hours at 100 C for jacket
 - (1) Tensile strength, percent retained 90 80
 - (2) Elongation at rupture, percent retained 85 70 (*)
- h. Accelerated water absorption (EM-60, 75 C)
 - (1) Dielectric constant after 24 hours 4.0
 - (2) Increase in SIC from 1 to 14 days percent 3.5

(*) After 7 days @ 121 Deg. C

BID DATA (CONTD)

NAME OF BIDDER

Nunn-Royal

(3)	Increase in SIC from 7 to 14 days, percent	<u>1.5</u>	
(4)	Stability factor after 14 days	<u>1.0</u>	
(5)	Dielectric constant after 52 weeks	<u>4.5</u>	
(6)	Stability factor after 52 weeks	<u>1.5</u>	
(7)	Insulation resistance constant (K) after 52 weeks	<u>7500 (*)</u>	
i.	Accelerated water absorption (Gravimetric Method)	(*) SIR after 52 weeks @ 75 deg. C	
	Water absorption, mg per square inch	<u>5.0</u>	
j.	Insulation resistance constant (K)	<u>50,000</u>	
k.	Cold bend, 24 hours at minus 25 C followed by wet voltage withstand test of 80 volts per mil ac, (pass/fail)	<u>NA (*)</u>	<u>NA (**)</u>
l.	Oxygen index	<u>20</u>	<u>26</u>
		(*) does pass ICEA-65 deg.C @ 1 hour	(**) does pass ICEA-35 deg.C @ 1 hour
m.	Design life tests		
(1)	Have proposed cables been subjected to elevated temperature testing to demonstrate 30 year life?		<u>Yes</u> Yes/No
(2)	Temperatures and test periods	<u>Temp. C</u>	<u>Duration, Wks.</u>
	Test 1	_____	_____
	Test 2	_____	_____
	Test 3	_____	_____
	Test 4	_____	_____

ITEM M: See demonstration of 40 year life Okonite Report No. FYL-2 (to follow)

BID DATA (CONTD)

NAME OF BIDDER

Nunn-Royal

(3) Description of pass/
fail criteria utilized,
e.g., voltage with-
stand, tensile
strength, etc.

(4) Test report reference

b. 600-volt armored power cable

(1) Manufacturer Okonite

(2) Material description 600V

(3) Catalog description 600V CLX

(4) Continuous temperature rating, C 90

(5) Emergency overload temperature rating,
C/short circuit temperature
rating, C 130 / 250

	<u>Insulation</u>	<u>Outer Jacket</u> (*)
(6) Physical characteristics before aging		

(a) Tensile strength, psi	<u>1800</u>	<u>1500</u>
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(b) Elongation at rupture, percent	<u>300</u>	<u>100</u>
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(7) Physical characteristics
after air oven aging of
168 hours at 150 C for
insulation and 168 hours
at 100 C for jacket

(a) Tensile strength, percent retained	<u>90</u>	<u>80</u>
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(b) Elongation at rupture, percent retained	<u>90</u>	<u>70</u>
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(*) Based on 7 days @ 121 deg. C

BID DATA (CONTD)

NAME OF BIDDER

Nunn-Royal

	<u>Insulation</u>	<u>Outer Jacket</u>
(8) Insulation resistance constant (K)	<u>20,000</u>	
(9) Cold bend, 24 hours at minus 25 C followed by wet voltage withstand test of 80 volts per mil ac, (pass/fail)	(See Item K Pg. DS-18)	
(10) Oxygen index	<u>22</u>	<u>26</u>
(11) Design life tests		
(a) Have proposed cables been subjected to elevated temperature testing to demonstrate 30 year life?	(See Item M Pg. DS-18)	
	_____ Yes/No	
(b) Temperatures and test periods	<u>Temp. C</u>	<u>Duration, Wks.</u>
Test 1	_____	_____
Test 2	_____	_____
Test 3	_____	_____
Test 4	_____	_____
(c) Description of pass/fail criteria utilized, e.g., voltage withstand, tensile strength, etc.	_____	

(d) Test report reference	_____	
c. 600-volt unarmored power cable		
(1) Manufacturer	<u>Okonite</u>	
(2) Material description	<u>Power Cable</u>	

BID DATA (CONTD)

NAME OF BIDDER

Nunn-Royal

- (3) Catalog description XHHW
- (4) Continuous temperature rating, C 90
- (5) Emergency overload temperature rating,
C/short circuit temperature
rating, C 130 / 250

Insulation

- (6) Physical characteristics
before aging
- (a) Tensile strength, psi 1800
- (b) Elongation at
rupture, percent 300
- (7) Physical characteristics
after air oven aging of
168 hours at 150 C for
insulation
- (a) Tensile strength,
percent retained 90
- (b) Elongation at rupture,
percent retained 90
- (8) Insulation resistance
constant (K) 20,000
- (9) Cold bend, 24 hours at
minus 25 C followed by wet
voltage withstand test of
80 volts per mil ac,
(pass/fail) (See Item K Pg. DS-18)
- (10) Oxygen index 22
- (11) Design life tests

- (a) Have proposed cables been
subjected to elevated
temperature testing to
demonstrate 30 year life? (See Item M Pg. DS-18)
- Yes/No

BID DATA (CONTD)

NAME OF BIDDER

Nunn-Royal

(b) Temperatures and
test periods

Temp. C

Duration, Wks.

Test 1

Test 2

Test 3

Test 4

(c) Description of pass/
fail criteria utilized,
e.g., voltage with-
stand, tensile
strength, etc.

(d) Test report reference

2. TESTS

List all factory tests, and their standard industry identification, that will be performed on the materials specified herein.

A. 5000-volt power cables: All tests as given in Paragraph 7A-D

B. 600-volt power cables: All tests as given in Paragraph 7B-D

Stearns-Roger

INCORPORATED

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Project No. C-21700

Spec. No. FJ50.50

November 3, 1976

SPECIFICATION

NO. FJ50.50

FOR

DOCUMENTATION

FOR

5000-VOLT AND
600-VOLT POWER CABLE

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STEARNS-ROGER ENGINEERING CORP.
DENVER, COLORADO

PROJECT NO. C-21700

Project No. C-21700

Spec. No. FJ50.50

DOCUMENTATION

1. SCOPE

- A. This Specification outlines the requirements for, and the procedures associated with, the preparation and exchange of documentation for the work, equipment and/or materials specified in the Contract or Specification to which this Specification is a supplement.
- B. This Specification supplements requirements in Engineering Standard No. FJ60.60.
- C. This Specification also supplements requirements, where specified, in Paragraph DOCUMENTATION of the Contract or Specification to which this Specification is a supplement.
- D. This Specification and supplementary references specified in the foregoing paragraphs cover minimum requirements for documentation and are not intended to limit the amount of additional documentation which may be required for the engineering coordination, use or maintenance of the work, equipment and/or materials being furnished. Such additional documentation shall be provided by Seller or Contractor.
- E. All references to "Seller" herein shall apply to Seller or Contractor. All references to "Buyer" herein shall apply to the Buyer or the Owner. All references to "Engineer" herein shall apply to Stearns-Roger Engineering Corp.

2. TYPE, QUANTITIES AND QUALITY OF COPIES

The type and quantities of copies for required documentation are specified on Engineering Standard No. FJ60.60. Quality requirements shall be as follows:

A. Reproducible Drawings

All reproducible drawings submitted to Engineer shall be furnished on ozalid vellum, auto-positive vellum or Mylar, black line on vellum, or other Engineer-approved medium, each to be suitable for legible reproduction by the diazo copy process. Reproducible drawings shall be rolled, not folded, and enclosed in mailing tubes when mailed to Engineer or otherwise handled.

B. Prints

Where designated by the word "Prints" on Engineering Standard No. FJ60.60, it shall be understood to mean suitable "blue-line print/copy," "blueprint," or other Engineer-accepted reproduction of an original Seller-prepared tracing or sepia.

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2. TYPE, QUANTITIES AND QUALITY OF COPIES (CONTD)

C. Other Documentation

Where designated by the word "Copies" on Engineering Standard No. FJ60.60, applicable documentation shall be submitted on legible, black on white, 8-1/2-inch by 11-inch pages.

3. DOCUMENTATION BY SELLER

A. General

a. Required types of documentation are specified on Engineering Standard No. FJ60.60. Where this Standard does not fully describe individual categories of documentation that are required, such detailed categories are specified in Paragraph DOCUMENTATION of the Contract or Specification to which this Specification is a supplement.

b. (Deleted) *

c. (Deleted) *

d. The following information shall be included in each drawing:

- (1) Buyer's Name.
- (2) Engineer's Project Number.
- (3) Plant or station name.
- (4) Unit number (if applicable).
- (5) Buyer's Purchase Order Number.

Other documentation submitted by Seller shall carry similar identification.

e. Unless specifically approved by the Engineer, "typical" or "similar" documentation is not acceptable for review.

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- f. "Standard Hardware Items" are defined as standard commercial items, such as air and hydraulic cylinders and operating valves, gear reducers, small motors, instruments, etc. For such items, review drawings are not required. Certified sheets showing exact mounting dimensions, overall dimensions, cross-sectional arrangement, parts nomenclature and material designation shall be submitted. Details of parts shall be furnished when requested by Buyer.
- g. Within 30 days after written notice of award, Seller shall submit a complete Definitive Drawing List, by drawing and title, of all drawings that will be submitted to Engineer. On this list, each drawing shall be identified by its appropriate category as defined in Items 1 or 2 on Engineering Standard No. FJ60.60, and as supplemented in Paragraph DOCUMENTATION of the Contract or Specification. Any drawing that does not fall under these predefined categories shall be identified on the list as "Miscellaneous." This list shall include proposed submittal dates for each drawing. This drawing list and schedule, together with any subsequent modifications, shall be subject to Engineer's review and comments.

B. Progress Reports

Seller shall furnish Engineer monthly progress reports and schedule status reports. These reports and schedules shall cover the complete status and progress of engineering, documentation, fabrication, materials, labor and shipment.

C. Review and Comment

- a. Entries in the column "WEEKS AFTER AWARD" on Engineering Standard No. FJ60.60 designate maximum time spans for Seller's submittal of documentation for review after the date of Buyer's written notification of award, whether such notification be in the form of a Purchase Order, a Letter of Intent or similar written authorization.
- b. All documentation to be certified and submitted by Seller for interface coordination shall show sufficient details of design so that the Engineer may proceed with his overall project design where interrelated with Seller's design.
- c. All documentation submitted in the correct and complete form to Engineer for his review and comment will be processed and a copy sent to Seller within 2 weeks after receipt of Seller's submittal. If more than 2 weeks review time is necessary, Engineer will advise Seller in writing as to his review schedule for such data. Seller shall then advise Engineer in writing what effect the extended review schedule has on the scheduled delivery of Seller's materials and equipment.

*
*

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- d. Drawings and data will be returned to Seller marked either "REVIEWED/NO COMMENTS," "REVIEWED/SEE COMMENTS" or "REVISE PER COMMENTS AND RESUBMIT FOR REVIEW."
- e. When the documentation is returned marked "REVIEWED/NO COMMENTS" or "REVIEWED/SEE COMMENTS," final certified submittals incorporating the noted changes shall be furnished, unless otherwise authorized by Engineer in writing, within 3 weeks from the time of receipt of copy by Seller or at least 3 weeks before the scheduled delivery of Seller's work, whichever is earlier. Where Engineering Standard No. FJ60.60 stipulates that drawing review is required before release for fabrication, "REVIEW/SEE COMMENTS" shall constitute such release.
- f. When the documentation is returned marked "REVISE PER COMMENTS AND RESUBMIT FOR REVIEW," the documentation with the noted revisions incorporated shall be resubmitted for review and comment within 3 weeks from the time of receipt of copy by Seller. The review and comment and final submittal schedule shall be as specified in Sub-paragraphs 3.C.c. and 3.C.e. above.
- g. The documentation submittal schedules shall be adhered to by Seller, unless otherwise authorized by Engineer in writing. In any case, final submittals shall be furnished at least 3 weeks before the scheduled delivery of Seller's work.
- h. When reviewed information is subsequently revised by Seller, or is subsequently found to be deficient because of Seller's error or omission, additional Seller submittals shall be made to Engineer as developed. Any Engineer's design changes and any changes in equipment or construction by others which are required to make such subsequent revisions an integral part of the overall project shall be made at Seller's expense.
- i. Fabrication or shipment shall be at Seller's risk, whether or not Engineer has reviewed Seller's drawings as specified on Engineering Standard No. FJ60.60.
- j. Seller will be notified of review by a stamped copy of Stearns-Roger Form 02.145 or TRMSR05A stating "Supplier: As to all Drawings/Data listed on this transmittal: PROCEED TO FABRICATE." All Seller drawings which are submitted as final shall be stamped "Final." Where specified on Engineering Standard No. FJ60.60, final drawings shall be certified for construction.
- k. Neither review of, nor comment or revision on drawings by Engineer relieves Seller or Contractor from compliance with Specifications or with all other requirements of Purchase Order or Contract, nor shall the procedures outlined herein be cause for delay of equipment deliveries, except as otherwise specified herein.

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1. Notations made during the review of drawings shall not be construed to authorize contractual changes in price or delivery of equipment or materials furnished by Seller. If the scope of work has been changed as a result of such notations, Seller shall request a change in Purchase Order price and/or delivery date(s). Seller shall make the request in writing to Engineer before proceeding with the work.

D. Operation and Maintenance Manualsa. General

- (1) Seller shall furnish Operation and Maintenance Manuals which shall be complete for all equipment and systems furnished by Seller and by Seller's suppliers. Any differences between equipment supplied for Unit 1 and Unit 2 with regard to operation and maintenance shall be clearly defined in these Manuals.
- (2) Manuals shall be forwarded four (4) weeks prior to complete delivery of equipment in accordance with Engineering Standard No. FJ60.60.
- (3) If the publication of a subassembly manufacturer does not contain a complete operation, maintenance and parts breakdown meeting the intent of this Specification, then it shall be the responsibility of Seller to include such information in the Operation and Maintenance Manual.
- (4) All necessary precautions and warnings relative to the safety of life and equipment shall be included.

b. Operation

As a minimum, the Operation Section of the Manual shall contain the following:

- (1) Starting instructions, including, as applicable, instructions for initial startup, normal starting, starting after overhaul and startup after emergency trip.
- (2) Operating instructions, including trouble-shooting procedures.
- (3) Shutdown instructions, for both normal and emergency shutdown.
- (4) Design data for all equipment and systems, specifying horsepower, kilowatts, voltage, amperage, pressure, temperature, revolutions per minute, flow, etc.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)D. Operation and Maintenance Manuals (Contd)c. Maintenance

As a minimum, the Maintenance Section of the Manual shall contain the following:

- (1) Disassembling and reassembling instructions.
- (2) Preventive maintenance and lubrication information.
- (3) Description and identification of special maintenance tools.
- (4) Settings, clearance and adjustment data.

d. Parts Breakdown

The Parts Breakdown Section of the Manual shall contain:

- (1) A list of replacement parts, including drawings and data for all equipment assemblies and subassemblies. The material shall cover all information required for ordering replacement parts such as part name, part number, equipment serial number, supplier, address and normal delivery time.
- (2) Complete instructions for procuring replacement parts. Recommended forms for tabulating replacement part information and instructions for returning material to the factory shall also be included. Special storage, handling or packaging procedures required for any particular parts shall be noted.

E. Bills of Material

Detailed Bills of Material are required to facilitate identification by constructors of the items received. Shipment, therefore, shall be preceded by submittal of Bills of Material in accordance with Engineering Standard No. FJ60.60, Item 4 C.

4. DRAWINGS BY ENGINEER

- A. For applicable equipment, prints of drawings prepared by Engineer for use by others in constructing foundations, building components and major piping and wiring requiring coordination with the work associated herewith will be furnished to Seller for review as soon as possible after Engineer's receipt from Seller of the certified equipment drawings and design information necessary for their preparation.
- B. Where material, locations, etc., are marked HOLD on Engineer's Drawings, that material, location, etc., shall not be detailed or fabricated by Seller until the HOLD is removed by Engineer.

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4. DRAWINGS BY ENGINEER (CONTD)

- C. Within 30 calendar days after the date of transmittal to Seller, Seller shall return to Engineer two (2) copies of each of these drawings marked to indicate Seller's review thereof either without change, or with any corrections or necessary changes clearly marked thereon in red or other contrasting color.
- D. After making such corrections or changes as shown on the review copies returned by Seller, Engineer will release these drawings for construction. Subsequent changes or corrections to foundations, building components, wiring or piping fabricated or installed in accordance with drawings corresponding to the review copies approved by the Seller, such changes having been necessitated by Seller-initiated modifications, shall be done in a manner satisfactory to Buyer and at Seller's expense.

5. TRANSMITTALS

When transmitting documentation, Seller shall:

- A. Prepare original and four (4) copies of transmittal letters to accompany each submittal of documentation. Drawing transmittal letters shall identify the purpose of the transmittal (drawings for review, revised drawings, final drawings), the piece of equipment or material involved, and shall list the drawing numbers with applicable revision numbers or dates.
- B. Identify each letter and parcel with Buyer's Project Name, Engineer's Project Number, Purchase Order Number and Seller's Shop Order Number, and transmit it by air mail or first class mail. Each parcel shall contain an enclosed copy of the transmittal letter.
- C. Stamp each document to be submitted with reproduction date and purpose of the transmittal, e.g., "For Review," "Revised," "Final," etc.

