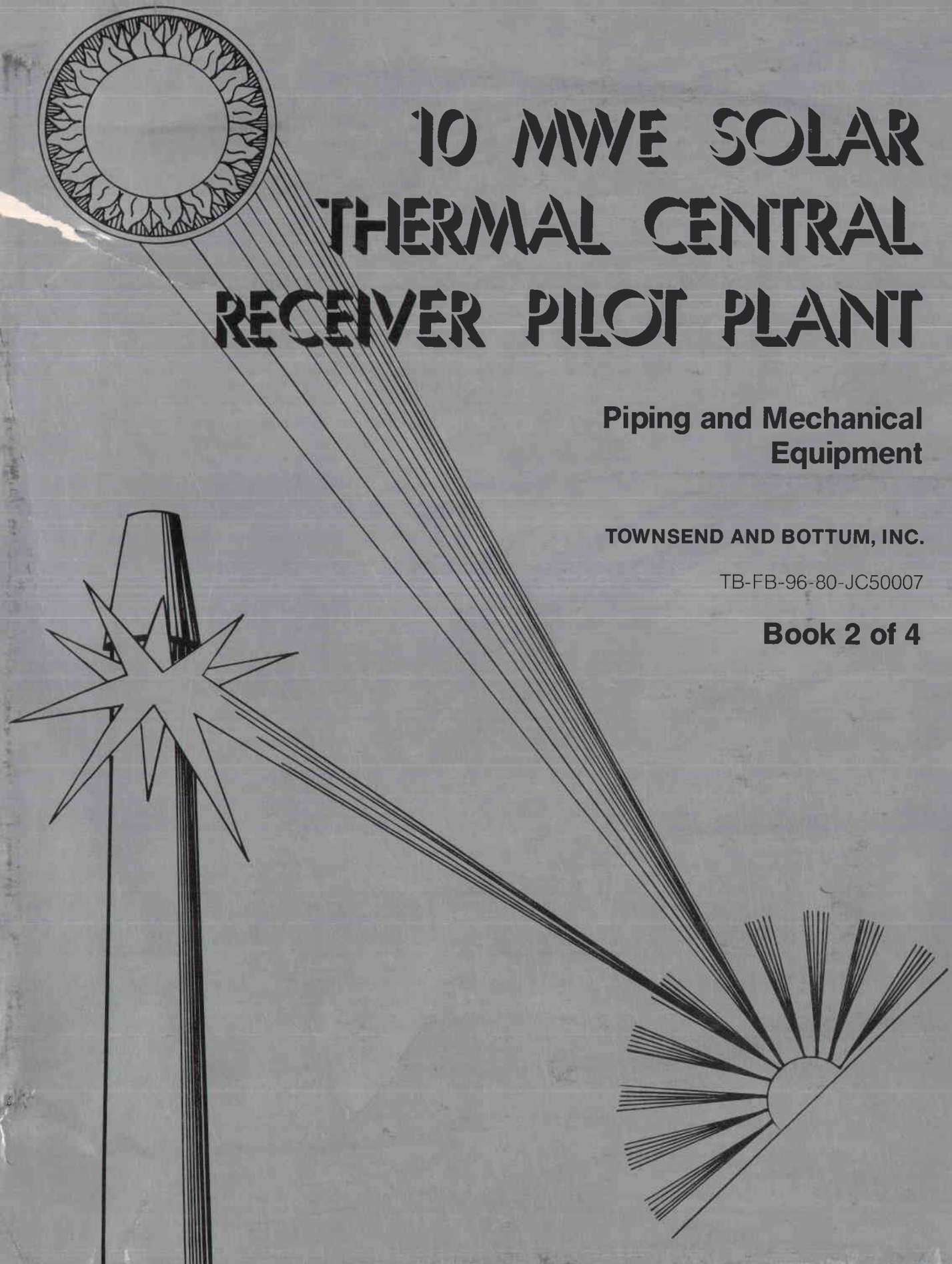

10 MWE SOLAR THERMAL CENTRAL RECEIVER PILOT PLANT

Piping and Mechanical Equipment

TOWNSEND AND BOTTUM, INC.

TB-FB-96-80-JC50007

Book 2 of 4

Section 5

TECHNICAL INFORMATION

SAN/0499-39
MDC G-8177

10 MWe Solar Thermal
Central Receiver Pilot Plant

SOLAR FACILITIES DESIGN INTEGRATION

CONSTRUCTION PACKAGE NO. 9 (RADL ITEM 7-33) PIPING AND MECHANICAL EQUIPMENT INSTALLATION

June 1980

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

MCDONNELL DOUGLAS CORPORATION | Stearns-Roger | Solar Energy

SAN/0499-39
MDC G-8177

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

CONSTRUCTION PACKAGE NO. 9 (RADL ITEM 7-33)
PIPING AND MECHANICAL EQUIPMENT INSTALLATION

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 technical construction package 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 7-33. This package was prepared by Stearns-Roger Engineering Corporation under MDAC Subcontract Number 78012035. This package also includes drawings and specifications prepared by Rocketdyne under MDAC Subcontract Number 78012038 for specific portions ofthe Receiver Subsystem and the Thermal Storage Subsystem.

This technical construction package will be included in the invitation for bid being prepared for the Department of Energy by Townsend and Bottum, Inc. for the Piping and Mechanical Equipment Installation Construction Package No. 9. This construction package consists of providing installed, tested, and operable mechanical equipment, piping and accessories for the 10 MWe Solar Pilot Plant. It includes installation of GFE equipment (prefabbed piping, pipe hangers and snubbers, equipment skid assemblies, valves, BCS targets, solar panel modules, etc.); furnishing and installating various piping, mechanical equipment and accessories; furnishing and installing HVAC equipment and miscellaneous steel work; performing miscellaneous earthwork; and performing testing of the installed piping and mechanical equipment. This work will be accomplished upon foundation and structures which will be provided by others as part of Construction Package No. 5, 5A and 7.

RADL 7-33 includes two parts, as follows:

- Technical Specifications for Construction Package No. 9 identified as STMPO Drawing 40M700-6S (Stearns-Roger Project No. C-21700), which consists of two volumes (Volume I-Technical Specification and Volume II-Supplements and Appendices
- Supplemental construction drawings as identified in Paragraph 2.1 of the Technical Specification (Reference Appendix 2 of Volume II)

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

CONSTRUCTION PACKAGE #9
PIPING AND MECHANICAL EQUIPMENT
SECTION 4 - IFB

NOTICE

Wherever the term "Construction Manager" is used, it is intended that it shall mean the Contracting Officer's duly authorized representative which is Townsend and Bottum, Inc.

The Construction Manager will not direct the day-to-day operations of the Contractor, but will provide the inspection and verification of the Contractor's performance in accordance with the design specifications and drawings.

Wherever "SFDI Approval" is used this is understood to mean that the approval will be by the SFDI via the Construction Manager.

Whenever the term Start-Up Engineer is used it shall mean SCE Start-Up Engineer. 6

TECHNICAL SPECIFICATIONS
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LIST OF ABBREVIATIONS

The following abbreviations used in this Section 4 are defined as follows:

BCS - Beam Characterization System

DOE - Department of Energy

EPGS -Electric Power Generation System

HVAC - Heating, Ventilating and Air Conditioning

PSS - Plan Support Systems

RS - Receiver System

SFDI - Solar Facilities Design Integrator

STMPO- Solar Ten Megawatt Project Office

TSS - Thermal Storage System

TSU - Thermal Storage Unit

UMU - Ullage Maintenance Unit

Rev. 1 July 16, 1980
Rev. 2 September 12, 1980
Rev. 3 October 17, 1980
Rev. 4 December 5, 1980
Rev. 5 January 30, 1981
Rev. 6 March 20, 1981

TECHNICAL SPECIFICATION
D.O.E. NO. 40 M 700 - 65

for

PIPING AND MECHANICAL EQUIPMENT

VOLUME I - TECHNICAL SPECIFICATION

CONSTRUCTION PACKAGE #9

Prepared by:

Stearns-Roger
ENGINEERING CORP.

PROJECT NO. C-21700

SECTION 4 - IFB
TECHNICAL INFORMATION

1.0. SCOPE OF WORK

The work of this Contract consists of providing installed, tested and operable mechanical equipment, piping and accessories, within the limits shown, for the 10 MWe Solar Pilot Plant near Daggett, California.

1.1. Description of Work. The work to be performed hereunder includes, but shall not necessarily be limited to, the following:

1.1.1. Receiving, unloading, placing in protective storage, transporting to place of installation, and installing all Government-furnished equipment.

1.1.2. Furnishing, delivering, receiving, unloading, transporting and installing all materials and equipment not furnished by the Government, but which are required for completion of the work of this Contract.

1.1.3. Designing, fabricating, furnishing, delivering, unloading and installing (includes Government and Contractor furnished pipe) all above-ground and below-ground piping, valves and specialty items as specified or defined on the Drawings.

1.1.4. Furnishing, delivering and installing all mechanical equipment and accessories required under this Contract, but which are not Government-furnished. This equipment shall be adapted to accommodate existing foundations and equipment furnished by others.

1.1.5. Furnishing and installing all secondary pipe hangers and supports, including supplemental structural steel, required to support piping installed under this Contract.

1.1.6. Surveying from existing reference points as necessary for maintaining horizontal and vertical control of the Contractor's work.

1.1.7. Performing excavating, trenching, bedding, backfilling, compacting, moisture control, stockpiling, grading and other earthwork operations necessary for completion of work of this Contract.

1.1.8. Making necessary connections to work installed by others.

1.1.9. Grouting of all equipment installed under this contract that requires grouting.

1.1.10. Designing, detailing, fabricating, delivering and erecting the Receiver Tower Electronics Rooms on the Receiver Tower and furnishing and installing Receiver Tower 15th level perimeter shielding on structural steel framing furnished by others.

1.1.11. Designing, furnishing and installing heating, ventilating and air conditioning for the Receiver Tower Electronics Rooms, Thermal Storage Control Buildings, and the Thermal Storage Electrical Equipment Building.

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1.1.12. Performing testing of all piping and equipment installed under this Contract, including but not limited to, hydrostatic and leak testing of piping; equipment alignment; vibration testing; equipment cleaning and lubrication, and motor rotational checks.

1.1.13. Correcting any defects determined to exist, and proving satisfactory correction by re-test.

1.1.14. Furnishing test reports covering testing performed and test results obtained.

1.1.15. Performing prime and touch-up painting as specified.

1.1.16. Maintaining and leaving Contractor's work storage, parking and office areas in acceptably neat and clean condition.

1.1.17. Furnishing labor, supervision, equipment, materials, temporary facilities, tools, instruments, supplies and services not furnished or performed by others, and which are necessary for the work of this Contract.

1.1.18. Selecting an approved Fire Protection Systems subcontractor who will design, furnish and install the Fire Protection System as defined herein.

1.1.19. Purchase and fill the Thermal Storage Unit with 260,000 gallons of Caloria HT-43 heat transfer fluid as specified in Appendix-4.

1.1.20. Furnishing and installing all building wall flashings for pipe penetrations including installation of piping, flashings, building insulation caulking and seal of penetration as shown on the architectural drawings.

1.1.21. Furnishing and installing insulation for receiver piping above the 15th level and receiver module upper manifold area.

1.1.22. Finish painting of the preheater and boiler modules and prime and finish painting of the module interface of the core structure as specified in Appendix 1.

1.1.23. Furnish and install temporary piping for chemical cleaning, velocity flush and steam blowing.

1.2 Work Not Included. The following items of work related to the work hereunder, will be performed by others:

1.2.1. Establishing horizontal and vertical control points for the Contractor's reference.

1.2.2. Sampling and testing of soils, and determining in-place compacted densities.

1.2.3. Constructing equipment foundations.

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1.2.4. Erecting Receiver Tower, excluding Receiver Tower Electronics Room.

1.2.5. Erecting the buildings and pipe rack structure involved in work under this Contract.

1.2.6. Furnishing, delivering and installing permanent electrical work external to the equipment installed hereunder.

1.2.7. Furnishing, delivering and installing insulation and lagging materials for piping and equipment.

1.2.8. Receiving, unloading and storing Government-furnished equipment received at the construction site prior to Contractor's mobilization.