6. SPECIAL CONSIDERATIONS

- A. It is understood that upon delivery of Seller's documentation without any restrictive notations concerning such work, they shall become Buyer's property and may be used in any manner desired for obtaining replacements, repairs and spare parts.
- B. Seller's final invoice will not be paid by Buyer until all materials and/or equipment governed hereunder have been received complete at the delivery point, and final certified submittals of all specified documentation have been received by Engineer.

DIVISION USAGE						Stearns-Roger <small>INCORPORATED</small> ENGINEERING STANDARD	STANDARD NUMBER			
MM	P	PP	SH	FI	SP		FJ 60.60			
APPROVALS: Des. Sec. <i>[Signature]</i> Sect. Supv. <i>[Signature]</i> Div. <i>[Signature]</i>						DOCUMENTATION REQUIREMENTS PROJECT: SOLAR ONE CONTRACT/REQUISITION NUMBER: F010.1 TITLE: 5000-VOLT AND 600-VOLT POWER CABLE		C-21700 ISSUED 7/16/79 REVISED		
TYPE OF DOCUMENTATION				TYPE OF COPIES	FOR REVIEW	FINAL		REVIEW	CTFY.	
					NO. OF COPIES	WEEKS AFTER AWARD*	NO. OF COPIES	"X" IF REQ'D	REQ'D BEFORE FAB.**	FINAL ISSUE ***
1-ENGINEERING DRAWINGS				Repro- ducibles Prints						
A-Outline, General Arrangement and Principal Dimensions										
B-Cross Sections										
C-Foundation Requirements, including Loadings & Anchoring Locations										
D-Physical Locations of Piping and/or Wiring Terminals										
E-Control Diagrams										
F-Electrical Schematic Diagrams										
G-Wiring Diagrams, Including Internal External and Interconnecting										
H-Standard Hardware Items										
2-ERECTION OR INSTALLATION INFO.				Repro- ducibles Prints						
A-Shop Fabrication Drawings										
B-Erection or Installation Drawings										
C-Erection or Install. Instructions				Copies	8	6-8	8	X		X
3-SPECIAL DOCUMENTATION										
A-Performance Data, including Curves				Copies						
B-Design Calculations				Copies						
C-Test Reports				Copies			8	X		X
D-Code Papers and Certificates				Copies						
E-Shop Fab. and/or Welding Proced.				Copies						
F-Shop Fabrication Reports				Copies						
G-Welder's Qualification Reports				Copies						
H-Operating Certificates				Copies						
4-MISCELLANEOUS										
A-Operation and Maintenance Manuals				Manuals						
B-Recommended Spare Parts List for 1 Year's Operation, with Unit Prices				Copies						
C-Bills of Material				Copies			8	X#		X
D-Definitive Drawing List				Copies						
*-Entries in the column "WEEKS AFTER AWARD" designate which types of review documentation are required. Blank spaces in this column denote that review documentation is not required. **-"X" in this column means drawing review req'd. before fabric. release. ***-"X" in this column means final issue must be certified for construction. # At least 2 weeks before each shipment, detailed Bills of Material shall be sent to the plant site, c/o Stearns-Roger Resident Engineer, with 3 copies to Stearns-Roger Denver Office.								Except where otherwise specified, send all Documentation to: Stearns-Roger Engineering Corp. P.O. Box 5888 Denver, Colorado 80217 Attn: Mr. R.K. Brushel		
This form supplements requirements, where specified, in Paragraph DOCUMENTATION in the Specification, and in Specification FJ50.50.										

ADDITIONAL DOCUMENTATION REQUIREMENTS

Documentation shall be in accordance with Specification No. FJ50.50, as applicable, and the following:

Item 2C of Engineering Standard No. FJ60.60 shall include installation and application data, terminating instructions, maximum allowable pulling tensions and side-wall pressures, and minimum allowable bending radii.

Stearns-Roger

SUPPLEMENTED PURCHASE ORDER
 Changes are underscored on lines identified in their left margin by the letter designator of the supplement. Pages changed by this supplement are reissued herewith. Remove the previous issue of these page(s) and replace them with current issue. All other terms and conditions of the original order and previous supplements, if any, remain unchanged.

PAGE NO. 1 of 4	DATE Mar 19/80	REQUISITION F2 REV 5	ACCOUNT See Below	REL. NO.	ORDER NO. 4000 C21700
REQUIRED AT DESTINATION See Below			SELLER'S SHIPPING PROMISE See Below		
F.O.B. POINT See Below			SHIPPING POINT See Below		
SELLER NUNN-ROYAL ELECTRIC SUPPLY CO. P.O. Box 4804 Carson, CA 90749 Attn: Mr. Jim Hape (213)637-6377			TERMS OF PAYMENT AND INVOICING INSTRUCTIONS ARE STATED AFTER LAST NUMBERED ITEM OF THIS ORDER DIRECT CORRESPONDENCE CONCERNING THIS ORDER TO: STEARNS-ROGER ENGINEERING CORPORATION BOX 5888, DENVER, CO 80217 ATTN: Mr. A. L. Higgason PHONE (303) 758-1122 TWX 910-931-0453 TELEX 045-540		

CONSIGN TO: TOWNSEND AND BOTTUM, INC., c/o J. M. ABRAM, CONSTRUCTION
 MANAGER, Solar-one Pilot Plant, Daggett, CA 92327

ROUTE VIA: See Below

SUPPLEMENT SUMMARY - SELLER MUST CHECK EACH REVISION AND COMPLY WITH ALL CHANGES.	
b	Supp. No. 2 - Sep 09/80 - Rev. pgs. 1, 2, 3 & 4 to add item 5A. <i>JWH</i>
PREVIOUS SUPPLEMENT SUMMARIES, IF ANY, ARE RECOUNTED ON THE LAST NUMBERED PAGE OF THIS ORDER	
CONFIRMING ORDER - DO NOT DUPLICATE	

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE
		POWER CABLE, 5,000V & 600V in full accordance with Stearns-Roger Specification F010.1, D.O.E. No. 40E500-4S Rev. 1., dated Mar 21/80, "For Purchase", and Rev. 2, dated Aug 28/80.	

SPECS. ATTACHED Rev. 2
 GENERAL CONDITIONS FOR JOB C21700 SUBCONTRACT
 DOE PRIME CONTRACT NO. DE-AC-03-79SF10499 ATTACHED
 TERMS AND CONDITIONS FORM TC 5-76 ATTACHED

APPROX TOTAL VALUE OF ORDER
\$236,428.00 (Rev.)

BUYER
 STEARNS-ROGER ENGINEERING CORPORATION

ORDER IS SUBJECT TO TERMS, CONDITIONS AND SPECIFICATIONS STATED HEREIN AND ATTACHED. ORDER AND ACCOUNT NUMBERS MUST BE STATED ON ALL INVOICES. CORRESPONDENCE, SHIPPING DOCUMENTS AND PACKAGES.

BY *J. W. Jones*
 THIS DOCUMENT CONSISTS OF 4 PAGE(S) NOT INCLUDING REFERENCED ATTACHMENTS

Stearns-Roger

PURCHASE ORDER

PAGE NO. 2	NUNN-ROYAL ELECTRIC SUPPLY CO.	REL. NO.	ORDER NO. 4000 C21700
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ITEM	QUANTITY	DESCRIPTION	UNIT PRICE
		TAG REELS: 2,000 ft. - 1 1,200 ft. - 3 1,200 ft. - 4 800 ft. - 5 800 ft. - 6 1,000 ft. - 7 1,000 ft. - 8 1,000 ft. - 9 1,000 ft. - 10	
1	10,000 ft.	CABLE, 5KV, #2/0, 3/C, shielded, metal-clad, w/ground tin coated (Sub. alloy coated-okoloy)	\$7,261.05 MF.
		TAG REELS: 1,000 ft. - F1 1,000 ft. - F2 1,000 ft. - F3 1,000 ft. - F4 1,000 ft. - F5 1,000 ft. - F6 1,000 ft. - F7	
2	7,000 ft.	CABLE, 600V, #10, 1/C, unarmored	108.42 MF.
		CABLE, 600V, Metal-Clad TAG REELS: 2,000 ft. - A1 2,000 ft. - A2 2,000 ft. - A3 2,000 ft. - A4 2,000 ft. - A5 2,000 ft. - A6	
3	12,000 ft.	#10, 2/C, w/ground tin coated (Sub. alloy coated-okoloy)	825.26 MF.
		TAG REELS: 52-2,000 ft. ea. - B1 THRU B52 1,000 ft. - B53	
4	105,000 ft.	#10, 4/C	867.36 MF.
		TAG REELS: 1,325 ft. - C1 1,325 ft. - C2 1,510 ft. - C3	
5	4,000 ft.	#8, 4/C	1,561.05 MF.
5A	3,140 ft.	TAG REEL: 3,140 ft - C4 #8, 4/C	1,744.70 MF.

Stearns-Roger

PURCHASE ORDER

PAGE NO. 3	NUNN-ROYAL ELECTRIC SUPPLY CO.	REL. NO.	ORDER NO. 4000 C21700
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ITEM	QUANTITY	DESCRIPTION	UNIT PRICE
		TAG REELS: <u>11-1,000 ft. ea. -</u> <u>D1 THRU D11</u>	
6	11,000 ft.	#6, 4/C	\$1,626.31 Mf.
		TAG REELS: <u>1,035 ft. - E1</u> <u>3,135 ft. - E2</u> <u>2,474 ft. - E3</u> <u>1,090 ft. - E4</u> <u>4,000 ft. - E5</u> <u>2,882 ft. - E6</u> <u>1,715 ft. - E7</u>	
7	16,000 ft.	#4, 4/C	2,029.47 Mf.

NOTE

- The shipping tolerance for this order is 0 to plus 10%.
- Charges for wood lagging and sizes of non-returnable reels - Will advise.

ESCALATION:

Items 1 thru 5, 6 and 7 only

Prices are firm except for metal. Prices on Purchase Order are based on copper base price of \$1.05625¢ per lb. and aluminum at \$.66 per lb. All invoices for this material will be adjusted either upward or downward for the producer's price of metals on date of shipment.

FIRM PRICES

Item 5A

TAXES

This Purchase is exempt from California Sales Use Tax under California Tax Permit No. SY-AL-93-003153 - For Resale by Authority of McDonnell - Douglas Corporation.

REQUIRED AT DESTINATION

Item 1 - Tag 1 - 2,000 ft. - Jun 16/80

Tag 3 thru Tag 10 - Aug 15/80

Item 2 - Jun 16/80

Item 3 - Jul 07/80

Item 4 - Jul 01/80

Items 5 thru 7 - Apr 01/80

Item 5A - Sep 26/80

Stearns-Roger

PURCHASE ORDER

PAGE NO. 4	NUNN-ROYAL ELECTRIC SUPPLY CO.	REL. NO.	ORDER NO. 4000 C21700
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SELLER'S SHIPPING DATE

Item 1 - 2000 Ft. Week ending Jun 16/80

8000 Ft. Week ending Aug 25/80

Item 2 - Week ending Jun 21/80

Items 3 & 4 - Week ending Jul 19/80

Item 5, 6 & 7 - Week ending Apr 19/80

Item 5A - Week ending Aug 29/80

TERMS OF PAYMENT

1/2 of 1% 10 days; Net 30

SHIPPING POINT

5KV Cable - Santa Maria, CA

600V Cable - Richmond, KY

ACCOUNTING SEGREGATION

50% - X73404

50% - X73405

INVOICING INSTRUCTIONS:

Mail original and 4 copies with original shipping documents to:

STEARNS-ROGER INC.

P. O. Box 5888

Denver, CO 80217

ROUTE VIA:

Items 1 thru 5, 6, & 7 - Prepaid - Truck - Vendor's option

Item 5A - Prepaid - Truck - Consolidated/V.B. Trucklines

F.O.B. SHIPPING POINT:

Items 1 thru 5, 6 & 7 - Jobsite F/A

Items 5A - Richmond, KY

CONFIRMING ORDER

This confirms telephone order of Feb 26/80 to your Mr. Jim Hape by our A. L. Higgason and Aug 25/80 to your Mr. George Mena by our Mr. A. L. Higgason.

REFERENCE

For reference purposes only and not by way of incorporating the same in this Purchase Order, see your written quotation numbered 733 of Jan 03/80 & Telexes of Jan 04/80, Mar 04/80, Aug 22/80 and Aug 28/80 by Mr. Jim Hape.

PREVIOUS SUPPLEMENTS

a Supp. No. 1 Apr 21/80 Rev. pgs. 1, 2, 3 & 4 to add invoicing instructions and to change page DS-15 of specification

March 13, 1980
(For Purchase)

SPECIFICATION

S-R F010.2

D.O.E. NO. 40 E 500 - 85

for

**COAXIAL CABLE
(COLLECTOR FIELD)**

for

10MW_e SOLAR PILOT PLANT

SOLAR - ONE

DAGGETT, CA.

Prepared by:

Stearns-Roger
ENGINEERING CORP.

PROJECT NO. C-21700

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SPECIAL INSTRUCTIONS

An asterisk has been placed in the right-hand margin to denote changes made to the "For Bid" Specification. The subject changes were made to conform this document to awardee's proposal and subsequent updating and/or negotiations.

All further changes to this "For Purchase" document shall be made by the issuance of a numbered revised copy.

DETAILED SPECIFICATION
FOR
COAXIAL CABLE

1. SCOPE

A. General

The materials to be furnished and delivered consist of the following:

- a. One (1) lot of RG-22B/U metal-clad cable
- b. One (1) lot of standard RG-11A/U cable

The above cable will be installed by others in the Collector Field of the 10 MW_e Solar Pilot Plant near Daggett, California.

B. Definitions

Engineer: Shall mean Stearns-Roger Engineering Corporation

2. SUPPLEMENTS

The following supplements are included with and form a part of this Specification.

- A. Specification No. FJ50.50, Documentation, dated 11/3/76, 7 pages.
- B. Engineering Standard No. FJ60.60, Documentation Requirements, dated 7/16/79, 1 page.

3. MATERIALS TO BE FURNISHED

The coaxial cable to be furnished shall be as follows:

<u>Description</u>	<u>Base Total Quantity, Feet</u>
A. RG-22B/U, metal-clad with overall PVC jacket	190,000
B. RG-11A/U	5,000

4. EQUIPMENT AND SERVICES FURNISHED BY OTHERS

All handling equipment and labor required to unload, install, connect, inspect and test the electrical cable in the field will be furnished by others.

5. OPERATING CONDITIONS

A. Environmental

The materials furnished shall be suitable for installation and shall provide satisfactory operation under the following environmental conditions:

- a. Plant elevation above mean sea level: 1950 feet (13.72 psia).
- b. Ambient temperature range: 9 F to 117 F.
- c. Soil pH range 9.0 to 10.0.
- d. Endemic pocket gopher (Thomomys sp.) population.

B. Service Conditions

- a. The cable shall be capable of operating continuously without deterioration of insulating, protecting and jacketing materials under the conditions specified.
- b. The metal-clad cable will be direct buried in earth or installed in rigid steel conduit or in PVC conduit. The RG-11A/U cable will be installed in rigid steel or PVC conduit.

6. DESIGN AND CONSTRUCTION

A. General

- a. The cable to be furnished hereunder shall have a design life of thirty (30) years. The cable shall consist of the manufacturer's standard design and first line quality which meets or exceeds the requirements of this Specification.
- b. The metal-clad cable shall be suitable for circuits operating in wet or dry locations.

c. Codes and Standards

All cable specified herein shall be manufactured and tested in accordance with the latest applicable requirements of the following Codes and Standards:

- (1) ASTM - American Society for Testing and Materials
- (2) ICEA - Insulated Cable Engineers Association, Inc.
- (3) NEC - National Electrical Code
- (4) NEMA - National Electrical Manufacturers Association
- (5) UL - Underwriters' Laboratories, Inc.

- d. The cable shall conform to the requirements of Federal Specification MIL-C-17.

B. Construction

- a. The RG-22B/U cable shall be of standard construction inside a close-fitting, impervious, continuous, smooth aluminum sheath having a nominal thickness of 45 mils. A flame resistant PVC jacket shall be applied over the aluminum sheath. The cable shall be rodent resistant and suitable for direct earth burial.
- b. The RG-11A/U cable shall be of standard construction.

*
*

7. PREPARATION FOR SHIPMENT

- A. All cable shall be packaged on reels in such a manner that the cable will be protected for shipment and for outdoor storage. Each end of the cable shall be protected with watertight seals and shall be secured to the reel.
- B. All reels shall have heavy-duty wood lagging consisting of closely spaced boards held in place by nailing and by not less than two (2) steel bands circumferentially secured. The required clearance and bedding shall be provided between the outer layer of the cable and the inner surface of the wood lagging to prevent damage to the cable from crushing by impact up to the impact limits of the lagging.
- C. The outside radius of the reel drum shall be not less than the bending radius recommended by the manufacturer for installation of the cable.
- D. The diameter of the reel flange shall not exceed 80 inches, unless special permission is granted by the Engineer to allow larger reels required by the cable length or construction.
- E. Each cable reel shall be marked on both flange sides with noncorrosive metal plates securely attached to the reel and legibly stating the Contract or Purchase Order Number, reel number, length of cable on the reel, number and size of conductors, gross shipping weight and net weight of the cable. A shipping tag containing the same information shall be attached to the outer end of the cable.