1.2.9. Field finish painting of work installed under this Contract other than as specified in 1.1.22.

1.2.10. Area dust control.

1.2.11. Systems start-up and test.

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TECHNICAL INFORMATION (CONTD)

2.0 SUPPLEMENTS

The following Supplements, located in Vol. II, are furnished with, and unless otherwise noted, form a part of these Specifications:

2.1. Drawings. Those Drawings listed in APPENDIX 2, DRAWING LIST.

2.2. Engineering Standards. Stearns-Roger Engineering Standards as follows:

Standard No.	Date	Title
JF16.02.02	10/12/79	NEMA Frame Induction Motors
JF16.02.02-1	3/27/79	Motor Data Sheets
JD40.4.10	11/3/78	Horizontal Centrifugal Pumps
JD40.4.11	12/18/78	Vertical Centrifugal Pumps
JF40.4.16	3/12/79	Vertical Sump Pump
JD40.4.14	3/8/79	Rotary Pumps
JC10.22.14.1	11/18/74	General Machinery Vibration Severity Chart
JC10.80	12/1/79	Special Instructions for Painting and Finishing HVAC Equipment, 3 pages
JC10.15.01.1	4/12/78	Recommended Sheet Metal Gages and Construction for Rectangular Duct
JC10.15.01.2	7/22/76	Recommended Sheet Metal Gages and Construction for Round Ducts
JC10.15.02	10/28/75	Typical Duct Connections Cross Joints, 2 pages.
JC10.15.03	9/16/74	Longitudinal Seams, 2 pages
JC10.15.04	10/28/75	Elbows, 2 pages
JC10.15.05	9/16/74	Vaned Elbows, 2 pages
JC10.15.06	10/28/75	Tapers and Offsets, 2 pages
JC10.15.08	9/16/74	Register and Grille Connections, 2 pages
JC10.15.09	9/16/74	Multiple Fan Unit Discharge Connections
JC10.15.10	9/16/74	Flexible Duct Connections, 2 pages
JC10.15.12	2/17/76	Access Doors and Ducts, 3 pages
JC10.15.15	2/17/76	Hangers for Ducts, 7 pages
JC10.15.23	2/17/76	Acoustical Treatment - Duct Lining, 2 pages
EJ14.31.1	3/6/70	Welding Symbols
E1(DOE 40P700-28S)	12/17/79	Piping Material Specification

FJ60.60, Documentation Requirements, dated 7/16/79, 1 page.

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Construction Test Check List, Form C-21700, dated 10/19/79, 1 page.

2.3. Construction Schedule, to be provided by the Construction Manager.

2.4. Appendices as follows:

Appendix 1, GOVERNMENT-FURNISHED EQUIPMENT
Appendix 2, DRAWING LIST
Appendix 3, INSTRUMENT INDEX (PSS)
Appendix 4, CONTRACTOR FURNISHED EQUIPMENT
Appendix 5, DETAILED SPECIFICATION FOR FIRE PROTECTION SYSTEMS
Appendix 6, DRAWINGS AND DATA FOR GOVERNMENT FURNISHED EQUIPMENT
Appendix 7, BID DATA SECTION

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3.0 CODES AND STANDARDS

3.1. The codes, standards and publications of the following organizations form a part of these Specifications to the extent indicated by the references thereto:

ACI - American Concrete Institute
AFBMA - Anti-Friction Bearing Manufacturer's Association
AISC - American Institute of Steel Construction
AISI - American Iron and Steel Institute
AMCA - Air Moving and Conditioning Association
ANSI - American National Standards Institute
ARI - Air Conditioning and Refrigeration Institute
ASHRAE - American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME - American Society of Mechanical Engineers
ASTM - American Society for Testing and Materials
AWS - American Welding Society
AWWA - American Water Works Association
FM - Factory Mutual Engineering Corporation
IEEE - Institute of Electrical and Electronics Engineers
IPCEA - Insulated Power Cable Engineers Association
MSS - Manufacturer's Standardization Society of the Valve and Fittings Industry
NBS - National Bureau of Standards, U.S. Dept. of Commerce
NEC - National Electrical Code
NEMA - National Electrical Manufacturer's Association
NESC - National Electrical Safety Code
NFPA - National Fire Protection Association
OSHA - Occupational Safety and Health Act of 1970 as Amended
PFI - Pipe Fabrication Institute
SMACNA - Sheet Metal and Air Conditioning Contractors National Association
SSPC - Steel Structures Painting Council
UBC - Uniform Building Code.
UL - Underwriters' Laboratories, Inc.

Federal, State, County or Municipal Codes, Laws and Ordinances of the place of installation.

3.2. Should a conflict be found to exist between the listed codes and standards and this Specification, the conflict shall be submitted to the Construction Manager for resolution.

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4.0 DRAWING AND DATA SUBMITTALS

Prior to fabrication or delivery to the jobsite of the equipment, devices and materials to be installed under this Contract, the Contractor shall submit to the Construction Manager for review and comment, the drawings and descriptive data called for in the various Articles of this Section 4. Drawings and data submittal shall be in accordance with Article GC.14 of Section 3, GENERAL CONDITIONS, Engineering Standard FJ60.60 attached and Appendix 7, Bid Data, attached.

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TECHNICAL INFORMATION (CONTD)

5.0 GENERAL REQUIREMENTS

This Article sets forth general requirements applicable to the work to be performed under this Contract. The requirements in this Article 5.0 are in addition to specific requirements specified in other Articles of Section 4 of these documents.

5.1. General.

5.1.1. The Drawings indicate the extent and general arrangement of the systems and equipment and the extent of the Contractor's scope of work. All Contractor-furnished items shall be coordinated to provide complete and properly functioning systems. Equipment, ductwork and piping shall fit into the spaces allotted and shall allow adequate and acceptable clearances for access, servicing and maintenance.

5.1.2. Any work for which procedures are not specified, or any deviations from the specified procedures which may be permitted by the Construction Manager, shall conform to best trade practices and shall produce an acceptable end result.

5.1.3. Manufacturer's names, trade names, and model numbers specified herein are used for facilitating description and establishing a standard of quality, required design characteristics, size, and required physical characteristics. Such designations are not intended to be restrictive other than above. All references to manufacturer and trade names shall be assumed to be followed by the words "or Contracting Officer-approved equal."

5.1.4. The Contractor may offer such changes in design which would, in his opinion, facilitate the work or improve its reliability. Such proposals of modification or substitution shall be made in writing for the Contracting Officer's consideration, whose decision shall be final. Proposal of modification or substitution shall include detail drawings showing arrangements and revisions to the Drawings necessary to incorporate the proposed modification. In all cases of approved substitution or modification, full responsibility for incorporating such substitution or modification including accommodation of any additional equipment nozzle loading as well as providing all necessary additional fittings, bolts, gaskets, in-line pipe components and pipe supports in a manner consistent with the requirements of this Contract, shall be the full responsibility of the Contractor, and shall be accomplished without additional compensation. The foregoing shall apply only to Contractor-furnished materials and equipment, and shall not apply to Government-furnished equipment.

5.1.5. Component features and design parameters specified herein are minimum requirements. If the design of the manufacturer of an item of Contractor-furnished equipment dictates that these minimum requirements should be exceeded to meet specified performance guarantees and to provide safe reliable operating units, it shall be the Contractor's responsibility to furnish all material and/or equipment above and beyond the specified minimum requirements, without additional compensation.

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5.1.6. The Contractor shall hold a valid ASME Certificate of Authorization, shall establish a quality control system in accordance with the ASME Boiler and Pressure Vessel Code, Section I, and shall submit evidence of such to the Construction Manager. The Contractor shall submit the name of their authorized inspection agency that will be verifying code work. The Construction Manager shall have the right to audit and monitor the quality control system.

5.1.7. The Contractor shall at all times provide the Construction Manager unrestricted access to the Contractor's facilities and to the work in progress for purposes of observing procedures and inspecting materials and work for this Contract.

5.2. Design and Construction. All materials and equipment furnished under this Contract shall be designed for the fluids and gases to be handled, all applicable service conditions as specified elsewhere in this Specification, and the following environmental conditions:

5.2.1. Plant elevation above mean sea level: 1940 feet

5.2.2. Barometric pressure: 13.67 psia (27.83 inches mercury).

5.2.3. Outdoor ambient temperature range: 9 degrees F to 117 degrees F.

5.2.4. Seismic Zone: The plant is located in Uniform Building Code Seismic Zone 3. Equipment shall be designed and supported to withstand lateral seismic forces generated by a ground acceleration of 0.25 g.

5.3. Noise Emission.

5.3.1. The Owner is obligated to comply with the laws of the State of California and the Federal Government as to permissible noise exposures to personnel within the plant area and maximum permissible noise levels at the site boundaries. Accordingly, noise emission data will be required for certain pieces of Contractor-furnished equipment, excluding electric motors.

5.3.2. The maximum permissible equivalent A-rated sound level is 90 dBA, based on a free field measured from a distance of 5 feet and in accordance with AMCA Bulletins 300 and 303.

5.3.3. A calibrated Model 308 vibration meter, as manufactured by International Research and Development Corporation or Construction Manager-approved equal, shall be used in measuring the noise level.

5.4. Vibration. Rotating mechanical equipment and motors shall be factory balanced statically and dynamically. Vibration values of self-excited vibration velocity shall be less than 0.10 inches per second when measured with a vibration meter on the frame of the unit in the vertical, horizontal and axial directions. The vibration meter shall be a calibrated Model 308, as manufactured by International Research and Development Corporation, or a Construction Manager-approved equal.

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5.5. Equipment Identification.

5.5.1. Each piece of Contractor-furnished equipment shall bear a nonferrous metal nameplate with all pertinent information legibly inscribed thereon. Each nameplate shall be permanently attached in a conspicuous place on its piece of equipment. Each nameplate shall include model number, serial number and Owner's Contract Number. The nameplate shall be fully visible on the equipment when the equipment is operating.

5.5.2. In addition to the foregoing, each piece of equipment shall be identified with a permanently attached nonferrous metal tag stamped with its identifying unit or Tag No. as specified herein.

5.5.3. The Contractor shall require his equipment suppliers to comply with the foregoing equipment identification procedures.

5.6. Special Requirements. 4

5.6.1. Special Tools and Devices. Any special tools or devices required for operation, maintenance or dismantling of any item of equipment furnished under this Contract shall be furnished and delivered with the equipment. Such items shall be in new and unused condition in a separate container for each item of equipment, with each container clearly identified as to the equipment to which the special tools or devices are applicable.

5.6.2. Special Marking Requirements. For special marking of Incoloy 800 material refer to Paragraph 18.3.3. 4

5.6.3. Special Handling. Incoloy 800 materials are subject to contamination by low melting metals such as cadmium, zinc, copper, tin, lead, etc. The Contractor shall take precautions to avoid contact with these low melting metals during handling, storage and erection. 4

5.7. Guarantees.

5.7.1. For each item of Contractor-furnished equipment, the Contractor shall obtain and furnish the equipment manufacturer's guarantee that the equipment furnished conforms to the requirements set forth and to the specified Codes, Standards and Regulations, and certification that all specified shop tests have been satisfactorily completed.

5.7.2. 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 under this Contract.

5.8. Temporary Removal of Installed Work.

5.8.1. During the course of his work, the Contractor may find it necessary or advantageous to remove and reinstall or replace certain floor grating or other items which have previously been installed by others. Prior

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to the removal of any such work, the Contractor shall schedule and program the work in a manner acceptable to the Construction Manager.

5.8.2. Permission to remove any installed component or item shall not in any way relieve the Contractor of full responsibility for the safe and proper performance of his work, or for the protection of life and property. Any installed component or item temporarily removed by the Contractor shall not be done in such manner as to impede the ability of other Contractors in the area to perform their work in a safe and proper manner. Where and as necessary for

safety or weather protection, the Contractor shall provide and maintain acceptable temporary protective devices such as guard rails, barricades, walkways, shores, braces, tarpaulins, flags, lights, etc., until the removed items have been replaced to provide "as was" conditions to the full satisfaction of the Construction Manager.

5.8.3. All costs of removing and reinstalling or replacing building or other components to permit or expedite the work of the Contractor shall be considered to be within the scope of this Contract and shall be performed by the Contractor and at the Contractor's expense.

5.9. Definitions. The following definitions define the meaning of the indicated terms wherever used in the various Articles of this Section 4:

5.9.1. Designing: Determining the quantity, size and quality of components in accordance with good engineering practice, the specified Code(s) and as further specified herein.

5.9.2. Furnishing: Performing material take-off, purchase, and delivery of materials and equipment to the construction site.

5.9.3. Receiving: Assisting the Construction Manager in inspecting and documenting the delivered condition of Government-furnished equipment, and inspecting and documenting the delivered condition of Contractor-furnished equipment.

5.9.4. Unloading: Removing the equipment and materials from the shipping conveyance in a timely manner so as to avoid demurrage and in such a manner as to avoid damage to the equipment.

5.9.5. Storing: Transporting the equipment and materials from the unloading point to a designated storage area, placing into storage, and maintaining in storage in accordance with the manufacturer's recommendations.

5.9.6. Erecting/Installing: Removing equipment and materials from storage, or directly from transport, to point of installation; setting in place, assembling, adjusting, aligning, grouting in place, cleaning, lubricating and protecting in accordance with the manufacturer's recommendations and coordinate erecting/installing through the Construction Manager.

5.9.7. Inspecting: Performing inspection and repair and/or assisting the Construction Manager, Owner, SFDI, and manufacturer's representative in inspecting and repairing the equipment to ensure that it is ready for operation.

5.9.8. Testing: Performing pressure testing and other tests in accordance with the applicable Codes, manufacturer's instructions, and instructions specified herein. Performing any other tests normally required by the equipment manufacturer.

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6.0. PIPING

6.1. Scope.

6.1.1. General.

6.1.1.1. This Section describes the specific requirements for the Piping Work to be performed by the Contractor. The requirements in this Article are in addition to those requirements specified in Article 5.0, GENERAL REQUIREMENTS. The supplements which are applicable to the Piping Work are listed in Article 2.0, SUPPLEMENTS, attached hereto.