8. DOCUMENTATION REQUIREMENTS

- A. Prior to fabrication or delivery to the jobsite of materials to be furnished under this Specification, the Seller shall submit to the Engineer, for review and comment, the drawings and descriptive data called for in this Specification. Drawings and data submittals shall be in accordance with Specification No. FJ50.50 and Engineering Standard No. FJ60.60, both attached.

In addition, all documentation shall bear identification in accordance with Paragraphs 4.2 and 4.4 of STMPO-A1 "Document Identification," attached. Final discipline, system and block numbers will be furnished to the Seller after award of Contract and receipt of Seller's drawing list, if applicable.

- B. Item 2C of Engineering Standard No. FJ60.60 shall include cable installation and application data, terminating instructions, maximum allowable pulling tensions and side-wall pressures, and minimum allowable bending radii.

9. GUARANTEES

- A. The Seller shall guarantee that the materials furnished conform to the requirements set forth herein and to the specified Codes and Standards, and that all required tests have been satisfactorily completed and passed.
- B. The Seller shall guarantee all physical and electrical properties tabulated in the Bid Data Section hereinafter.
- C. The foregoing shall not be construed in any way to limit or negate any other standard guarantee or portion thereof which may provide a more comprehensive guarantee than those required by this Specification.

BID DATA

NAME OF BIDDER

Nunn-Royal

In addition to other data and descriptive material furnished with the Bidder's Proposal, Bidder shall fill in all spaces of the following Bid Data Section:

1. GUARANTEED PHYSICAL AND ELECTRICAL PROPERTIES

	<u>RG-22B/U</u>	<u>RG-11A/U</u>	
A. Weight, pounds per 1000 feet	<u>266</u>	<u>89</u>	
B. Overall cable diameter, inches	<u>.575</u>	<u>.405</u>	*
C. Minimum bend radius, inches	<u>5.75</u>	<u>5</u>	*
D. Maximum pulling force, pounds	<u>150*</u>	<u>----</u>	
E. Conductor gage, AWG	<u>18</u>	<u>26</u>	
F. Material Thickness, mils	<u> </u>	<u> </u>	
a. Insulation	<u>22</u>	<u>----</u>	
b. Jacket	<u>43</u>	<u>----</u>	
c. Metal sheath	<u>45</u>	<u>N/A</u>	*
d. Outer jacket	<u>50</u>	<u>N/A</u>	
G. Insulation material	<u>PE</u>	<u>PE</u>	

NOTES:

- 1) *Maximum on conductors in braids pulled together.
- 2) Under the environmental conditions given in IP5.0 of C-21700 the insulation and jacket materials have established service lives of over 30 years.
- 3) Military Spec. Sheet MIL-C-17/15 and MIL-C-17/6 of Mil Spec. MIL-C-17D.

Project No. C-21700
Spec. No. FJ50.50

November 3, 1976

SPECIFICATION

NO. FJ50.50

FOR

DOCUMENTATION

FOR

10MWe SOLAR PILOT PLANT
SOLAR ONE
DAGGETT, CA

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STEARNS-ROGER ENGINEERING CORP.
DENVER, COLORADO

PROJECT NO. C-21700

Project No. C-21700

Spec. No. FJ50.50

DOCUMENTATION

1. SCOPE

- A. This Specification outlines the requirements for, and the procedures associated with, the preparation and exchange of documentation for the work, equipment and/or materials specified in the Contract or Specification to which this Specification is a supplement.
- B. This Specification supplements requirements in Engineering Standard No. FJ60.60.
- C. This Specification also supplements requirements, where specified, in Paragraph DOCUMENTATION of the Contract or Specification to which this Specification is a supplement.
- D. This Specification and supplementary references specified in the foregoing paragraphs cover minimum requirements for documentation and are not intended to limit the amount of additional documentation which may be required for the engineering coordination, use or maintenance of the work, equipment and/or materials being furnished. Such additional documentation shall be provided by Seller or Contractor.
- E. All references to "Seller" herein shall apply to Seller or Contractor. All references to "Buyer" herein shall apply to the Buyer or the Owner. All references to "Engineer" herein shall apply to Stearns-Roger Incorporated.

2. TYPE, QUANTITIES AND QUALITY OF COPIES

The type and quantities of copies for required documentation are specified on Engineering Standard No. FJ60.60. Quality requirements shall be as follows:

A. Reproducible Drawings

All reproducible drawings submitted to Engineer shall be furnished on ozalid vellum, auto-positive vellum or Mylar, black line on vellum, or other Engineer-approved medium, each to be suitable for legible reproduction by the diazo copy process. Reproducible drawings shall be rolled, not folded, and enclosed in mailing tubes when mailed to Engineer or otherwise handled.

B. Prints

Where designated by the word "Prints" on Engineering Standard No. FJ60.60, it shall be understood to mean suitable "blue-line print/copy," "blueprint," or other Engineer-accepted reproduction of an original Seller-prepared tracing or sepia.

Project No. C-21700
Spec. No. FJ50.50

2. TYPE, QUANTITIES AND QUALITY OF COPIES (CONTD)

C. Other Documentation

Where designated by the word "Copies" on Engineering Standard No. FJ60.60, applicable documentation shall be submitted on legible, black on white, 8-1/2-inch by 11-inch pages.

3. DOCUMENTATION BY SELLER

A. General

- a. Required types of documentation are specified on Engineering Standard No. FJ60.60. Where this Standard does not fully describe individual categories of documentation that are required, such detailed categories are specified in Paragraph DOCUMENTATION of the Contract or Specification to which this Specification is a supplement.
- b. Where equipment for Units 1 and 2 is identical, or where equipment is common to Units 1 and 2, one (1) set of documentation shall be furnished. If equipment is identical, Seller shall certify, on each document, that it is applicable to both Units 1 and 2. Where equipment is neither identical for nor common to Units 1 and 2, two (2) complete, individual sets of documentation shall be furnished, appropriately identified.
- c. The title block of each drawing shall denote the applicability of the drawing either to "Unit 1," "Unit 2" or "Units 1 and 2." Other documentation submitted by Seller shall carry similar identification.
- d. The following information shall be included in each drawing:
 - (1) Buyer's Name.
 - (2) Engineer's Project Number.
 - (3) Plant or station name.
 - (4) Unit number (if applicable).
 - (5) Buyer's Purchase Order Number.

Other documentation submitted by Seller shall carry similar identification.

- e. Unless specifically approved by the Engineer, "typical" or "similar" documentation is not acceptable for review.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)A. General (Contd)

- f. "Standard Hardware Items" are defined as standard commercial items, such as air and hydraulic cylinders and operating valves, gear reducers, small motors, instruments, etc. For such items, review drawings are not required. Certified sheets showing exact mounting dimensions, overall dimensions, cross-sectional arrangement, parts nomenclature and material designation shall be submitted. Details of parts shall be furnished when requested by Buyer.
- g. Within 30 days after written notice of award, Seller shall submit a complete Definitive Drawing List, by drawing and title, of all drawings that will be submitted to Engineer. On this list, each drawing shall be identified by its appropriate category as defined in Items 1 or 2 on Engineering Standard No. FJ60.60, and as supplemented in Paragraph DOCUMENTATION of the Contract or Specification. Any drawing that does not fall under these predefined categories shall be identified on the list as "Miscellaneous." This list shall include proposed submittal dates for each drawing. This drawing list and schedule, together with any subsequent modifications, shall be subject to Engineer's review and comments.

B. Progress Reports

Seller shall furnish Engineer monthly progress reports and schedule status reports. These reports and schedules shall cover the complete status and progress of engineering, documentation, fabrication, materials, labor and shipment.

C. Review and Comment

- a. Entries in the column "WEEKS AFTER AWARD" on Engineering Standard No. FJ60.60 designate maximum time spans for Seller's submittal of documentation for review after the date of Buyer's written notification of award, whether such notification be in the form of a Purchase Order, a Letter of Intent or similar written authorization.
- b. All documentation to be certified and submitted by Seller for interface coordination shall show sufficient details of design so that the Engineer may proceed with his overall project design where interrelated with Seller's design.
- c. All documentation submitted in the correct and complete form to Engineer for his review and comment will be processed and a copy sent to Seller within 2 weeks after receipt of Seller's submittal. If more than 2 weeks review time is necessary, Engineer will advise Seller in writing as to his review schedule for such data. Seller shall then advise Engineer in writing what effect the extended review schedule has on the scheduled delivery of Seller's materials and equipment.

Project No. C-21700Spec. No. FJ50.50**3. DOCUMENTATION BY SELLER (CONTD)****C. Review and Comment (Contd)**

- d. Drawings and data will be returned to Seller marked either "REVIEWED/NO COMMENTS," "REVIEWED/SEE COMMENTS" or "REVISE PER COMMENTS AND RESUBMIT FOR REVIEW."
- e. When the documentation is returned marked "REVIEWED/NO COMMENTS" or "REVIEWED/SEE COMMENTS," final certified submittals incorporating the noted changes shall be furnished, unless otherwise authorized by Engineer in writing, within 3 weeks from the time of receipt of copy by Seller or at least 3 weeks before the scheduled delivery of Seller's work, whichever is earlier. Where Engineering Standard No. FJ60.60 stipulates that drawing review is required before release for fabrication, "REVIEW/SEE COMMENTS" shall constitute such release.
- f. When the documentation is returned marked "REVISE PER COMMENTS AND RESUBMIT FOR REVIEW," the documentation with the noted revisions incorporated shall be resubmitted for review and comment within _____ weeks from the time of receipt of copy by Seller. The review and comment and final submittal schedule shall be as specified in Sub-paragraphs 3.C.c. and 3.C.e. above.
- g. The documentation submittal schedules shall be adhered to by Seller, unless otherwise authorized by Engineer in writing. In any case, final submittals shall be furnished at least 3 weeks before the scheduled delivery of Seller's work.
- h. When reviewed information is subsequently revised by Seller, or is subsequently found to be deficient because of Seller's error or omission, additional Seller submittals shall be made to Engineer as developed. Any Engineer's design changes and any changes in equipment or construction by others which are required to make such subsequent revisions an integral part of the overall project shall be made at Seller's expense.
- i. Fabrication or shipment shall be at Seller's risk, whether or not Engineer has reviewed Seller's drawings as specified on Engineering Standard No. FJ60.60.
- j. Seller will be notified of review by a stamped copy of Stearns-Roger Form 02.145 or TRMSR05A stating "Supplier: As to all Drawings/Data listed on this transmittal: PROCEED TO FABRICATE." All Seller drawings which are submitted as final shall be stamped "Final." Where specified on Engineering Standard No. FJ60.60, final drawings shall be certified for construction.
- k. Neither review of, nor comment or revision on drawings by Engineer relieves Seller or Contractor from compliance with Specifications or with all other requirements of Purchase Order or Contract, nor shall the procedures outlined herein be cause for delay of equipment deliveries, except as otherwise specified herein.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)C. Review and Comment (Contd)

1. Notations made during the review of drawings shall not be construed to authorize contractual changes in price or delivery of equipment or materials furnished by Seller. If the scope of work has been changed as a result of such notations, Seller shall request a change in Purchase Order price and/or delivery date(s). Seller shall make the request in writing to Engineer before proceeding with the work.

D. Operation and Maintenance Manualsa. General

- (1) Seller shall furnish Operation and Maintenance Manuals which shall be complete for all equipment and systems furnished by Seller and by Seller's suppliers. Any differences between equipment supplied for Unit 1 and Unit 2 with regard to operation and maintenance shall be clearly defined in these Manuals.
- (2) Manuals shall be forwarded four (4) weeks prior to complete delivery of equipment in accordance with Engineering Standard No. FJ60.60.
- (3) If the publication of a subassembly manufacturer does not contain a complete operation, maintenance and parts breakdown meeting the intent of this Specification, then it shall be the responsibility of Seller to include such information in the Operation and Maintenance Manual.
- (4) All necessary precautions and warnings relative to the safety of life and equipment shall be included.

b. Operation

As a minimum, the Operation Section of the Manual shall contain the following:

- (1) Starting instructions, including, as applicable, instructions for initial startup, normal starting, starting after overhaul and startup after emergency trip.
- (2) Operating instructions, including trouble-shooting procedures.
- (3) Shutdown instructions, for both normal and emergency shutdown.
- (4) Design data for all equipment and systems, specifying horsepower, kilowatts, voltage, amperage, pressure, temperature, revolutions per minute, flow, etc.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)D. Operation and Maintenance Manuals (Contd)c. Maintenance

As a minimum, the Maintenance Section of the Manual shall contain the following:

- (1) Disassembling and reassembling instructions.
- (2) Preventive maintenance and lubrication information.
- (3) Description and identification of special maintenance tools.
- (4) Settings, clearance and adjustment data.

d. Parts Breakdown

The Parts Breakdown Section of the Manual shall contain:

- (1) A list of replacement parts, including drawings and data for all equipment assemblies and subassemblies. The material shall cover all information required for ordering replacement parts such as part name, part number, equipment serial number, supplier, address and normal delivery time.
- (2) Complete instructions for procuring replacement parts. Recommended forms for tabulating replacement part information and instructions for returning material to the factory shall also be included. Special storage, handling or packaging procedures required for any particular parts shall be noted.

E. Bills of Material

Detailed Bills of Material are required to facilitate identification by constructors of the items received. Shipment, therefore, shall be preceded by submittal of Bills of Material in accordance with Engineering Standard No. FJ60.60, Item 4 C.

4. DRAWINGS BY ENGINEER

- A. For applicable equipment, prints of drawings prepared by Engineer for use by others in constructing foundations, building components and major piping and wiring requiring coordination with the work associated herewith will be furnished to Seller for review as soon as possible after Engineer's receipt from Seller of the certified equipment drawings and design information necessary for their preparation.
- B. Where material, locations, etc., are marked HOLD on Engineer's Drawings, that material, location, etc., shall not be detailed or fabricated by Seller until the HOLD is removed by Engineer.

Project No. C-21700

Spec. No. FJ50.50

4. DRAWINGS BY ENGINEER (CONTD)

- C. Within 30 calendar days after the date of transmittal to Seller, Seller shall return to Engineer two (2) copies of each of these drawings marked to indicate Seller's review thereof either without change, or with any corrections or necessary changes clearly marked thereon in red or other contrasting color.
- D. After making such corrections or changes as shown on the review copies returned by Seller, Engineer will release these drawings for construction. Subsequent changes or corrections to foundations, building components, wiring or piping fabricated or installed in accordance with drawings corresponding to the review copies approved by the Seller, such changes having been necessitated by Seller-initiated modifications, shall be done in a manner satisfactory to Buyer and at Seller's expense.

5. TRANSMITTALS

When transmitting documentation, Seller shall:

- A. Prepare original and four (4) copies of transmittal letters to accompany each submittal of documentation. Drawing transmittal letters shall identify the purpose of the transmittal (drawings for review, revised drawings, final drawings), the piece of equipment or material involved, and shall list the drawing numbers with applicable revision numbers or dates.
- B. Identify each letter and parcel with Buyer's Project Name, Engineer's Project Number, Purchase Order Number and Seller's Shop Order Number, and transmit it by air mail or first class mail. Each parcel shall contain an enclosed copy of the transmittal letter.
- C. Stamp each document to be submitted with reproduction date and purpose of the transmittal, e.g., "For Review," "Revised," "Final," etc.

6. SPECIAL CONSIDERATIONS

- A. It is understood that upon delivery of Seller's documentation without any restrictive notations concerning such work, they shall become Buyer's property and may be used in any manner desired for obtaining replacements, repairs and spare parts.
- B. Seller's final invoice will not be paid by Buyer until all materials and/or equipment governed hereunder have been received complete at the delivery point, and final certified submittals of all specified documentation have been received by Engineer.

DIVISION USAGE						<h1 style="text-align: center;">Stearns-Roger</h1> <p style="text-align: center;">INCORPORATED</p> <p style="text-align: center;">ENGINEERING STANDARD</p>	STANDARD NUMBER					
MM	P	PP	SH	FI	SP		FJ 60.60					
APPROVALS Des. Sec. <i>[Signature]</i> Sect. Sup. <i>[Signature]</i> Div. <i>[Signature]</i>						DOCUMENTATION REQUIREMENTS PROJECT: SOLAR ONE CONTRACT/REQUISITION NUMBER: F010.2 TITLE: COAXIAL CABLE			C-21700 ISSUED 7/16/79 REVISED			
TYPE OF DOCUMENTATION						TYPE OF COPIES	FOR REVIEW		FINAL		REVIEW REQ'D BEFORE FAB.**	CTFY. FINAL ISSUE ***
							NO. OF COPIES	WEEKS AFTER AWARD*	NO. OF COPIES	"X" IF REQ'D		
1-ENGINEERING DRAWINGS						Repro- ducibles Prints						
A-Outline, General Arrangement and Principal Dimensions												
B-Cross Sections												
C-Foundation Requirements, including Loadings & Anchoring Locations												
D-Physical Locations of Piping and/or Wiring Terminals												
E-Control Diagrams												
F-Electrical Schematic Diagrams												
G-Wiring Diagrams, Including Internal External and Interconnecting												
H-Standard Hardware Items												
2-ERECTION OR INSTALLATION INFO.						Repro- ducibles Prints						
A-Shop Fabrication Drawings												
B-Erection or Installation Drawings												
C-Erection or Install. Instructions						Copies	8	6-8	8	X		X
3-SPECIAL DOCUMENTATION												
A-Performance Data, including Curves						Copies						
B-Design Calculations						Copies						
C-Test Reports						Copies						
D-Code Papers and Certificates						Copies						
E-Shop Fab. and/or Welding Proced.						Copies						
F-Shop Fabrication Reports						Copies						
G-Welder's Qualification Reports						Copies						
H-Operating Certificates						Copies						
4-MISCELLANEOUS												
A-Operation and Maintenance Manuals						Manuals						
B-Recommended Spare Parts List for 1 Year's Operation, with Unit Prices						Copies						
C-Bills of Material						Copies			8	X#		X
D-Definitive Drawing List						Copies						
<p>*-Entries in the column "WEEKS AFTER AWARD" designate which types of review documentation are required. Blank spaces in this column denote that review documentation is not required.</p> <p>**-"X" in this column means drawing review req'd. before fabric. release.</p> <p>***-"X" in this column means final issue must be certified for construction.</p> <p># At least 2 weeks before each shipment, detailed Bills of Material shall be sent to the plant site, c/o Stearns-Roger Resident Engineer, with 3 copies to Stearns-Roger Denver Office.</p> <p>This form supplements requirements, where specified, in Paragraph DOCUMENTATION in the Specification, and in Specification FJ50.50.</p>												
										Except where otherwise specified, send all Documentation to: Stearns-Roger Engineering Corp. P.O. Box 5888 Denver, Colorado 80217 Attn: Mr. R.K. Brushel		

April 15, 1980
(For Purchase)

SPECIFICATION
S-R F230.6

D.O.E. NO. 40 E 500 - 65

for

HELIOSTAT POWER CENTERS

for

10MW_e SOLAR PILOT PLANT

SOLAR - ONE
DAGGETT, CA.

Prepared by:

Stearns-Roger
ENGINEERING CORP.

PROJECT NO. C-21700

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SPECIAL INSTRUCTIONS

An asterisk has been placed in the right-hand margins to denote changes made to the "For Bid" Specification. The subject changes were made to conform this document to awardee's proposal and subsequent updating and/or negotiations.

All further changes to this "For Purchase" document shall be made by the issuance of a numbered revised copy.

DETAILED SPECIFICATION
FOR
HELIOSTAT POWER CENTERS

1. SCOPE

A. General

The equipment to be furnished and delivered shall consist of fourteen (14) Heliostat Power Centers, each with a pad-mounted 4160-208Y/120 volts distribution transformer and a 120/208-volt, 3-phase, 4-wire, power distribution panelboard, complete from high voltage incoming line terminals to low voltage outgoing feeder terminals and with the accessories as specified, and seven (7) watt transducers as specified.

B. Definitions

Engineer: Shall mean Stearns-Roger Engineering Corporation

2. SUPPLEMENTS

The following supplements are included with and form a part of this Specification.

- A. Specification No. FJ50.50, Documentation, dated 11/3/76, 7 pages.
- B. Engineering Standard No. FJ60.60, Documentation Requirements, dated 1/7/80, 1 page.
- C. Stearns-Roger Engineering Corporation Sketches

<u>Sketch No.</u>	<u>Date/Rev.</u>	<u>Title</u>
SK-E57	1/18/80	Heliostat Power Center Arrangement
SK-E62	1/8/80	Collector Field Grounding

D. Stearns-Roger Engineering Corporation Drawings

<u>Drawing No.</u>	<u>Sheet No.</u>	<u>Rev.</u>	<u>Title</u>	
40E7005133106	E2-2A	1	One Line Diagram - 4160 Volt Feeders	*
40E5005132700	E2-7A	1	Panel Schedule - Collector Subsystem	*

<u>Drawing No.</u>	<u>Sheet No.</u>	<u>Rev.</u>	<u>Title</u>	
40E5005132712	E2-8A	1	Panel Schedule - Collector Subsystem	*
40E5005132710	E8-13A	0	Heliostat Watt Transducer Enclosure - Details & Wiring Diagrams	
40E5005132723	E12-13A	1	Collector Subsystem Cable, Conduit and Grounding Details	*
40C5005132709	C36-9	2	Collector Field Transformer Foundations	*

3. EQUIPMENT TO BE FURNISHED

Major components of equipment to be furnished under this Specification consist of the following:

- A. Fourteen (14) outdoor, weatherproof type power center assemblies with 112.5 KVA pad-mounted, oil-filled distribution transformers and distribution panelboards, as follow:
- a. Eleven (11) power center assemblies, identical in design and construction, identified as:
 - POWER CENTER NO. 1
 - POWER CENTER NO. 4
 - POWER CENTER NO. 5
 - POWER CENTER NO. 7
 - POWER CENTER NO. 8
 - POWER CENTER NO. 9
 - POWER CENTER NO. 10
 - POWER CENTER NO. 11
 - POWER CENTER NO. 12
 - POWER CENTER NO. 13
 - POWER CENTER NO. 14
 - b. One (1) power center assembly, identical in design and construction to the above listed power centers except that it shall be equipped with two (2) loop-feed loadbreak switches as specified, identified as: POWER CENTER NO. 3
 - c. Two (2) power center assemblies; identical in design and construction to the power centers listed in a. above except that each power center shall be provided with equipment for metering

consisting of current transformers, watt transducer enclosure with watt transducer and accessories, and circuitry as shown on the Drawings; identified as: POWER CENTER NO. 2, POWER CENTER NO. 6

- B. Five (5) watt transducers, Scientific Columbus Model No. XL5C5A4, or Engineer-approved equal, for heliostat power system metering. These watt transducers shall be shipped loose and unmounted for installation by others. Each transducer shall be identified with an instrument tag having an instrument number as follows:

Instrument No.

JT-1451X
JT-1452X
JT-1453X
JT-1454X
JT-1455X

- C. Two (2) watt transducers, Scientific Columbus Model No. XL31K5A4, or Engineer-approved equal, for primary metering equipment. These watt transducers shall be shipped loose and unmounted for installation by others. Each transducer shall be identified with an instrument tag having an instrument number as follows:

Instrument No.

JT-1458X
JT-1459X

- D. Special tools and devices, if required, for operation and maintenance.

4. EQUIPMENT AND SERVICES FURNISHED BY OTHERS

The following will be furnished by others:

- A. Receiving, unloading, installation, and field inspection and testing.
B. Concrete foundations and anchor bolts for the Power Centers.
C. 5 kV power cable for incoming lines and 600-volt power cables for outgoing feeders.
D. Control cable for external metering circuits.

5. OPERATING CONDITIONS

A. Environmental

The equipment furnished shall incorporate all features necessary for satisfactory operation under the following environmental conditions:

- a. Location: Outdoors, subject to blowing sand and dust.
- b. Plant elevation above mean sea level: 1950 feet (13.72 psia).
- c. Ambient temperature range, degrees 9 F to 117 F
- d. Seismic loads: The plant is located in Uniform Building Code Seismic Zone 3.

B. Service Conditions

The Power Centers will receive 4160-volt, 3-phase, 60 hertz incoming power from the Heliostat Interface Load Interrupter Switchgear as shown on the Drawings.

6. DESIGN AND CONSTRUCTION

A. General

The equipment to be furnished hereunder shall have a service life of thirty (30) years. The equipment shall consist of essentially standard design and quality which meets or exceeds the requirements of this Specification. Materials shall be in accordance with ASTM requirements, be new and of first quality, and shall be free of all defects which could affect performance or service life of the equipment, or which would cause unsightly or unworkmanlike appearance.

B. Codes, Standards and Regulations

All equipment specified herein shall be manufactured and tested in accordance with the latest applicable Standards and requirements of the following:

- a. ANSI - American National Standards Institute
- b. ASTM - American Society for Testing and Materials
- c. AWS - American Welding Society
- d. IEEE - Institute of Electrical and Electronic Engineers

- e. NEC - National Electrical Code
- f. NEMA - National Electrical Manufacturers Association
- g. OSHA - Occupational Safety and Health Act
- h. UBC - Uniform Building Code

If there is a conflict between any of the requirements of this Specification and the requirements of the Williams-Steiger Occupational Safety and Health Act of 1970, Part 1910, "Occupational Safety and Health Standards," as amended, the state of California OSHA Standards and/or any other applicable statute, ordinance or code, then the requirement which is most stringent or has governing jurisdiction shall apply. Seller shall not be liable for factors over which it has no control, e.g., incorrect installation, operation and maintenance.

C. Ratings and Design Parameters

a. Pad-Mounted Distribution Transformers

The transformers shall be 3-phase, oil-filled, self-cooled, dead-front units constructed in accordance with ANSI C57.26. "T-T" type core and coil construction is not acceptable.

(1)	Continuous capacity, 63 C rise, OA, KVA	112.5	*
(2)	Frequency, hertz	60	
(3)	High-voltage winding, volts	4160 delta connected	
(4)	Low-voltage winding, volts	208Y/120	
(5)	Insulation liquid	Mineral oil	
(6)	Insulation class, kV	5	
(7)	BIL, kV	60 (minimum)	
(8)	Impedance on 112.5 KVA base, percent	3.2 (approximate)	
(9)	Taps, high voltage winding		
	(a) Quantity - percent above normal	2 - 2.5	
	(b) Quantity - percent below normal	2 - 2.5	

b. Current-Limiting Fuses

(1)	Voltage rating, volts	4,800
(2)	Current rating, amperes	45
(3)	Interrupting rating, rms amperes symmetrical	25,000
(4)	Interrupting rating, rms amperes asymmetrical	40,000

c. Loadbreak Switches (Power Center No. 3)

(1)	Type	3-pole, oil-immersed, manually gang-operated, 2-position, with stored energy operation
(2)	Maximum voltage rating, kV	5
(3)	Continuous current rating, amperes	200
(4)	Loadbreak current rating, amperes	200
(5)	Close-in rating, rms amperes asymmetrical	10,000
(6)	Momentary rating, rms amperes asymmetrical	10,000
(7)	Two-second rating, rms amperes symmetrical	4,000

d. Current Transformers (Power Centers No. 2 and No. 6)

(1)	Class, volts	400
(2)	Ratio	300/5A
(3)	Metering accuracy class, ANSI	0.6 at B-0.1

e. Distribution Panelboards

(1) Panelboard Ratings

(a)	Voltage rating, volts ac	240
(b)	Main bus current rating, amperes	400
(c)	Short circuit rating, amperes	10,000 (minimum)

*

- (2) Main Breaker Ratings
 - (a) Voltage rating, volts ac 240
 - (b) Current rating, amperes 400
 - (c) Interrupting rating, rms amperes symmetrical 22,000
- (3) Branch Circuit Breaker Ratings
 - (a) Voltage rating, volts ac 240 & 120
 - (b) Current rating, amperes
 - 1 Single-pole breakers(120 volts) 30
 - 2 3-Pole breaker (240 volts) 40
- (4) The panelboards shall be in accordance with NEMA Standard PB-1.

f. Watt Transducers

- (1) The two (2) watt transducers for use with Power Centers No. 2 and No. 6 shall be indoor type, self-powered, 3-element units for 120/208 volts, 3-phase/4-wire connection, with effective range of 0 to 3000 watts and 1500 watts calibration.
- (2) The five (5) watt transducers for heliostat power system metering shall be indoor type, self-powered, 1-element units for 120-volt, single-phase connection, with effective range of 0 to 1000 watts and 500 watts calibration.
- (3) The two (2) watt transducers for primary metering equipment shall be indoor type, self-powered, 2-element units for 120-volt, 3-phase/3-wire connection, with effective range of 0 to 2000 watts and 1000 watts calibration.
- (4) All watt transducers furnished shall be in accordance with applicable ANSI and NEMA Standards and the following:
 - (a) Nominal voltage input, volts (per element) 120
 - (b) Burden at 120 volts, voltamperes 0.1
 - (c) Continuous overload voltage, volts 175

(d)	Voltage range, volts	0-150
(e)	Input current, amperes	
	<u>1</u> Nominal	5
	<u>2</u> Range	0-10
	<u>3</u> Continuous overload	15
	<u>4</u> 10 seconds/hour overload	50
	<u>5</u> 1 second/hour overload	400
(f)	Element burden at 5 amperes input current, voltamperes	0.2
(g)	Rated output (Full Scale), milliamperes dc	± 1
(h)	Accuracy, percent	$\pm(0.2 \text{ Reading} +$ 0.01 rated $\text{output})$
(i)	Load resistance, kilohms	0-10
(j)	Output ripple peak, percent	Less than 0.5 of rated output
(k)	Response time (to 99 percent), milliseconds	Less than 400
(l)	Frequency, hertz	58-62
(m)	Temperature range, degrees C	Minus 20 to plus 70
(n)	Temperature influence, percent per degree C, maximum	± 0.005
(o)	Operating humidity, percent	0-95
(p)	Stability (per year), percent	± 0.1 of rated output maximum
(q)	Dielectric test, rms volts at 60 hertz	1800

- | | |
|---------------------------------|--|
| (r) Surge withstand | Withstand IEEE
Standard 472 SWC
test |
| (s) Calibration adjust, percent | ± 2 (minimum) |

D. Power Center Design Features

a. Enclosure

- (1) The power center enclosure shall be of the weatherproof, tamper-resistant type designed and constructed for dead-front, loop-feed operation with high voltage (HV) and low voltage (LV) compartments as specified. Typical power center arrangement required is shown on Sketch No. SK-E57 attached as a supplement.
- (2) The enclosure shall include, but not be limited to, the following standard design features:
 - (a) Rear-hinged, removable weatherproof cover to limit access to terminal compartment and transformer tank handhole unless compartment doors are opened first.
 - (b) High and low voltage terminal compartments with removable front sill for bolt-on construction.
 - (c) HV/LV compartment barrier.
 - (d) Removable, hinged, lift-off compartment doors with open-position stops.
 - (e) Three-point compartment door latching with single handle and provisions for padlocking.
 - (f) Bolted safety catch between the HV/LV compartment barrier and the HV compartment door.
 - (g) Enclosure lifting lugs located approximately 60 inches above bottom of enclosure and recessed jacking pads at bottom of enclosure.

b. Transformer

- (1) The transformer shall be designed for use under the "usual service conditions" as described in ANSI C57.12.00, "General Requirements for Liquid Filled Transformers."

- (2) All transformer parts shall be adequately sized, insulated and braced to singly and collectively withstand, without impairment to successful operation, the short-circuit test code prepared by the IEEE Transformer Committee as an amplification of ANSI Standard C57.12, Section 10, latest revision at the time of design.
- (3) A handhole shall be provided bolted on to the tank top.
- (4) The tap changer shall be located to provide for external control in the HV compartment and shall be arranged for deenergized operation only. A nameplate shall be provided for the tap changer.
- (5) The transformer shall be provided with an oil-fill plug and with a self-actuating pressure relief device.
- (6) The transformer shall be provided with the ANSI accessory group of valves, gages and tank accessories as follows:
 - (a) Dial-type thermometer with maximum temperature indicator.
 - (b) Liquid-level gage.
 - (c) Drain valve with sampling device.
 - (d) Provisions only for a vacuum-pressure gage.

c. High Voltage and Low Voltage Compartments

(1) General

The high-voltage incoming line terminal compartment and the low-voltage outgoing line terminal compartment shall be full-height, air-filled compartments, side by side, separated by a steel barrier with the high voltage compartment on the left as shown on the Drawings. The high voltage compartment shall be accessible only after the low voltage compartment door has been opened. Incoming and outgoing cable entrance shall be from the bottom. The weatherproof enclosure cover and compartment doors shall be removable as specified hereinbefore to facilitate installation of cables.

(2) High Voltage Compartment

- (a) Equipment enclosed in the high voltage compartment shall include the following:

- 1 Six (6) 200-ampere universal type bushing wells for non-loadbreak use complete with cable terminators.
- 2 Six (6) parking stands for cable terminators.
- 3 Drawout loadbreak current limiting fuse assembly.
- 4 Loadbreak switches for Power Center No. 3 only.
- 5 No-load tap changer.
- 6 Drain valve and sampling device.
- 7 Cable terminating compartment with adequate space and provisions for terminating six (6) incoming lines in a dead-front, loop-feed arrangement, including a removable structural support for installation of cable terminators as shown on the Drawings.
- 8 ANSI tank grounding provisions with one (1) 1/2-13 tapped hole.
- 9 Ground bus connected to transformer ground pad, and provisions for grounding the 5000-volt metal-clad shielded power cables as shown on the Drawings.