6.1.1.2. All pipelines shall be installed by this Contractor complete, including the "in-line" accessories, valves and specialties, as shown on the Contract Drawings and as specified herein.

6.1.1.3. Any work for which procedures are not specified, or any deviations from the specified procedures which may be permitted by the Construction Manager, shall conform to best trade practices and shall produce an acceptable end result. When completed, the work shall be of uniformly neat and workmanlike appearance with finished surfaces.

6.1.1.4. If field welding of attachments is required to piping, the welding shall be performed in accordance with the applicable code and welding procedures approved by the Construction Manager.

6.1.2. Materials and Equipment Furnished, Erected and/or Installed by the Contractor. In general the Contractor shall furnish, deliver, install and test the following materials, equipment and work: (This list is not intended to be all inclusive, but is provided as an indication of the overall scope of work under this Contract. The Contractor shall do all Material Take-Offs and shall furnish and install all equipment and materials not furnished by the Government as shown on the drawings and as specified herein.)

6.1.2.1. All above ground 2 inch and smaller piping, tubing, flex hoses, valves, fittings, flanges, bolts, gaskets, and in-line items such as traps, strainers, and flow restriction orifices. The Contractor shall prepare isometric drawings for all 2-inch and smaller above ground piping.

6.1.2.2. All non-primary (secondary) pipe and the fabrication thereof as shown on the Contract Drawings, fittings, flanges, bolts, gaskets, and valves. Non-primary piping is defined as all above ground piping except the primary piping as defined in APPENDIX 1, GOVERNMENT FURNISHED EQUIPMENT.

6.1.2.3. All underground and embedded piping as shown on the P8 Series Drawings and as specified herein.

6.1.2.4. The following additional valves and specialty items as shown on the drawings and/or specified in this Specification.

(1) Safety relief valves

(2) General service valves

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(3) Rubber expansion joints with thrust control devices

(4) Metal expansion joints with thrust control devices

(5) Permanent and temporary strainers

(6) Steam traps

(7) Flexible hoses

(8) Restriction orifices

(9) Vacuum breakers

(10) Airhose bibb connectors

(11) Auxiliary Steam System desuperheater

(12) Steam dump desuperheater

(13) Service water stations

6.1.2.5. The prime painting and touch-up of all noninsulated piping and any structural steel furnished and installed by this Contract, also the touch-up of other Contractor's work damaged by this Contract.

6.1.2.6. All equipment and components, specified with tag numbers and procured by the Contractor, shall be furnished with the appropriate tag number attached to the item in a conspicuous place.

6.1.2.7. Pipe hangers and supports required to support all non-primary (secondary) piping furnished by the Contractor as further specified in Article 7.0, HANGERS AND SUPPORTS.

6.1.2.8. All earthwork, excavating, trenching, compacting of structural fill, fill, pipe bedding, pipe bedding material, drain material, filter material and the backfilling of all piping trenches as required for the complete installation of each piping system. Earthwork is further defined in Article 12.0, EARTHWORK.

6.1.2.9. All concrete work required to complete the underground piping including thrust block and fire hose house foundations.

6.1.2.10. All consumable items required to perform the work specified herein including, but not limited to, lubricants, packing materials, gaskets, welding rod, weld rings (if specified) and joint compounds.

6.1.2.11. Furnishing and installing nuts required to support insulation on all piping.

6.1.2.12. Furnishing and installing all piping system vents and drains including valves.

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6.1.2.13. The Contractor shall furnish, inventory and store one (1) complete spare set of all gaskets, packings and/or seal devices for each valve in a separate container identified with the valve tag number. Spare parts shall be containerized for long term indoor storage.

6.1.3. Government-Furnished Items for Erection and/or Installation by Contractor. The Contractor shall erect and/or install the following Government furnished materials located within the systems defined herein as shown on the Drawings, and as specified as part of the work of this Contract: 2

6.1.3.1. The piping materials and hangers required for the primary piping systems as shown on the drawings and as specified in APPENDIX 1 GOVERNMENT-FURNISHED EQUIPMENT. This primary piping will be shop fabricated by others to the maximum practical extent.

6.1.3.2. Piping, hangers and in-line specialty items furnished and/or integral with the Government-furnished equipment.

6.1.3.3. Control Valves.

6.1.3.4. Pressure Seal Valves.

6.1.3.5. Furnish and install ceramic fiber insulation having an integral aluminum cover for receiver piping above the 15th level. Furnish and install ceramic fiber insulation on the upper and lower manifold area of 24 receiver module assemblies. Type of material, method of fastening, specific location and other specific requirements shall be as defined in Appendix 1.

6.1.3.6. Painting of uninsulated piping above the 15th level as specified in Appendix 1.

6.1.3.7. Identification of piping above the 15th level as specified in Appendix 1.

6.1.4. Work Furnished by Others. The following work will be performed by others:

6.1.4.1. Installation of all piping and equipment inside the EPGS area with the exception of main steam, admission steam, admission steam crossover, admission steam PSV header, steam dump line, feedwater and admission feed water as shown on the Drawings. 4 4

6.1.4.2. Drain piping beneath the TSS equipment Heat Exchanger Area to the waste oil sump and oil water separator. This piping includes area drains as well as the hot oil PSV piping.

6.1.4.3. Insulation and lagging of all piping, vessels, tanks, and process equipment.

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6.1.5. Layout of Work. The Contractor shall, before commencing his fabrication, carefully investigate structural conditions, equipment locations and orientation, equipment connections, horizontal and vertical controls and any other conditions affecting the piping work and shall plan his work accordingly.

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6.2. Materials.

6.2.1. General. The materials used for each piping system shall be new and of first quality and shall be free of all defects which would affect performance or service life of the system.

6.2.2. Piping.

6.2.2.1. Each pipeline specified on the P and ID's physical and line schedule drawings has a 3-letter designation. An example defining the 3-letter pipeline designation is shown on Drawing XL-22934, Sheet P1-1 Symbols & Nomenclature.

6.2.2.2. The Piping Material Specification sheet corresponding to the 3-letter designation establishes the requirements for pipe, valves, fittings, flanges, bolts and gaskets. The Pipe Material Specification sheets are included in Specification No. E1 for Piping Materials attached as a supplement hereto. Any deviations from the Piping Material Specification sheets are shown on the drawings.