(b) Each power cable to be terminated in the high voltage compartment will be a 5000-volt, shielded 3/C - No. 2/0 AWG, metal-clad cable with two No. 2/0 AWG bare stranded alloy coated copper ground conductors included. Conductors will be stranded copper with ethylene propylene rubber insulation.

*
*

(c) The incoming line connections shall be identified by stencil markings on the front plate of the transformer. Phase designations H1A, H2A and H3A shall be used to identify source "A"; and H1B, H2B and H3B shall be used to identify source "B" of the loop-feed system.

(3) Low Voltage Compartment

(a) Equipment enclosed in the low voltage compartment shall include the following:

- 1 Low-voltage porcelain or epoxy bushings externally clamped with 4-hole spades with NEMA hole spacing. An insulated low-voltage neutral bushing with an externally removable ground strap shall be included.
- 2 Main buses for connection from low-voltage bushings to main circuit breaker in power distribution panelboard.
- 3 Dial-type thermometer with maximum temperature indicator.
- 4 Liquid-level gage.
- 5 Oil-fill plug and self-actuating pressure relief device.
- 6 Provision for vacuum-pressure gage.
- 7 Transformer nameplate.
- 8 120/208-volt power distribution panelboard as specified herein and shown on the Drawings.
- 9 Space heaters as specified herein.
- 10 Control panel for space heaters as specified herein.
- 11 Current transformers for Power Centers No. 2 and No. 6 only.
- 12 Cable terminating compartment with adequate space for 14 - 4C metal-clad 600-volt power cables, sizes as shown on the Drawings, entering from below with a removable structural support for installation of cable terminators as shown on the Drawings.
- 13 ANSI tank grounding provisions with one (1) 1/2-13 tapped hole.
- 14 Ground bus connected to transformer ground pad, and provisions for grounding the 600-volt metal-clad power cables as shown on the Drawings.
- 15 Insulated copper bus or cable connections from low-voltage neutral bushing to distribution panel neutral bus and to transformer ground pad.

d. Transformer Overcurrent Protection

- (1) Each transformer shall have overcurrent protection provided by a set of three (3) drawout loadbreak current limiting fuses. The current limiting fuse assembly shall be capable of being used as a high-voltage disconnect to remove the transformer from the incoming line during system operation and to permit easy fuse replacement.
- (2) The drawout loadbreak current limiting fuse assembly shall be capable of breaking load approximately ten times without replacement. The drawout loadbreak current limiting fuse assembly shall be made up with general purpose current limiting fuses and dry well interrupters. The fuses and loadbreak devices shall be isolated from the transformer insulating oil.
- (3) The fuse assembly shall be hook-stick operable.

e. Loadbreak Switches (Power Center No. 3)

- (1) Two (2) loop-feed loadbreak, oil-immersed switches shall be furnished for primary selective switching of high-voltage feeders to Transformer No. 3 in Power Center No. 3.
- (2) Each loadbreak switch shall have a 2-position (Open-Closed) switching section and the switching sections for the two switches shall operate independently of each other. Four different combinations of switching positions shall be provided for in the loop feed arrangement.
- (3) The loadbreak switch mechanism shall utilize a manually charged, stored-energy spring action for opening and closing operations.
- (4) The loadbreak switches shall be hook-stick operable.

f. Current Transformers (Power Centers No. 2 and No. 6)

- (1) Ring type current transformers (one per phase) shall be provided for the watt transducer metering on Power Centers No. 2 and No. 6 only.
- (2) The current transformers shall be mounted either around the transformer low-voltage bushings or around the low voltage bus connections to the distribution panelboard.
- (3) The current transformer secondary leads shall be installed and connected to the watt transducer in the watt-transducer enclosure as shown on the Drawings.

g. Distribution Panelboards

- (1) Each power distribution panelboard shall be a 120/208-volt, 3-phase, 4-wire, 42 circuit panel with branch circuit breakers and main circuit breaker as shown on the Drawings. The panelboard shall be a Westinghouse Type WEB, or Engineer-approved equal, conforming to Federal Specification WP-115a, Type 1, Class 1.
- (2) The main circuit breaker shall be a molded-case, thermal-magnetic type for bolt-on installation meeting Federal Specification WC-375b, Class 14b, and including pressure type Al/Cu terminals for wire size 3/0 AWG to 250 MCM.
- (3) The branch circuit breakers shall be bolt-on type meeting Federal Specification WC-375b and including pressure type Al/Cu terminals for wire size No. 14 AWG to No. 4 AWG.
- (4) Each distribution panelboard shall be provided with a directory card in a waterproof envelope. The directory shall list the branch circuits as shown on the panel schedules on the drawings.

h. Low-Voltage Buses (Low-Voltage Bushings to Main Breaker)

Buses shall be high conductivity copper or aluminum and shall be sized for the rated continuous and momentary currents within allowable temperature rise. Bus joints shall be all welded or high pressure bolted. Bolted joints shall be silver or tin surfaced. Belleville type spring washers shall be used on all aluminum-to-aluminum bus joints made up with non-aluminum bolts.

i. Grounding

(1) General

- (a) In general, all electrical equipment frames and/or bases, control equipment, panels, transformers, supporting steel structures, metal cabinets containing connected electrical apparatus, wiring devices, and metal-clad cable systems must be connected to ground.
- (b) Single-point grounding will be employed in the power centers secondary power distribution system. All power source system neutrals will be connected to the ground grid at one point only as shown in Sketch No. SK-E62.

(2) Specific Requirements

- (a) Each power center shall be furnished with two transformer ground pads as specified hereinbefore, one in the high-voltage compartment and one in the low-voltage compartment. Each compartment shall be provided with a continuously silver-plated copper ground bus extending the entire length of the compartment and connected to the transformer ground pad. The minimum size of the ground bus shall be 1 inch by 1/4 inch. Ground bus splice joints shall not be coincident with bolts which support the bus. Bolted connections to the ground bus shall be separate from support and splice joint bolts. The ground buses shall be adequate to terminate cable ground wires, cable conductor shields, and cable metal sheaths as shown on the Drawings.
- (b) Ground cable terminations shall be bolted, compression-type lug connections utilizing silicon bronze machine bolts. The size of ground conductors for the system grounds will be as shown on the Drawings or in accordance with NEC requirements if no size is indicated.
- (c) Each transformer secondary shall have its neutral connected to the transformer ground pad to provide for connection to the ground grid at one point only. The neutral shall also be grounded with the ground wire in the 5000-volt power cable feeding the transformer primary as shown on Sketch No. SK-E62.
- (d) Each power distribution panelboard shall contain an insulated neutral bus connected to the transformer secondary neutral insulated bushing for the 208Y/120 volts system.

j. Watt Transducer Enclosures (Power Centers No. 2 and 6)

- (1) The watt-transducer enclosures shall be furnished, equipped, wired and installed in accordance with the Drawings.
- (2) The receptacle boxes shall be Killark, FDQ and the box covers Killark type FCLR, or Engineer-approved equal.
- (3) Each watt transducer shall be identified with an instrument number on an instrument tag and shall be located as follows:

<u>Watt Transducer Instrument No.</u>	<u>Located in Watt Transducer Enclosure No.</u>
JT-1456X	JB-1926
JT-1457X	JB-1927

- (4) Each watt transducer shall receive its voltage input from a fused source obtained from the power distribution panelboard. The fuses shall be located in the watt-transducer enclosure and the voltage source connected to the panelboard as shown on the Drawings.
- (5) The single receptacle shall receive its voltage input from a circuit breaker as shown on the Drawings.
- (6) Wiring shall meet the following requirements as applicable.
 - (a) Furnish and install all instrument power and control wiring between all devices and between devices and outgoing terminal blocks. All insulated wire, cable and wiring accessories including connectors, wire clamps and supports, terminal blocks, and receptacles and their supports shall be furnished. Interconnecting wiring and external wiring shall enter the enclosure from the back and bottom. All wiring shall be bundled and shall be complete with clamps and supports.
 - (b) Control wiring shall be securely supported and connected to terminal blocks for connection to external cables. Wiring shall be stranded switchboard type with SIS 600-volt class insulation. All wiring shall be connected to device studs and terminal blocks with insulated compression ring-tongue type lugs. Bundles of panel wiring and individual wires shall have 90-degree bends with the required radius to prevent possible wire damage. All wiring shall be capable of passing the FR-1 UL-44 flame test.
 - (c) All current transformer secondary wiring shall have a red sleeve at the point of origin and point of termination. All voltage transformer secondary circuits shall have a blue sleeve at the point of origin and point of termination. All case ground circuits, if used, shall have a green sleeve at the point of origin and point of termination. All other circuits shall have a white sleeve at the point of origin and at point of termination. Conductors shall be plainly marked on the sleeve with a wire

number in accordance with the Drawings. In addition to the wire number, dc control power circuits shall have the polarity, "+" or "-", marked on the sleeve and ac control power circuits shall have the polarity "X1" or "X0", marked on the sleeve. The sleeve shall be immediately adjacent to the connector. The wire number and color of each sleeve shall appear on all associated drawings.

(d) Terminal Blocks

- 1 Within each enclosure, all wiring and interface terminals of the same classification to be used for interconnecting with all associated devices in one remote location shall be grouped together on one or more adjacent terminal block(s). The terminal blocks shall be mounted for accessibility and entry of external cables. The arrangement and location of all interface terminal blocks shall be as shown on the Drawings.
- 2 All terminal blocks shall have slotted washer-head, screw-type connectors as required for terminating No. 10 AWG conductor ring-tongue terminals. Terminal blocks shall be Marathon Series 100, or Engineer-approved equal.
- 3 At least 20 percent spare terminal block points shall be provided. All internal wiring shall be terminated with no more than two (2) conductors per terminal block point, and on only one side of a terminal block array.
- 4 All terminal block points shall be marked in accordance with the Drawings.

k. Space Heaters

- (1) Space heaters, as required to prevent condensation, shall be provided and installed in the low-voltage compartment of each Power Center. The space heaters shall be rated 230 volts ac single phase and shall be connected to operate on 120 volts from the power distribution panel.
- (2) A space heater control panel shall be provided and installed in the low voltage compartment to contain a thermostat with OFF-AUTO selector switch, circuit breaker(s) as required, terminal block(s) and wiring.

- (3) The Seller shall furnish and install space heater wiring in conduit as required.
- (4) Control panel wiring shall be switchboard type with SIS 600-volt class insulation to meet the FR-1 UL-44 flame test. All wiring shall be connected to devices and terminal blocks with insulated compression ring-tongue type terminals. Terminal blocks shall be Marathon Co. Series 1500, or Engineer-approved equal, with screw-type connectors as required for terminating No. 10 AWG conductors.
- (5) The thermostat range shall be between 40 degrees F and 70 degrees F with set point adjusted at 55 degrees F.

7. NAMEPLATES

- A. Each power distribution transformer shall be provided with a stamped or engraved metal nameplate in accordance with ANSI C57.12.
- B. Nameplates shall be provided for each power center, power distribution panelboard, watt-transducer enclosure, and control panel as shown on the Drawings and specified herein. All nameplates shall be subject to approval by the Engineer. Nameplate material shall be 1/16-inch thick black and white laminated phenol resin. The engraving shall extend through a semimatte black surface to give white letters of adequate readability. Gothic letters shall be provided with a weight to height ratio of 1 to 8. Nameplate mounting screws shall be of the pan-head, self-tapping type.
- C. Power center nameplates shall be 1-1/2 inches high by 6 inches wide with 3/8-inch letters and figures. Distribution panelboard and watt-transducer enclosure nameplates shall be a minimum of 1-inch high by 3 inches wide with approximately 1/8-inch letters and figures. Control panels shall have nameplates with approximately 1/8-inch letters and figures.
- D. The Seller shall provide stainless steel instrument tags for the watt transducers, bearing instrument number and Buyer's order number.

8. FACTORY TESTS

- A. Each power distribution transformer shall be tested in accordance with the applicable sections of ANSI C57.12.00 and ANSI C57.12.90.
- B. The Seller shall perform operational and wiring tests on the Power Centers in accordance with the applicable requirements of ANSI and NEMA Standards.

- C. The Seller shall perform the following tests as required on all control and distribution panels in accordance with ANSI C37.20-5.3 and NEMA Standard PB-1.
 - a. Dielectric tests
 - b. Sequence tests
 - c. Check on control wiring
 - d. Mechanical tests
- D. All wires and cables furnished under this Specification shall meet the requirements of the FR-1 UL-44 flame test.

9. FINISHING AND PAINTING

A. General

All metallic equipment surfaces shall be cleaned and painted by the manufacturer before shipment, except for surfaces finished in a noncorrosive material such as aluminum, zinc (galvanized) or similar material.

B. Surface Preparation

Surfaces to be painted shall be thoroughly cleaned in accordance with the manufacturer's standard practice. All mill scale, loose metal particles, weld spatter and other foreign matter shall be removed. All burrs shall be removed, all sharp edges eased and all surfaces wire brushed as necessary to provide a smooth surface. Prior to painting, the entire surface shall be cleaned with solvent cleaner to remove oil, grease and any residue from prior cleaning operations.

C. Painting

All steel surfaces shall be given one (1) coat of a rust-resisting primer. Exterior surfaces shall be given two (2) coats of semigloss enamel, ANSI Standard Z55.1 No. 70 light gray. Interior surfaces shall be painted in accordance with the manufacturer's standard. At least one (1) pint of each type of paint shall be supplied for field touchup.

10. SPECIAL TOOLS AND DEVICES

One (1) complete set of new and unused special tools and devices required for operation and maintenance of the equipment furnished shall be furnished and delivered with the equipment in a separate container.

11. PREPARATION FOR SHIPMENT

- A. The equipment shall be shipped to the jobsite in the smallest practical number of shop fabricated and assembled sections.
- B. Each section shall be sealed to prevent entrance of water and dust during shipment. Each box, crate and shipping section shall be marked for identification and to indicate contents to permit orderly field assembly.
- C. Openings and terminal connections shall be protected by covers or wood guards. Wherever applicable, parts shall be factory boxed, crated or otherwise suitably prepared to prevent shipping and weather damage.

12. DOCUMENTATION REQUIREMENTS

- A. Prior to fabrication or delivery to the jobsite of equipment to be furnished under this Specification, the Seller shall submit to the Engineer, for review and comment, the drawings and descriptive data called for in this Specification. Drawings and data submittals shall be in accordance with Specification No. FJ50.50 and Engineering Standard No. FJ60.60, both attached.

In addition, all documentation shall bear identification in accordance with Paragraphs 4.2 and 4.4 of STMPO-A1 "Document Identification," attached. Final discipline, system and block numbers will be furnished to the Seller after award of Contract and receipt of Seller's drawing list, if applicable.

- B. Documentation shall be in accordance with FJ50.50 and the following:
 - a. Item 1A of Engineering Standard No. FJ60.60 shall include equipment weights.
 - b. Item 1F of Engineering Standard No. FJ60.60 shall include elementary diagrams.
 - c. Item 1G of Engineering Standard No. FJ60.60 shall include:
 - (1) Connection diagrams
 - (2) Nameplate data

13. GUARANTEES

- A. The Seller shall guarantee that the equipment furnished conforms to the requirements set forth and to the specified Codes, Standards and Regulations and that all specified tests have been satisfactorily completed.

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B. The foregoing shall not be construed in any way to limit or negate any other standard guarantee or portion thereof which may provide a more comprehensive guarantee than those required by this Specification.

14. SCHEDULE

Shipment shall be as follows: Fifteen to seventeen weeks after order. *

EQUIPMENT BID DATA

NAME OF BIDDER

Westinghouse Electric Supply

In addition to other data and descriptive material furnished with Bidder's Proposal, Bidder shall fill in all spaces of the following Bid Data Section:

1. WEIGHTS, POUNDS

- A. Power Center No. 1 3500 *
- B. Power Center No. 2 3500 *
- C. Power Center No. 3 3500 *
- D. Heaviest shipping assembly 3500 *

2. DIMENSIONS, INCHES

- A. Complete power center assembly
 - a. Maximum length
 - b. Maximum height
 - c. Maximum depth
- B. Power distribution panelboard, h x w x d x x

3. COMPONENT INFORMATION

- A. Pad-mounted transformers
 - a. Manufacturer Westinghouse *
 - b. Impedance, percent 3.2 *
- B. Distribution panelboard
 - a. Panelboard manufacturer Westinghouse *
 - b. Circuit breaker manufacturer Westinghouse *
- C. Current transformers
 - a. Type
 - b. Manufacturer
- D. Watt transducer
 - a. Type of model number
 - b. Manufacturer Scientific Columbus *

EQUIPMENT BID DATA (CONTD)

NAME OF BIDDER

Westinghouse Electric Supply

4. SPECIAL TOOLS

List all special tools required and included for operation, maintenance and repair of the equipment.

NONE

Project No. C-21700
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November 3, 1976

SPECIFICATION

NO. FJ50.50

FOR

DOCUMENTATION

FOR

HELIOSTAT POWER CENTERS

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STEARNS-ROGER INCORPORATED
DENVER, COLORADO

PROJECT NO. C-21700

Project No. C-21700
Spec. No. FJ50.50

DOCUMENTATION

1. SCOPE

- A. This Specification outlines the requirements for, and the procedures associated with, the preparation and exchange of documentation for the work, equipment and/or materials specified in the Contract or Specification to which this Specification is a supplement.
- B. This Specification supplements requirements in Engineering Standard No. FJ60.60.
- C. This Specification also supplements requirements, where specified, in Paragraph DOCUMENTATION of the Contract or Specification to which this Specification is a supplement.
- D. This Specification and supplementary references specified in the foregoing paragraphs cover minimum requirements for documentation and are not intended to limit the amount of additional documentation which may be required for the engineering coordination, use or maintenance of the work, equipment and/or materials being furnished. Such additional documentation shall be provided by Seller or Contractor.
- E. All references to "Seller" herein shall apply to Seller or Contractor. All references to "Buyer" herein shall apply to the Buyer or the Owner. All references to "Engineer" herein shall apply to Stearns-Roger Incorporated.

2. TYPE, QUANTITIES AND QUALITY OF COPIES

The type and quantities of copies for required documentation are specified on Engineering Standard No. FJ60.60. Quality requirements shall be as follows:

A. Reproducible Drawings

All reproducible drawings submitted to Engineer shall be furnished on ozalid vellum, auto-positive vellum or Mylar, black line on vellum, or other Engineer-approved medium, each to be suitable for legible reproduction by the diazo copy process. Reproducible drawings shall be rolled, not folded, and enclosed in mailing tubes when mailed to Engineer or otherwise handled.

B. Prints

Where designated by the word "Prints" on Engineering Standard No. FJ60.60, it shall be understood to mean suitable "blueprint print/copy," "blueprint," or other Engineer-accepted reproduction of an original Seller-prepared tracing or sepia.

Project No. C-21700Spec. No. FJ50.50**2. TYPE, QUANTITIES AND QUALITY OF COPIES (CONTD)****C. Other Documentation**

Where designated by the word "Copies" on Engineering Standard No. FJ60.60, applicable documentation shall be submitted on legible, black on white, 8-1/2-inch by 11-inch pages.

3. DOCUMENTATION BY SELLER**A. General**

- a. Required types of documentation are specified on Engineering Standard No. FJ60.60. Where this Standard does not fully describe individual categories of documentation that are required, such detailed categories are specified in Paragraph DOCUMENTATION of the Contract or Specification to which this Specification is a supplement.
- b. Where equipment for Units 1 and 2 is identical, or where equipment is common to Units 1 and 2, one (1) set of documentation shall be furnished. If equipment is identical, Seller shall certify, on each document, that it is applicable to both Units 1 and 2. Where equipment is neither identical for nor common to Units 1 and 2, two (2) complete, individual sets of documentation shall be furnished, appropriately identified.
- c. The title block of each drawing shall denote the applicability of the drawing either to "Unit 1," "Unit 2" or "Units 1 and 2." Other documentation submitted by Seller shall carry similar identification.
- d. The following information shall be included in each drawing:
 - (1) Buyer's Name.
 - (2) Engineer's Project Number.
 - (3) Plant or station name.
 - (4) Unit number (if applicable).
 - (5) Buyer's Purchase Order Number.

Other documentation submitted by Seller shall carry similar identification.

- e. Unless specifically approved by the Engineer, "typical" or "similar" documentation is not acceptable for review.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)A. General (Contd)

- f. "Standard Hardware Items" are defined as standard commercial items, such as air and hydraulic cylinders and operating valves, gear reducers, small motors, instruments, etc. For such items, review drawings are not required. Certified sheets showing exact mounting dimensions, overall dimensions, cross-sectional arrangement, parts nomenclature and material designation shall be submitted. Details of parts shall be furnished when requested by Buyer.
- g. Within 30 days after written notice of award, Seller shall submit a complete Definitive Drawing List, by drawing and title, of all drawings that will be submitted to Engineer. On this list, each drawing shall be identified by its appropriate category as defined in Items 1 or 2 on Engineering Standard No. FJ60.60, and as supplemented in Paragraph DOCUMENTATION of the Contract or Specification. Any drawing that does not fall under these predefined categories shall be identified on the list as "Miscellaneous." This list shall include proposed submittal dates for each drawing. This drawing list and schedule, together with any subsequent modifications, shall be subject to Engineer's review and comments.

B. Progress Reports

Seller shall furnish Engineer monthly progress reports and schedule status reports. These reports and schedules shall cover the complete status and progress of engineering, documentation, fabrication, materials, labor and shipment.

C. Review and Comment

- a. Entries in the column "WEEKS AFTER AWARD" on Engineering Standard No. FJ60.60 designate maximum time spans for Seller's submittal of documentation for review after the date of Buyer's written notification of award, whether such notification be in the form of a Purchase Order, a Letter of Intent or similar written authorization.
- b. All documentation to be certified and submitted by Seller for interface coordination shall show sufficient details of design so that the Engineer may proceed with his overall project design where interrelated with Seller's design.
- c. All documentation submitted in the correct and complete form to Engineer for his review and comment will be processed and a copy sent to Seller within 2 weeks after receipt of Seller's submittal. If more than 2 weeks review time is necessary, Engineer will advise Seller in writing as to his review schedule for such data. Seller shall then advise Engineer in writing what effect the extended review schedule has on the scheduled delivery of Seller's materials and equipment.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)C. Review and Comment (Contd)

- d. Drawings and data will be returned to Seller marked either "REVIEWED/NO COMMENTS," "REVIEWED/SEE COMMENTS" or "REVISE PER COMMENTS AND RESUBMIT FOR REVIEW."
- e. When the documentation is returned marked "REVIEWED/NO COMMENTS" or "REVIEWED/SEE COMMENTS," final certified submittals incorporating the noted changes shall be furnished, unless otherwise authorized by Engineer in writing, within 3 weeks from the time of receipt of copy by Seller or at least 3 weeks before the scheduled delivery of Seller's work, whichever is earlier. Where Engineering Standard No. FJ60.60 stipulates that drawing review is required before release for fabrication, "REVIEW/SEE COMMENTS" shall constitute such release.
- f. When the documentation is returned marked "REVISE PER COMMENTS AND RESUBMIT FOR REVIEW," the documentation with the noted revisions incorporated shall be resubmitted for review and comment within 3 weeks from the time of receipt of copy by Seller. The review and comment and final submittal schedule shall be as specified in Sub-paragraphs 3.C.c. and 3.C.e. above.
- g. The documentation submittal schedules shall be adhered to by Seller, unless otherwise authorized by Engineer in writing. In any case, final submittals shall be furnished at least 3 weeks before the scheduled delivery of Seller's work.
- h. When reviewed information is subsequently revised by Seller, or is subsequently found to be deficient because of Seller's error or omission, additional Seller submittals shall be made to Engineer as developed. Any Engineer's design changes and any changes in equipment or construction by others which are required to make such subsequent revisions an integral part of the overall project shall be made at Seller's expense.
- i. Fabrication or shipment shall be at Seller's risk, whether or not Engineer has reviewed Seller's drawings as specified on Engineering Standard No. FJ60.60.
- j. Seller will be notified of review by a stamped copy of Stearns-Roger Form 02.145 or TRMSR05A stating "Supplier: As to all Drawings/Data listed on this transmittal: PROCEED TO FABRICATE." All Seller drawings which are submitted as final shall be stamped "Final." Where specified on Engineering Standard No. FJ60.60, final drawings shall be certified for construction.
- k. Neither review of, nor comment or revision on drawings by Engineer relieves Seller or Contractor from compliance with Specifications or with all other requirements of Purchase Order or Contract, nor shall the procedures outlined herein be cause for delay of equipment deliveries, except as otherwise specified herein.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)C. Review and Comment (Contd)

1. Notations made during the review of drawings shall not be construed to authorize contractual changes in price or delivery of equipment or materials furnished by Seller. If the scope of work has been changed as a result of such notations, Seller shall request a change in Purchase Order price and/or delivery date(s). Seller shall make the request in writing to Engineer before proceeding with the work.

D. Operation and Maintenance Manualsa. General

- (1) Seller shall furnish Operation and Maintenance Manuals which shall be complete for all equipment and systems furnished by Seller and by Seller's suppliers. Any differences between equipment supplied for Unit 1 and Unit 2 with regard to operation and maintenance shall be clearly defined in these Manuals.
- (2) Manuals shall be forwarded four (4) weeks prior to complete delivery of equipment in accordance with Engineering Standard No. FJ60.60.
- (3) If the publication of a subassembly manufacturer does not contain a complete operation, maintenance and parts breakdown meeting the intent of this Specification, then it shall be the responsibility of Seller to include such information in the Operation and Maintenance Manual.
- (4) All necessary precautions and warnings relative to the safety of life and equipment shall be included.

b. Operation

As a minimum, the Operation Section of the Manual shall contain the following:

- (1) Starting instructions, including, as applicable, instructions for initial startup, normal starting, starting after overhaul and startup after emergency trip.
- (2) Operating instructions, including trouble-shooting procedures.
- (3) Shutdown instructions, for both normal and emergency shutdown.
- (4) Design data for all equipment and systems, specifying horsepower, kilowatts, voltage, amperage, pressure, temperature, revolutions per minute, flow, etc.

Project No. C-21700Spec. No. FJ50.503. DOCUMENTATION BY SELLER (CONTD)D. Operation and Maintenance Manuals (Contd)c. Maintenance

As a minimum, the Maintenance Section of the Manual shall contain the following:

- (1) Disassembling and reassembling instructions.
- (2) Preventive maintenance and lubrication information.
- (3) Description and identification of special maintenance tools.
- (4) Settings, clearance and adjustment data.

d. Parts Breakdown

The Parts Breakdown Section of the Manual shall contain:

- (1) A list of replacement parts, including drawings and data for all equipment assemblies and subassemblies. The material shall cover all information required for ordering replacement parts such as part name, part number, equipment serial number, supplier, address and normal delivery time.
- (2) Complete instructions for procuring replacement parts. Recommended forms for tabulating replacement part information and instructions for returning material to the factory shall also be included. Special storage, handling or packaging procedures required for any particular parts shall be noted.

E. Bills of Material

Detailed Bills of Material are required to facilitate identification by constructors of the items received. Shipment, therefore, shall be preceded by submittal of Bills of Material in accordance with Engineering Standard No. FJ60.60, Item 4 C.

4. DRAWINGS BY ENGINEER

- A. For applicable equipment, prints of drawings prepared by Engineer for use by others in constructing foundations, building components and major piping and wiring requiring coordination with the work associated herewith will be furnished to Seller for review as soon as possible after Engineer's receipt from Seller of the certified equipment drawings and design information necessary for their preparation.
- B. Where material, locations, etc., are marked HOLD on Engineer's Drawings, that material, location, etc., shall not be detailed or fabricated by Seller until the HOLD is removed by Engineer.

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4. DRAWINGS BY ENGINEER (CONTD)

- C. Within 30 calendar days after the date of transmittal to Seller, Seller shall return to Engineer two (2) copies of each of these drawings marked to indicate Seller's review thereof either without change, or with any corrections or necessary changes clearly marked thereon in red or other contrasting color.
- D. After making such corrections or changes as shown on the review copies returned by Seller, Engineer will release these drawings for construction. Subsequent changes or corrections to foundations, building components, wiring or piping fabricated or installed in accordance with drawings corresponding to the review copies approved by the Seller, such changes having been necessitated by Seller-initiated modifications, shall be done in a manner satisfactory to Buyer and at Seller's expense.

5. TRANSMITTALS

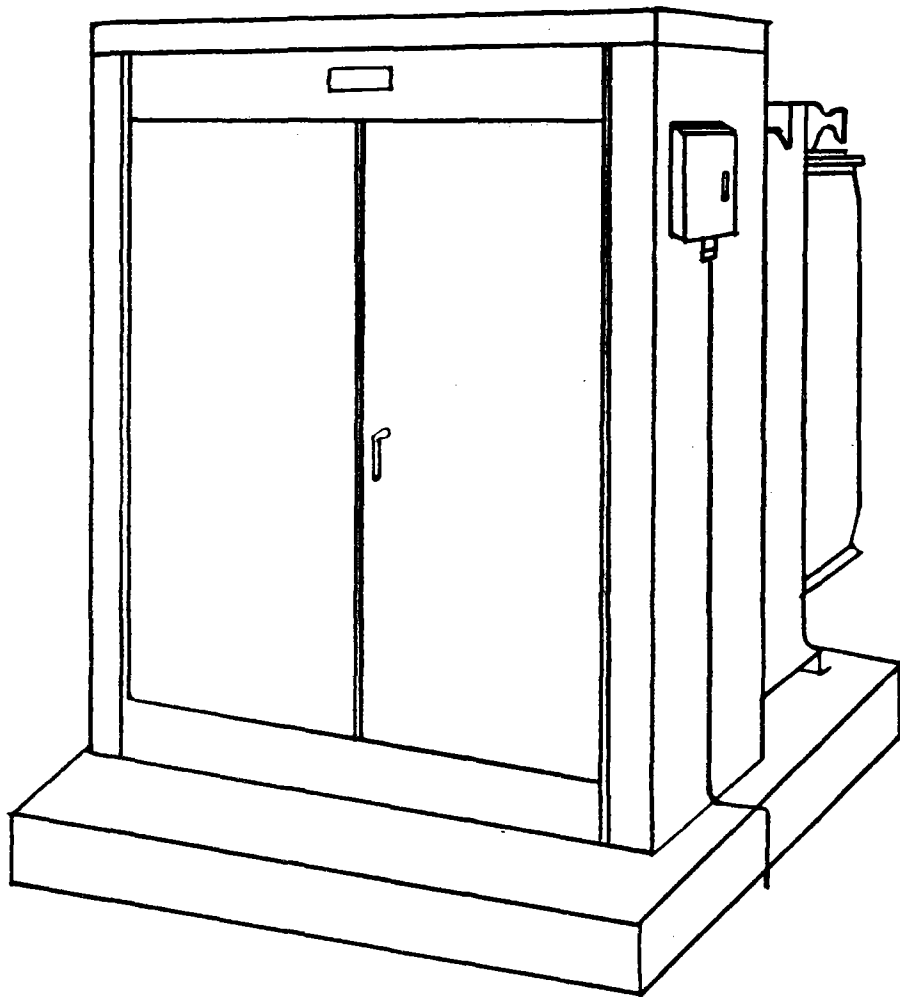
When transmitting documentation, Seller shall:

- A. Prepare original and four (4) copies of transmittal letters to accompany each submittal of documentation. Drawing transmittal letters shall identify the purpose of the transmittal (drawings for review, revised drawings, final drawings), the piece of equipment or material involved, and shall list the drawing numbers with applicable revision numbers or dates.
- B. Identify each letter and parcel with Buyer's Project Name, Engineer's Project Number, Purchase Order Number and Seller's Shop Order Number, and transmit it by air mail or first class mail. Each parcel shall contain an enclosed copy of the transmittal letter.
- C. Stamp each document to be submitted with reproduction date and purpose of the transmittal, e.g., "For Review," "Revised," "Final," etc.

6. SPECIAL CONSIDERATIONS

- A. It is understood that upon delivery of Seller's documentation without any restrictive notations concerning such work, they shall become Buyer's property and may be used in any manner desired for obtaining replacements, repairs and spare parts.
- B. Seller's final invoice will not be paid by Buyer until all materials and/or equipment governed hereunder have been received complete at the delivery point, and final certified submittals of all specified documentation have been received by Engineer.

DIVISION USAGE						Stearns-Roger <small>INCORPORATED</small> ENGINEERING STANDARD	STANDARD NUMBER	
MM	P	PP	SH	FI	SP		FJ 60.60	
APPROVALS: Des. Sect. <i>[Signature]</i> Sect. Supv. <i>[Signature]</i> Div. <i>[Signature]</i>						DOCUMENTATION REQUIREMENTS PROJECT: SOLAR ONE CONTRACT/REQUISITION NUMBER: TITLE: HELIOSTAT POWER CENTERS		C-21700 ISSUED 1/7/80 REVISED
TYPE OF DOCUMENTATION		TYPE OF COPIES	FOR REVIEW NO. OF COPIES	WEEKS AFTER AWARD*	FINAL NO. OF COPIES	"X" IF REQ'D	REVIEW REQ'D BEFORE FAB.**	CTFY. FINAL ISSUE ***
1-ENGINEERING DRAWINGS		Repro-ducibles	4		4			
A-Outline, General Arrangement and Principal Dimensions		Prints	8	6-8	8	X	X	X
B-Cross Sections								
C-Foundation Requirements, including Loadings & Anchoring Locations				6-8		X	X	X
D-Physical Locations of Piping and/or Wiring Terminals				6-8		X	X	X
E-Control Diagrams				6-8		X	X	X
F-Electrical Schematic Diagrams				6-8		X	X	X
G-Wiring Diagrams, Including Internal External and Interconnecting				6-8		X	X	X
H-Standard Hardware Items				6-8		X	X	X
2-ERECTION OR INSTALLATION INFO.		Repro-ducibles	4		4			
A-Shop Fabrication Drawings		Prints	4		8			
B-Erection or Installation Drawings				6-8		X		X
C-Erection or Install. Instructions		Copies	8	6-8		X		X
3-SPECIAL DOCUMENTATION								
A-Performance Data, including Curves		Copies			8	X		X
B-Design Calculations		Copies						
C-Test Reports		Copies			8	X		X
D-Code Papers and Certificates		Copies						
E-Shop Fab. and/or Welding Proced.		Copies						
F-Shop Fabrication Reports		Copies						
G-Welder's Qualification Reports		Copies						
H-Operating Certificates		Copies						
4-MISCELLANEOUS								
A-Operation and Maintenance Manuals		Manuals			8	X		(See FJ50.50 Para. 3.D.a(2))
B-Recommended Spare Parts List for 1 Year's Operation, with Unit Prices		Copies			8	X		X
C-Bills of Material		Copies			8	X#		X
D-Definitive Drawing List		Copies			See FJ50.50, Para. 3.A.g.			
*-Entries in the column "WEEKS AFTER AWARD" designate which types of review documentation are required. Blank spaces in this column denote that review documentation is not required. **-"X" in this column means drawing review req'd. before fabric. release. ***-"X" in this column means final issue must be certified for construction.							Except where otherwise specified, send all Documentation to: Stearns-Roger Engineering Co. P.O. Box 5888 Denver, Colorado 80217 Attn: Mr. R.K. Brushel	
#-At least 2 weeks before each shipment, detailed Bills of Material shall be sent to the plant site, c/o Stearns-Roger Resident Engineer, with 3 copies to Stearns-Roger Denver Office. This form supplements requirements, where specified, in Para. DOCUMENTATION in the Specification, and in Specification FJ50.50.								