6.2.3. Valves. Valves designated on the applicable Valve List to be furnished under this Contract shall be furnished in accordance with the applicable Valve Specification sheet included in Specification No. E1 and shall be manufactured by one of the recommended valve manufacturers. Safety relief valves are specified below:

6.2.3.1. Safety Relief Valves. Safety relief valves shall be furnished in accordance with the following requirements and the SAFETY RELIEF VALVE DATA SHEETS contained herein under Drawing No. 40P70011I, Sheet P26-7. The safety relief valves are sized by the SFDI to facilitate location and establish pipe routing.

6.2.3.1.1. Design and Construction.

6.2.3.1.1.1. All valves shall be factory set at the pressure specified on the Relief Valve Data Sheets, be capable of smooth unloading and accurate operation within the specified pressure ranges, and shall have 100 percent reset capability after operation.

6.2.3.1.1.2. Each Safety Relief Valve and its accessories shall be in accordance with this Specification, the Safety Relief Valve Data Sheets, and all other supplements attached hereto.

6.2.3.1.1.3. Gags are not required on sentinel relief valves. All other relief valves, unless otherwise stated on the Relief Valve Data Sheets, shall be designed to allow the use of the gags. Gags, when specified on the Relief Valve Data Sheets, shall be furnished with the applicable safety valve.

6.2.3.1.1.4. Safety relief valves shall be as manufactured by Farris, Atwood-Morill, Consolidated, Lonergan or SFDI-approved equal.

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6.2.3.1.2. Service Conditions. Valves specified for back pressures other than atmospheric pressure shall be bellows type to eliminate the effect of backpressure on set point.

6.2.3.1.3. Materials.

6.2.3.1.3.1. Body and Bonnet Materials.

Carbon steel shall be ASTM A216, Grade WCB or ASTM A105, carbon steel.

Cast iron shall be ASTM A126, Class B cast iron.

Bronze shall be ASTM B62 Bronze.

Stainless steel shall be AISI Type 304 stainless steel or equal.

6.2.3.1.3.2. Trim Material.

Bronze shall be ASTM B62 Bronze.

Stainless steel shall be AISI Type 304 stainless steel or equal.

6.2.3.2. General Service Valves. Valves shall be furnished in accordance with the valve list Drawing No. 40P7006I, Sheet P26-2 attached hereto, and the Valve Specification Sheets unless otherwise specified.

6.2.3.3. Shop Construction and Tests. Shop construction shall include:

(1) The fabricating, welding, machining, fitting, inspecting and checking of all valve components by the Manufacturer.

(2) Complete assembly of all valve components and shop testing as specified herein.

6.2.4. Expansion Joints. Expansion joints shall be furnished in accordance with the expansion joint lists Drawing No. 40P70010I, Sheet P26-6 attached hereto, and the following requirements:

6.2.4.1. Rubber Expansion Joints.

6.2.4.1.1. Inner Tube. The protective leakproof inner tube or lining shall be made of natural or synthetic rubber and shall extend through bore and over the face of the flange to the outside edges of the flanges. In no case shall the inner diameter of the inner tube be less than the inside diameter of the connecting pipe.

6.2.4.1.2. Carcass. The carcass fabric shall be high quality woven cotton duck. All fabric plies shall be impregnated with age-resistant rubber or synthetic compounds, laminated into a unit and reinforced with heavy duty, solid anti-migration metal rings. The plies shall be welded into a strong, tough body under heat and pressure of vulcanization.

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6.2.4.1.3. Cover. The exterior surface or cover of rubber expansion joints shall be formed from natural or synthetic rubber, compounded to withstand dry heat. Joints specified for outdoor installations shall have neoprene covering.

6.2.4.1.4. Flanges. Expansion joints shall be furnished with integral flat face flanges of fabric-reinforced rubber. Flange diameter and drilling shall conform to ANSI B16.1. Bolt holes shall straddle centerline.

6.2.4.1.5. Split Retaining Rings. Split retaining rings shall be furnished with each expansion joint. Rings shall be of flat-rolled steel, split, beveled, galvanized and drilled in accordance with ANSI B16.1.

6.2.4.1.6. Bolt Holes. Bolt holes shall be thoroughly coated with self-vulcanizing rubber at the factory to seal them against absorption and wicking of moisture and oils.

6.2.4.1.7. Control Units. Control units complete with bolts, plates, washers and nuts shall be furnished. Each plate shall be drilled with three holes; two for bolting to the flange, the third for passage of the stretcher bolt. Rubber washers, backed with metal washers shall be placed under the head of the bolt and under the nut. The design and number of control units per joint shall be as recommended by the manufacturer. Control units shall be provided with inner nuts to prevent overcompression.

6.2.4.1.8. Arches. Arches shall not be filled.

6.2.4.1.9. Recommended Manufacturers. Rubber expansion joints shall be as manufactured by one of the following, or SFDI-approved equal:

Garlock
Goodall Rubber Co.
Holz Rubber Co.
Uniroyal

6.2.4.2. Metal Expansion Joints.

6.2.4.2.1. Bellows. Bellows shall be of Type 304 or 321 stainless steel. All expansion joints shall be furnished with Type 304 or 321 stainless steel internal sleeves or liners installed in the bellows.

6.2.4.2.2. End Connections. The expansion joints shall be furnished with ASTM A105 forged carbon steel flanges. Flanges shall be raised face with diameter and drilling conforming to ANSI B16.5, Class 150 unless specified otherwise.

6.2.4.2.3. Control Units. Control units complete with bolts, plates, washers and nuts shall be furnished. The design and number of control units per joint shall be as recommended by the manufacturer.

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6.2.4.2.4. Recommended Manufacturers. Metal expansion joints shall be as manufactured by one of the following, or SFDI-approved equal:

American Boa Incorporated
Flexonics
Pathway Bellows
Process Engineering Incorporated
Tempflex

6.2.5. Strainers and Traps.

6.2.5.1. Strainers. Temporary and permanent strainers shall be furnished in accordance with the Strainer List Drawing No. 40P7008I and 40P7009I, Sheets P26-4 and 5.

6.2.5.1.1. Temporary strainers shall be as manufactured by one of the following or SFDI-approved equal:

Mack Iron Works Company
Winston Manufacturing Company
Process Strainers Incorporated

6.2.5.1.2. Permanent strainers shall be as manufactured by one of the following, or SFDI-approved equal:

Armstrong
Hayward Manufacturing Company
Leslie
Tate Temco
Winston Manufacturing Company
Process Strainers Incorporated

6.2.5.2. Traps.

6.2.5.2.1. The traps and drainers shall be of the specified size and suitable for the maximum pressure, temperature and flow conditions specified in Drawing 40P70012I, Sheet P26-8, TRAP LIST. The traps and drainers shall be of the Yarway type, or SFDI-approved equal.