HELIOSTAT POWER CENTER
ARRANGEMENT

MAT'L. LIST NO.		Stearns-Roger	
ORDER NO. C-21700			
REV. 1-18-80		DRW. CEW	CHK.
DATE: 1-8-80		APP.	DRAWING NO. SK-E 57

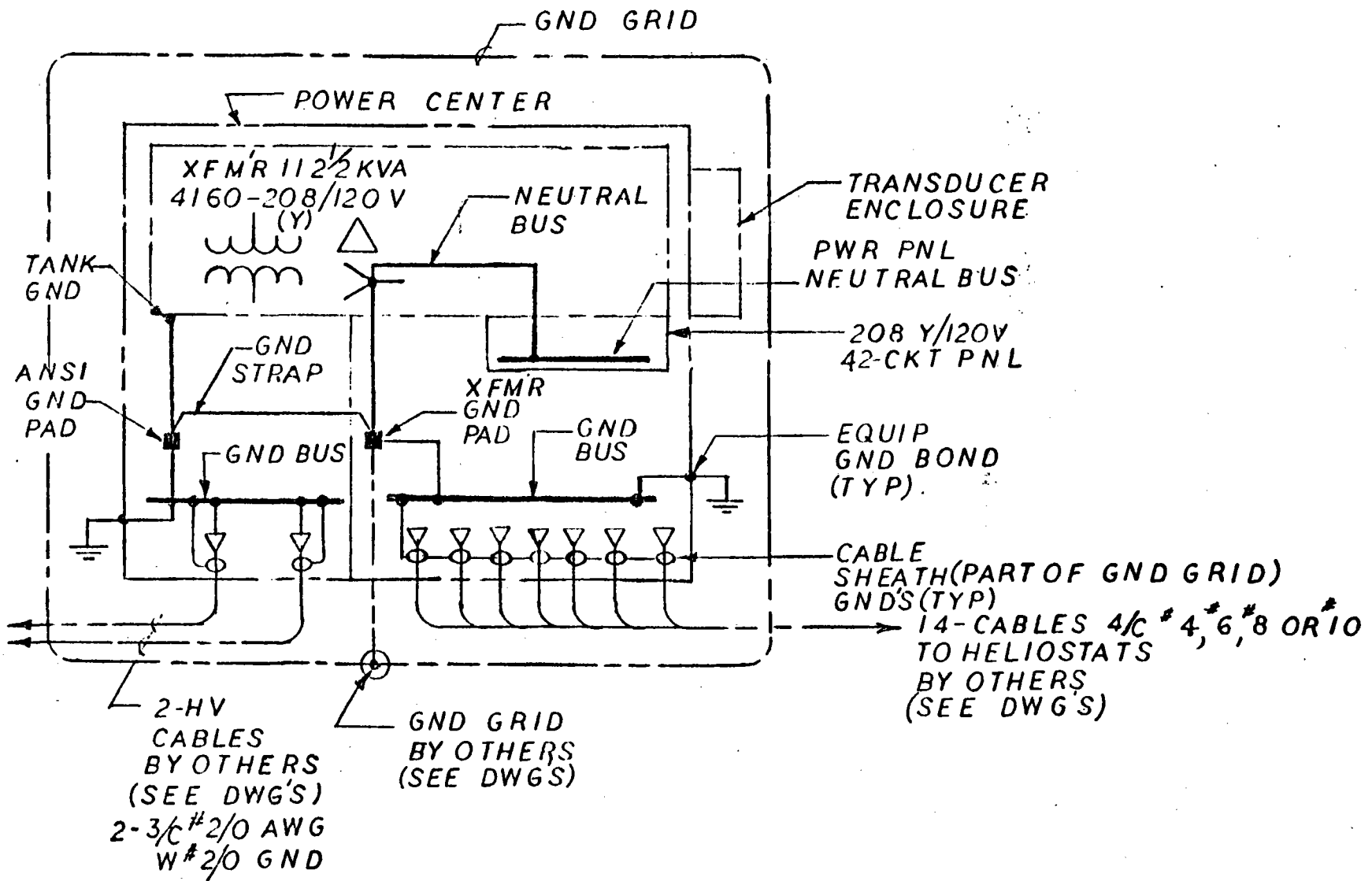
DATE: 1-5-80

MAT'L LIST NO.
ORDER NO. C-21700

DRW. C E W
CHK.
APP. 138

DRAWING NO.
SK E-62

MOORE-NOYER



COLLECTOR FIELD GROUNDING

APPENDIX II

PURCHASE SPECIFICATIONS
FOR
COLLECTOR FIELD ELECTRICAL
CONSTRUCTION PACKAGE 11A

LONG LEAD MATERIAL

Stearns-Roger

SUPPLEMENTED PURCHASE ORDER

Changes are underscored on lines identified in their left margin by the letter designator of the supplement. Pages changed by this supplement are reissued herewith. Remove the previous issue of these page(s) and replace them with current issue. All other terms and conditions of the original order and previous supplements, if any, remain unchanged.

PAGE NO 1 of 4	DATE Mar 19/80	REQUISITION F2 REV 4	ACCOUNT See Below	REL. NO	ORDER NO. 4000 C21700
REQUIRED AT DESTINATION See Below			SELLER'S SHIPPING PROMISE See Below		
F.O.B. POINT Jobsite FFA			SHIPPING POINT See Below		
SELLER NUNN-ROYAL ELECTRIC SUPPLY CO. P.O. Box 4804 Carson, CA 90749 Attn: Mr. Jim Hape (213)637-6377			TERMS OF PAYMENT AND INVOICING INSTRUCTIONS ARE STATED AFTER LAST NUMBERED ITEM OF THIS ORDER DIRECT CORRESPONDENCE CONCERNING THIS ORDER TO: STEARNS-ROGER ENGINEERING CORPORATION BOX 5888, DENVER, CO 80217 ATTN: Mr. A. L. Higgason PHONE (303) 758-1122 TWX 910-931-0453 TELEX 045-540		

CONSIGN TO: TOWNSEND AND BOTTUM, INC., c/o J. M. ABRAM, CONSTRUCTION MANAGER, Solar-one Pilot Plant, Daggett, CA 92327

ROUTE VIA: Prepaid - Truck - Vendor's Option

SUPPLEMENT SUMMARY - SELLER MUST CHECK EACH REVISION AND COMPLY WITH ALL CHANGES.	
a	Supp. No. 1 Apr 21/80 Rev. pgs. 1, 2, 3 & 4 to add invoicing instructions and to change page DS-15 of specification <i>gjm</i>
PREVIOUS SUPPLEMENT SUMMARIES, IF ANY, ARE RECOUNTED ON THE LAST NUMBERED PAGE OF THIS ORDER.	

CONFIRMING ORDER - DO NOT DUPLICATE

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE
		POWER CABLE, 5,000V & 600V in full accordance with Stearns-Roger Specification F010.1, D.O.E. No. 40E500-4S dated <u>Mar 21/80</u> , "For Purchase".	

SPECS. ATTACHED
GENERAL CONDITIONS FOR JOB C21700 SUBCONTRACT
DOE PRIME CONTRACT NO. DE-AC-03-79SF10499 ATTACHED
TERMS AND CONDITIONS FORM TC 5-76 ATTACHED

APPROX TOTAL VALUE OF ORDER \$230,950.00
ORDER IS SUBJECT TO TERMS, CONDITIONS AND SPECIFICATIONS STATED HEREIN AND ATTACHED. ORDER AND ACCOUNT NUMBERS MUST BE STATED ON ALL INVOICES, CORRESPONDENCE, SHIPPING DOCUMENTS AND PACKAGES. VIS #2898

BUYER
STEARNS-ROGER ENGINEERING CORPORATION

BY *J. B. Maguire*

THIS DOCUMENT CONSISTS OF - 4 - PAGE(S) NOT INCLUDING REFERENCED ATTACHMENTS.
8323D/ALH/rt/ao

Stearns-Roger

PURCHASE ORDER

PAGE NO. 2	NUNN-ROYAL ELECTRIC SUPPLY CO.	REL NO.	ORDER NO. 4000 C21700
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ITEM	QUANTITY	DESCRIPTION	UNIT PRICE
a 1	10,000 ft.	TAG REELS: 2,000 ft. - 1 1,200 ft. - 3 1,200 ft. - 4 800 ft. - 5 800 ft. - 6 1,000 ft. - 7 1,000 ft. - 8 1,000 ft. - 9 1,000 ft. - 10 CABLE, 5KV, #2/0, 3/C, shielded, metal-clad, w/ground tin coated (Sub. alloy coated-okoloy)	\$7,261.05 Mf.
a 2	7,000 ft.	TAG REELS: 1,000 ft. - F1 1,000 ft. - F2 1,000 ft. - F3 1,000 ft. - F4 1,000 ft. - F5 1,000 ft. - F6 1,000 ft. - F7 CABLE, 600V, #10, 1/C, unarmored	108.42 Mf.
a 3	12,000 ft.	CABLE, 600V, Metal-Clad TAG REELS: 2,000 ft. - A1 2,000 ft. - A2 2,000 ft. - A3 2,000 ft. - A4 2,000 ft. - A5 2,000 ft. - A6 #10, 2/C, w/ground tin coated (Sub. alloy coated-okoloy)	825.26 Mf.
a 4	105,000 ft.	TAG REELS: 52-2,000 ft. ea. - B1 THRU B52 1,000 ft. - B53 #10, 4/C	867.36 Mf.
a 5	4,000 ft.	TAG REELS: 1,325 ft. - C1 1,325 ft. - C2 1,510 ft. - C3 #8, 4/C	1,561.05 Mf.

Stearns-Roger

PURCHASE ORDER

PAGE NO. 3	NUNN-ROYAL ELECTRIC SUPPLY CO.	REL. NO.	ORDER NO. 4000 C21700
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<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>UNIT PRICE</u>
		TAG REELS: <u>11-1,000 ft. ea. -</u> <u>D1 THRU D11</u>	
6	11,000 ft.	#6, 4/C	\$1,626.31 Mf.
		TAG REELS: <u>1,035 ft. - E1</u> <u>3,135 ft. - E2</u> <u>2,474 ft. - E3</u> <u>1,090 ft. - E4</u> <u>4,000 ft. - E5</u> <u>2,882 ft. - E6</u> <u>1,715 ft. - E7</u>	
7	16,000 ft.	#4, 4/C	2,029.47 Mf.

NOTE

- The shipping tolerance for this order is 0 to plus 10%.
- ~~Charges for wood lagging and sizes of non-returnable reels - Will advise.~~

ESCALATION:

Prices are firm except for metal. Prices on Purchase Order are based on copper base price of \$1.05625¢ per lb. and aluminum at \$.66 per lb. All invoices for this material will be adjusted either upward or downward for the producer's price of metals on date of shipment.

TAXES

This Purchase is exempt from California Sales Use Tax under California Tax Permit No. SY-AL-93-003153 - For Resale by Authority of McDonnell - Douglas Corporation.

REQUIRED AT DESTINATION

a Item 1 - Tag 1 - 2,000 ft. - Jun 16/80
 Tag 3 thru Tag 10 - Aug 15/80
 a Item 2 - Jun 16/80
 Item 3 - Jul 07/80
 Item 4 - Jul 01/80
 Items 5 thru 7 - Apr 01/80

Stearns-Roger

PURCHASE ORDER

PAGE NO. 4	NUNN-ROYAL ELECTRIC SUPPLY CO.	REL. NO.	ORDER NO. 4000 C21700
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SELLER'S SHIPPING DATE

a
a
a
a
a
Item 1 - 2000 Ft. Week ending Jun 16/80
8000 Ft. Week ending Aug 25/80
Item 2 - Week ending Jun 21/80
Items 3 & 4 - Week ending Jul 19/80
Item 5, 6 & 7 - Week ending Apr 19/80

TERMS OF PAYMENT

1/2 of 1% 10 days; Net 30

SHIPPING POINT

5KV Cable - Santa Maria, CA
600V Cable - Richmond, KY

ACCOUNTING SEGREGATION

50% - X73404
50% - X73405

INVOICING INSTRUCTIONS:

a
Mail original and 4 copies with original shipping documents
to:
STEARNS-ROGER INC.
P. O. Box 5888
Denver, CO 80217

CONFIRMING ORDER

This confirms telephone order of FEB 26/80 to your Mr. Jim Hape by our A. L. Higgason.

REFERENCE

For reference purposes only and not by way of incorporating the same in this Purchase Order, see your written quotation numbered 733 of Jan 03/80 & Telexes of Jan 04/80 & Mar 04/80 by Mr. Jim Hape.

retyped 4/21/80 ao

Stearns-Roger

PURCHASE ORDER

PAGE NO 1 of 2	DATE Mar 06/80	REQUISITION F1 REV 3	ACCOUNT X73403	REL. NO.	ORDER NO. 4001 C21700
REQUIRED AT DESTINATION Jun 05/80			SELLER'S SHIPPING PROMISE Jun 05/80		
F.O.B POINT Jobsite F/A			SHIPPING POINT Houston, TX		
SELLER POWELL ELECTRICAL MANUFACTURING CO. c/o Electrical Sales Co. of Colorado 7555 West 10th Avenue Lakewood, CO 80215 Attn: Mr. Brian Dodd (303) 237-0448			TERMS OF PAYMENT AND INVOICING INSTRUCTIONS ARE STATED AFTER LAST NUMBERED ITEM OF THIS ORDER DIRECT CORRESPONDENCE CONCERNING THIS ORDER TO: STEARNS-ROGER ENGINEERING CORPORATION BOX 5888, DENVER, CO 80217 ATTN: Mr. A. L. Higgason PHONE (303) 758-1122 TWX 910-931-0453 TELEX 045-540		

CONSIGN TO: TOWNSEND AND BOTTUM, INC.. c/o J. M. ABRAM, CONSTRUCTION MANAGER, Solar-One Pilot Plant, Daggett, CA 92327

ROUTE VIA: Prepaid - Truck - Vendor's Option

SUPPLEMENT SUMMARY - SELLER MUST CHECK EACH REVISION AND COMPLY WITH ALL CHANGES.
PREVIOUS SUPPLEMENT SUMMARIES, IF ANY, ARE RECOUNTED ON THE LAST NUMBERED PAGE OF THIS ORDER.

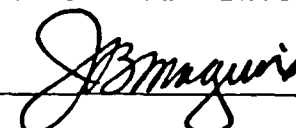
CONFIRMING ORDER - DO NOT DUPLICATE

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE
1	1	HELIOSTAT INTERFACE LOAD INTERRUPTER SWITCHGEAR ASSEMBLY, 5KV, & INTERFACE CONTROL CABINETS, all in accordance w/Stearns-Roger Specification F233.3 & D.O.E. No. 40E500-3S dated Feb 26/80. Heliostat Interface Load Interrupter Switchgear Assembly, 5KV, complete w/incoming line terminals to outgoing feeder terminals & accessories: Wt.: 2,000 lbs.	\$11,064.00
2	2	Heliostat Interface Control Cabinets Wt.: 260 lbs.	372.00 Ea

GENERAL CONDITIONS FOR JOB C21700 SUBCONTRACT TO D.O.E. PRIME CONTRACT NO. DE-AC-03-79SF10499 ATTACHED SPECS. ATTACHED (Already in Vendor's Possession) TERMS AND CONDITIONS FORM TC 5-76 ATTACHED

APPROX TOTAL VALUE OF ORDER \$11,808.00
ORDER IS SUBJECT TO TERMS, CONDITIONS AND SPECIFICATIONS STATED HEREIN AND ATTACHED. ORDER AND ACCOUNT NUMBERS MUST BE STATED ON ALL INVOICES, CORRESPONDENCE, SHIPPING DOCUMENTS AND PACKAGES.

BUYER
STEARNS-ROGER ENGINEERING CORPORATION

BY 

THIS DOCUMENT CONSISTS OF 2 PAGE(S) NOT INCLUDING REFERENCED ATTACHMENTS.

145
8034D/ALH/gd

Stearns-Roger

PURCHASE ORDER

PAGE NO. 2	POWELL ELECTRICAL MANUFACTURING COMPANY	REL. NO.	ORDER NO. 4001 C21700
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<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>UNIT PRICE</u>
3		Drawing & Data in accordance with Specification No. FJ50.50 & Engineering Standard No. FJ60.60	N/C

ESCALATION:

Powell Electrical Manufacturing Company's P-2000A Price Adjustment Clause, Revised Mar 01/77.

TOTAL WEIGHT: 2,260 lbs. (approx.)

TERMS OF PAYMENT:

Net 30 days

TAXES:

This purchase order is exempt from California Sales & Use Tax under California Tax Permit No. SY-AL-93-003153, for resale by authority of McDonnell-Douglas Corporation.

INVOICING INSTRUCTIONS:

Mail original and 4 copies with original shipping documents to:
STEARNS-ROGER ENGINEERING CORPORATION
P. O. Box 5888
Denver, CO 80217

GOVERNMENT CONTRACT:

This Purchase Order is issued under Government Contract No. DE-AC-03-79SF10499 (Department of Energy).

CONFIRMING ORDER

This confirms telephone order of Feb 29/80 to your Mr. Brian Dodd by our Mr. A. L. Higgason.

REFERENCE

For reference purposes only and not by way of incorporating the same in this Purchase Order, see your written quotation numbered H80-0138-52 of Dec 18/79 & Telexes of Dec 18/79, Jan 10/80 & Feb 28/80 by Mr. A. S. MacNutt, Jr., & Stearns-Roger clarification letter of Jan 07/80.

Stearns-Roger

PURCHASE ORDER

PAGE NO. 1 of 2	DATE Mar 24/80	REQUISITION F3 REV 1	ACCOUNT X73404	REL. NO.	ORDER NO. 4002 C21700
REQUIRED AT DESTINATION Jul 18/80			SELLER'S SHIPPING PROMISE Jul 18/80		
F.O.B. POINT Jobsite FFA			SHIPPING POINT See Below		
SELLER NUNN-ROYAL ELECTRIC SUPPLY CO. P.O. Box 4804 Carson, CA 90749 Attn: Mr. Jim Hape (213) 637-6377			TERMS OF PAYMENT AND INVOICING INSTRUCTIONS ARE STATED AFTER LAST NUMBERED ITEM OF THIS ORDER DIRECT CORRESPONDENCE CONCERNING THIS ORDER TO: STEARNS-ROGER ENGINEERING CORPORATION BOX 5888, DENVER, CO 80217 ATTN: Mr. Al Higgason PHONE (303) 758-1122 TWX 910-931-0453 TELEX 045-540		

CONSIGN TO: TOWNSEND AND BOTTUM, INC., c/o J.M. ABRAM, CONSTRUCTION MANAGER
Solar-one Pilot Plant, Daggett, CA 92327

ROUTE VIA: Prepaid - Truck - Vendor's Option

SUPPLEMENT SUMMARY - SELLER MUST CHECK EACH REVISION AND COMPLY WITH ALL CHANGES.
PREVIOUS SUPPLEMENT SUMMARIES, IF ANY, ARE RECOUNTED ON THE LAST NUMBERED PAGE OF THIS ORDER.

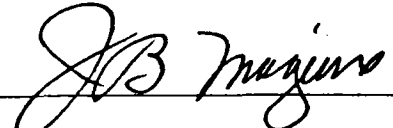
CONFIRMING ORDER - DO NOT DUPLICATE

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE
1	190,000 Ft.	COAXIAL CABLE, to be in full accordance with Stearns-Roger Specification No. F010.2, D.O.E., No. 40E500-8S dated Mar 13/80, "For Purchase". Metal clad, w/PVC jacket, smooth sheath on 5,000 ft. reels, Okonite No. RG-22B/U Copper wt. - 77 lbs./mft. Alum. wt. - 71 lbs. mft.	\$1,100.00 mf
2	5,000	Belden Co., #RG-11A/U on 2-2,500 ft. reels Copper wt. - 37 lbs./mft.	245.00 mf
3	39	LAGGING CHARGES, for 5,000 ft. non-returnable reels	45.00 Ea.

GENERAL CONDITIONS FOR JOB C21700 SUBCONTRACT TO
DOE PRIME CONTRACT NO. DE-AC-03-79SF10499 ATTACHED
SPECS. ATTACHED
TERMS AND CONDITIONS FORM TC 5-76 ATTACHED

APPROX TOTAL VALUE OF ORDER \$211,980.00
ORDER IS SUBJECT TO TERMS, CONDITIONS AND SPECIFICATIONS STATED HEREIN AND ATTACHED. ORDER AND ACCOUNT NUMBERS MUST BE STATED ON ALL INVOICES, CORRESPONDENCE, SHIPPING DOCUMENTS AND PACKAGES.

BUYER
STEARNS-ROGER ENGINEERING CORPORATION

BY 

THIS DOCUMENT CONSISTS OF 2 PAGE(S) NOT INCLUDING REFERENCED ATTACHMENTS.

147 8447D/JAB/ao

Stearns-Roger

PURCHASE ORDER

PAGE NO. 2	NUNN-ROYAL ELECTRIC SUPPLY CO.	REL. NO.	ORDER NO. 4002 C21700
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ESCALATION:

Prices are firm except for metals. Prices on Purchase Order are based on copper base price of \$1.30/lb. and aluminum at 0.66/lb. All invoices for this material will be adjusted either upward or downward for the producer's price of metals on date of shipment.

NOTE

The shipping tolerance for the above cable is:

Item 1 - Minus 5 plus 10%

Item 2 - Minus 0 plus 10%

TAXES:

This Purchase is exempt from California Sales, Use Tax under California Tax Permit No. SY-A: -93-003 153 for Resale by Authority of McDonnell-Douglas Corporation.

WEIGHT

51000 lbs. (approx.)

TERMS OF PAYMENT:

Net 30 days

INVOICING INSTRUCTIONS:

Mail original and 4 copies with original shipping documents to:

STEARNS-ROGER INC.

P. O. Box 5888

Denver, CO 80217

SHIPPING POINT

Item 1 - Worcester, MA

Item 2 - Phoenix, AZ

NOTE

There will be no extra charges for lagging on 2 reels of 2,500 ft. on item 2. Only one charge for both reels.

CONFIRMING ORDER

This confirms telephone order of Mar 13/80 to your Mr. Jim Hape by our Mr. Al Higgason.

REFERENCE

For reference purposes only and not by way of incorporating the same in this Purchase Order, see your written quotation numbered 874 of Feb 26/80 and telex dated Mar 18/80 by Mr. Jim Hape.

Stearns-Roger

PURCHASE ORDER

PAGE NO 1 of 3	DATE May 06/80	REQUISITION F4 Rev. 1	ACCOUNT See Below	REL. NO.	ORDER NO. 4003 C21700
REQUIRED AT DESTINATION Jun 15/80			SELLER'S SHIPPING PROMISE Aug 22/80		
F.O.B POINT Denver, CO			SHIPPING POINT Denver, CO		
SELLER WESTINGHOUSE ELECTRIC SUPPLY CO. 1661 W. 3rd Ave. Denver, CO 80223			TERMS OF PAYMENT AND INVOICING INSTRUCTIONS ARE STATED AFTER LAST NUMBERED ITEM OF THIS ORDER		
Attn: Mr. Lewis Stieghorst (303) 573-7550			DIRECT CORRESPONDENCE CONCERNING THIS ORDER TO: STEARNS-ROGER ENGINEERING CORPORATION BOX 5888, DENVER, CO 80217 ATTN: A. L. Higgason PHONE (303) 758-1122 TWX 910-931-0453 TELEX 045-540		

CONSIGN TO: TOWNSEND AND BOTTUM, INC., c/o J. M. ABRAM, Construction
Manager, Solar-one Pilot Plant, Daggett, CA 92327

ROUTE VIA: Prepaid - Truck - ICX

SUPPLEMENT SUMMARY - SELLER MUST CHECK EACH REVISION AND COMPLY WITH ALL CHANGES.

PREVIOUS SUPPLEMENT SUMMARIES, IF ANY, ARE RECOUNTED ON THE LAST NUMBERED PAGE OF THIS ORDER.

CONFIRMING ORDER - DO NOT DUPLICATE

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE
		ACCOUNTING SEGREGATION: 50% - X73406 50% - X73407	
1	14	HELIOSTAT POWER CENTERS, to meet the requirements of conditions of service as set forth in Stearns-Roger Specification S-R F230.6, D.O.E. No. 40E500-6S dated Apr 15/80 and Dwgs. as listed below: 4160V Feeders Collector Subsystem 40E7005133106 Rev. 1 dated 4/21/80 Panel Schedule Collector System #40E5005132700 Rev. 1 dated 4/21/80	

GENERAL CONDITIONS FOR JOB C21700 SUBCONTRACT DOE PRIME CONTRACT

NO. DE-AC-03-79SF10494 ATTACHED
SPECS. ATTACHED (VENDOR ONLY)
DWGS. ATTACHED (ALREADY IN VENDOR'S POSSESSION)
TERMS AND CONDITIONS FORM TC 5-76 ATTACHED

APPROX TOTAL VALUE OF ORDER
\$88,025.00

ORDER IS SUBJECT TO TERMS, CONDITIONS AND SPECIFICATIONS STATED HEREIN AND ATTACHED. ORDER AND ACCOUNT NUMBERS MUST BE STATED ON ALL INVOICES, CORRESPONDENCE, SHIPPING DOCUMENTS AND PACKAGES.

BUYER
STEARNS-ROGER ENGINEERING CORPORATION

BY: 

149 THIS DOCUMENT CONSISTS OF 3 PAGE(S) NOT INCLUDING REFERENCED ATTACHMENTS.
9532D/ALH/sf

Stearns-Roger

PURCHASE ORDER

PAGE NO. 2	WESTINGHOUSE ELECTRIC SUPPLY CO.	REL. NO.	ORDER NO. 4003 C21700
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<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>UNIT PRICE</u>
		Panel Schedule Collector Subsystem #40E5005132712 Rev. 1 dated 4/21/80	
		Collector Subsystem Cable, Conduit and Grounding Details #40E5005132723 Rev. 1 dated 4/21/80	
		Heliostat Watt Transducer Enclosure Details and wiring diagram #40E5005132700 Rev. 0 dated 4/21/80	
		Collector Field Transformer Foundations #40C5005132709 Rev. 2 dated 2/6/80	
		Material to be assembled is as listed below:	\$5,901.00 Ea.
1A	14	TRANSFORMERS, Westinghouse POW-R-PAD C-LINE, Padmounted oil filled, with 20 in. wide low voltage compartment suitable and arranged for mounting panelboard, 112.5 KV, 4160V delta W (2) 2 1/2% FCAN and FCBN Taps, to 120/208V wye, dead front, loop feed, drawout CLT fuses on all units. Substation accessory group, HV/LB Barriers, 63 deg. C rise on 47 deg. C Ambient. Unit 3 only contains LBOR Loop feed switches. Units 2 and 6 contain ring type CT's shipped loose for mtg. and wired to watt transducer boxes	Included in Item 1
1B	14	PANELBOARDS, Type WCA with DA 400A main breaker, 3 ph, 4w, 42 circuit, w/type BA Branch Breaker's	Included in Item 1
1C	28	BRACKETS, OZ #BK20 mounted in H. V. com- partment	Included in Item 1
1D	14	STRIP HEATERS, Chromalax #OT1430, 14 in., 300 watt, with WR 66 thermostat, and Auto-off switch and terminals mounted and wired.	Included in Item 1

Stearns-Roger

PURCHASE ORDER

PAGE NO.	REL. NO.	ORDER NO.
3	WESTINGHOUSE ELECTRIC SUPPLY CO.	4003 C21700

<u>ITEM</u>	<u>QUANTITY</u>	<u>DESCRIPTION</u>	<u>UNIT PRICE</u>
2	2	WATT TRANSDUCERS, in nema 4 box, with accessories, assembled and wired.	\$1,506.00 Ea.
3	5	SCIENTIFIC COL. #XL5CSA4 (loose)	313.00 Ea.
4	2	SCIENTIFIC COL. #L31K5A4 (loose)	417.00 Ea.

FIRM PRICES

TOTAL WEIGHT: 49,000 lbs. (approx.)

TAXES

This purchase is exempt from California Sales use Tax under California Tax Permit No. SY-AL-93-003153 - for resale by authority of the McDonnell Douglas Corporation.

TERMS OF PAYMENT:

Net 30 days

CONFIRMING ORDER

This confirms telephone order of Apr 16/80 to your Mr. Rich Garza by our A. L. Higgason.

REFERENCE

For reference purposes only and not by way of incorporating the same in this Purchase Order, see your written quotation numbered DNLS-0304 of Mar 07/80 by Mr. Lewis Stieghorst.

STMPO - 212 (1)



Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Reply To: DOE Solar One Project Office
P.O. Box 366
Daggett, CA 92327

Mr. Robert L. Gervais
Solar One Project Office
McDonnell Douglas Astronautics Corp.
P.O. Box 366
Daggett, CA 92327

SEP 26 1984

Subject: Clearance of Contract DE-AC03-79SF10499
Solar One Reports for DOE/TIC Submission.

Dear Bob:

Enclosed are copies of covers and title pages of eight reports prepared by McDonnell Douglas Astronautics Corporation for the Solar One Project under the above referenced contract. In preparation for delivery of these documents to DOE/TIC, I have prepared a SAN form 70 "Request for Patent Clearance" and a DOE form RA-426 "Recommendations for Announcement and Distribution of Documents" for each document.

Please have the appropriate MDAC personnel complete and sign these forms. As agreed, SAN form 70 should be forwarded to SAN/OPC by your office with copies of the completed SAN form 70 and the transmittal letter being sent to me. The completed DOE form RA-426 should be sent directly back to me.

The documents covered by this letter are:

<u>Primary Document No.</u>	<u>Secondary No.</u>	<u>Brief Title</u>
DOE/SF/10499-T19 REV	STMPO 212	Plant Support Subsystem Procurement
DOE/SF/10499-T9 REV	STMPO 214	Purchased Demineralized Water
DOE/SF/10499-T45 REV	STMPO 122	Receiver Feedwater Pump and Drive
DOE/SF/10499-T13 REV	STMPO 222	Plant Support Subsystem Procurement
DOE/SF/10499-T27 REV	STMPO 127	Master Control Subsystem Hardware
DOE/SF/10499-T25 REV 2	STMPO 206	System Integration Lab Test Plan
MDC-G-8591 REV	STMPO 220	Plant Support Subsystem Procurement
MDC-G-8575 REV	STMPO 218	Plant Support Subsystem Procurement

Note that only the updates, revisions or additions need to be reviewed; the basic documents are already on file at TIC.

If you should have any questions or concerns please do not hesitate to contact me by telephone at (619) 254-2672.

Sincerely,



S.D. Elliott, Jr., Director
DOE Solar One Project Office

SDE/aks
Project File: CCC001.RNO(SDO)

Encl: Eight Document Covers W/forms 70 and RA-426

cc: Robert G. Riedesel, MDAC
Roger Gaither, SAN/OPC
W.D. Matheny, DOE/TIC
Mike Lopez, DOE/SAN (FGS)
Mary Soderstrum, B&McD



DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

Prime Contract No. DE-AC03-79SF10499
Subcontract No. (N/A)
Report No. (STMPO 212) DOE/SF/10499-T19 Rev
Date of Report August 1980
Name & Phone No. of DOE Technical Representative S.D. Elliott, Jr. (619) 254-2672

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM: McDonnell Douglas Corporation
3855 Lakewood Blvd.
Long Beach, CA 90846

- Document Title: Plant Support Subsystem Procurement Documentation
(Revision 2 of August 28, 1980) (RADL 7-44A)
- Type of Document: Technical Report, Conference Paper, Journal Article, Abstract or Summary,
 Copy of Oral Presentation, Other (please specify): _____
- In order to meet a publication schedule or submission deadline, patent clearance by (Routine)
would be desired.

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 - A disclosure of the invention was submitted to DOE on _____ (date)
 - A disclosure of the invention will be submitted shortly _____ (approximate date)
 - A waiver of DOE's patent rights to the contractor:
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- This document is being submitted, but no review has been made of this document for possible inventive subject matter.
Provide copy of clearance to: Solar One Project Office
- Remarks: P.O. Box 366, Daggett, CA 92327

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FROM: ASSISTANT CHIEF FOR PROSECUTION
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H009-M-837



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CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

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Subcontract No.
(N/A)
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Reviewing/Submitting Official: Name (Print/Type) Donald L. Royer
Title Asst. Chief Patent Counsel, MDC (MS 122-23)
Signature *Donald L. Royer* Date 8 October 1984

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