6.2.5.2.2. All traps and drainers shall be provided with upstream and downstream isolation valves. Bypass valves shall be provided when shown on the drawings.

6.2.6. Flexible Hoses. Flexible hoses shall be furnished in accordance with the Drawing No. 40P70014I, Sheet P26-10, FLEXIBLE HOSE LIST.

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6.2.7. Restriction Orifices.

6.2.7.1. Orifice plates will have stamped on the handle all pertinent information including the identification number and orifice hole size given in Restriction Orifice Data Sheets.

6.2.7.2. The orifices shall be designed, manufactured, rated, and marked in accordance with Restriction Orifice Data Sheets shown on Drawing No. 40P70013I, Sheet P26-9.

6.2.8. Vacuum Breakers. Vacuum breakers shall be furnished as specified on the drawings.

6.2.9. Airhose Bibb Connectors. Airhose bibb connectors where shown on the drawings shall be 3/4-inch threaded coupler bodies, Chicago Pneumatic No. C-91857Y, or SFDI-approved equal.

6.2.10. Desuperheaters.

6.2.10.1. Two (2) desuperheaters shall be provided, one for the Auxiliary Steam System and one for the Condenser Dump Desuperheating Systems.

6.2.10.2. Design and Construction.

6.2.10.2.1. Auxiliary Steam Desuperheater. A desuperheater capable of reducing the temperature of 82 psia steam from 860 F inlet to 345 F outlet. Maximum inlet steam flow shall be 13,354 lb/hr. Minimum inlet steam flow shall be 270 lb/hr. Atomizing steam or thermal sleeves shall not be required. Desuperheater to be mounted in a 6 inch steam line and shall be available for vertical mounting. Body to be ASTM A217WC6 with 4 inch ANSI Class 300 steam line flanges and 1 inch ANSI Class 300 water connection flange.

6.2.10.2.2. Condenser Dump System Desuperheater. A steam atomizing desuperheater capable of reducing the temperature of 100 psia steam from 863 F inlet to 338 F outlet. Maximum inlet steam flow shall be 130,000 lb/hr. Minimum inlet steam flow shall be 4000 lb/hr. Desuperheater to be welded in a 10 inch steam line and shall be available for horizontal mounting. Body to have 2-inch NPT water connection and 2-inch NPT atomizing steam connection.

6.2.10.3. Equipment Data. The system design is based on the equipment as selected and described in this paragraph. If other than this equipment is purchased by the Contractor it will be his responsibility to meet the requirements as stated in 6.2.10.2.1 and 6.2.10.2.2.

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		Auxiliary Steam	Condenser Dump	
6.2.10.3.1.	Manufacturer	Copes-Vulcan	Graham	
6.2.10.3.2.	Figure No.	V076	Type SA	
6.2.10.3.3.	Materials			
	Body	ASTM A217WC6	ASTM A335, P11	
	Mounting Flange	By Supplier	N/A	
	Water Connection Flange	By Supppier	N/A	
6.2.10.3.4.	Construction			
	Water Inlet Size, inches	1"-300# FLG	2" SW	6
	Atomizing Steam Connection Size	N/A	2" SW	6
	Steam Line Mounting Size, inches	4"-300# FLG	10-SCH40 BW	
	Overall Length, inches	24-3/8	14-1/4"	
	Centerline to Face, inches	By Supplier	13"	
	Weight, lbs	By Supplier	By Supplier	
	Pressure Drop, psi	5	Negligible	
	Water/Steam Pressure Diff., Min/Max, psi	10/10	0/0	

6.2.11. Service Water Stations. Service water stations where shown on the drawings shall be 1-inch threaded coupled bodies, Chicago Pneumatic No. C-91857Y, or SFDI approved equal.

6.3. Shop Fabrication.

6.3.1. General.

6.3.1.1. All 2 1/2-inch and larger piping shall be fabricated as required by the applicable Piping Material Specification Sheet for each pipeline, and as shown on the drawings. All 2-1/2 inch and larger piping and fittings shall be shop fabricated to the greatest extent practicable while still maintaining units of shippable size. The use of short pieces (less than random lengths) of pipe in making up long runs shall be approved by the SFDI.

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6.3.1.2. Fabricated assembly linear dimensional tolerances shall be in accordance with PFI Standard ES-3 or plus or minus 1/8 inch end-to-end, center-to-center, center-to-end, face-to-center, etc.

6.3.1.3. All connections for vents, drains, instruments and small connecting piping shall incorporate the branch connections as specified on the applicable Piping Material Specification Sheet or as called out on the drawings.

6.3.1.4. All instrumentation connections shall be tagged with a 1 by 2 inch metal tag and with the appropriate tag number and the connection installed in the pipe by the Contractor.

6.3.1.5. Nuts required for supporting vertical pipe insulation shall be attached to the pipe in accordance with Engineering Standard DP30.1 which is included in Specification E-1. Care shall be taken by the Contractor to ensure these nuts do not interfere with other welded attachments to the piping such as hanger lugs.

6.3.1.6. The Contractor shall at all times make available and provide access to all portions of the work and all inspection reports for inspection by the Construction Manager.

6.3.2. Welded Construction.

6.3.2.1. All welders shall be qualified (with the Construction Manager reserving the right to observe) at the Contractor's expense, in accordance with the requirements of the code(s) governing the class of work to be done. Copies of the qualification papers shall be furnished as tests are performed in accordance with the FJ60.60 attached hereto.

6.3.2.2. Piping transitions shall conform to ANSI B31.1

6.3.2.3. Welding processes and butt weld end preparation requirements are specified in the GENERAL NOTES section of Specification No. E1 for Piping Materials. Pipe ends for socket weld joints shall be machine cut and reamed.

6.3.2.4. Weld rings may be used only when allowed by the applicable Piping Material Specification Sheet. The Contractor shall furnish all weld rings necessary for both shop and field welds.

6.3.2.5. All welded attachments to piping specified to be postheat treated shall be attached prior to such postheat treatment.

6.3.2.6. Access holes and plugs shall be provided by the Contractor for field welded joints larger than 6 inch nominal pipe size that require field radiographic inspection. Access holes and plugs shall be designed and fabricated in accordance with PFI Standard ES-16.

6.3.2.7. Visual examination of welding operations shall be performed by the Contractor's inspectors and shall include examination of bevel details prior to welding, examination of surface holes, cracks and other defects during welding, and examination for undercuts or other surface defects and reinforcement dimensions after welding. Visual examination of all completed welds shall be performed and necessary repairs made prior to any postheat treatment. Welds shall be visually re-examined after any postheat treatment.

6.3.2.8. Imperfect welds as defined by ANSI B31.1 and ASME Codes are unacceptable and shall be repaired. Repaired welds shall then be reinspected in accordance with the original requirements.

6.3.2.9. Any interruption of welding shall be governed by ANSI B31.1 and PFI-ES-8 as applicable.

6.3.2.10. All weld rod shall be supplied by the Contractor and stored in accordance with the manufacturer's recommendations and code requirement. Where there is a conflict, the more restrictive will have precedence.

6.3.3. Heat Treatment.

6.3.3.1. Preheat and postheat treatment for welded joints shall conform to the applicable qualified welding procedure and the requirements of ANSI B31.1.

6.3.3.2. All attachments shall be preheated, welded and stress relieved as required by code. "Temple-stiks" may be used to indicate minimum preheat temperature only. Heat treatment shall be full furnace heat treatment, local induction or resistance stress relieved. Heat treatment with gas fired local heaters will not be permitted.

6.3.4. Flanged Connection and Construction.

6.3.4.1. Contact surfaces of pipe flanges shall be concentric in accordance with PFI Standard, with the axis of the piping. Flanges and flanged fittings shall be accurately machined, shall be drilled true to template and shall conform to ANSI B16.5. Flanges shall be installed so that bolt holes straddle the horizontal or vertical centerline of the pipe and/or equipment.

6.3.4.2. Flanged joints shall not be made up in the shop, however all flanges, bolts, studs, nuts, washers, gaskets, etc., required for makeup of flanged joints shall be provided and installed by the Contractor.

6.3.4.3. PFI Standard ES-3 shall be used for control of flange face angularity and rotation tolerances.

6.3.4.4. Alloy bolt studs shall be properly marked and have finished ends for micrometer length measurements in accordance with the requirements specified in the GENERAL NOTES section of Specification No. E1.

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6.3.4.5. Tensile loading shall be in accordance with Crane Company procedures for "Assembly and Maintenance of Flanged Joints" as specified in Crane Catalog No. VC-1900.

6.3.5. Branch Connections.

6.3.5.1. Branch connections shall be as specified on the applicable Piping Material Specification Sheet and shall comply with ANSI B31.1.

6.3.5.2. Openings 1-1/2 inches and smaller in pipe shall be drilled. Openings larger than 1-1/2 inches shall be made by milling, air arc gouging, or flame cutting. If air arc gouging or flame cutting is used, the parent metal shall be preheated in accordance with the applicable welding procedure, and the hole shall be finished by grinding or other suitable means to assure a smooth radius finish.

6.3.5.3. All threaded attachments shall be cleaned and trued by use of a thread tap or die after welding of the attachment to the parent pipe and any required postheat treatment has been completed.

6.3.6. Fittings.

6.3.6.1. Unless otherwise shown on the drawings, welding elbows shall have a radius of one and one-half times the diameter of the pipe and tees shall have well-rounded branch outlets. Miter welded bends shall not be used, unless shown on the drawings.

6.3.6.2. Welded branch connections and all special welded fabricated fittings shall be carefully fitted and properly reinforced. Cast fittings shall not be used.

6.3.6.3. All connections for pressure instruments shall be finished on the internal edge in accordance with Figure No. II-II-5 of the ASME Performance Test Code Supplement PTC 19.5-1972.

6.3.7. Cleaning and Finishing.

6.3.7.1. All pipe and fittings shall have paint removed from the interior surfaces.

6.3.7.2. Shop fabricated piping shall have all welding icicles, cuttings, beads and burrs removed and accessible internal weld surfaces ground smooth. Pipe shall then be rapped to loosen dirt, scale, etc., and blown and otherwise cleaned inside and outside before shipment, in accordance with PFI Standard ES-5.

6.3.7.3. All butt weld end preparations shall be coated with deoxyaluminate in accordance with the manufacturer's recommendations.

6.4. Preparation for Shipment, Delivery, and Storage of Material.

6.4.1. Pipe and Fittings - Protection for Shipment.

6.4.1.1. For shipment, all pipe materials and fabricated piping assemblies shall be adequately blocked, secured and fitted with plywood inserts held in place with metal-end closures, tack welded to the pipe such as to prevent any damage to the weld end preparation of the pipe and sealed with at least three wraps of waterproof tape to ensure against damage such as the following:

(1) Load shifting or humping.

(2) Damage to machined surfaces and weld end preparations during shipping, storage and field handling.

(3) Entrance of foreign matter during shipment and while in storage at the site.

(4) Climatic conditions encountered enroute as well as the hazards of transportation and handling.

6.4.1.2. Shipping protection shall also be adequate for up to 12 months field storage.

6.4.1.3. Each unit shall be completely drained of liquid prior to shipment.

6.4.1.4. For shipment, each unit shall be disassembled only to such extent as may be necessary to facilitate field handling and to prevent damage during shipment. Loose components shall be strung on wire and securely attached to a bundle or to a major component to prevent their loss. Each assembly or component shall be skidded, crated, boxed or otherwise protected against damage or loss during shipment, and to facilitate field handling. All openings shall be sealed with temporary closures to prevent entry of dust, dirt or other foreign matter.

6.4.1.5. Gasket surfaces and flange faces shall be thoroughly cleaned, greased and protected with plywood or masonite covers sealed and bolted to the flange with not less than four bolts. Protect small connections with plastic inserts pressed into the connection and sealed with at least three wraps of waterproof tape.

6.4.1.6. Exposed threaded parts shall be greased and protected with metallic or other type protection.

6.4.1.7. Female threaded openings shall be closed with forged steel pipe plugs unless otherwise specified.

6.4.1.8. The Contractor shall submit to the Construction Manager for review all documentation as specified in Paragraph 6.7.

6.4.2. Pipe and Fittings - Marking.

6.4.2.1. Each pipe and fitting shall bear the manufacturer's stamp or mark indicating the ASTM or ASME Specification under which the pipe or fitting was manufactured.

6.4.2.2. To facilitate identification and assembly in the field, each pipe spool shall be conspicuously marked with clear and legible identifying markings showing the following:

(1) Spool piece number and line number.

(2) Weight.

(3) Shop radiography identification numbers.

(4) Arrows indicating direction of flow.

6.4.2.3. All bolts, studs, gaskets, etc., required for flanged joints shall be assembled, packaged and identified by line pipe size, material and pressure class. Spare gaskets shall be separately packaged and tagged as spare parts.

6.4.2.4. The markings shall be done with paint or ink that will not smear, fade, peel or otherwise become illegible during transportation, handling or storage. Stamping shall be performed with low stress round nose steel stamps or other methods approved by the Construction Manager.

6.5. Field Erection and/or Installation.

6.5.1. Extent of Work. All pipelines shall be installed by this Contractor complete, including the "in line" accessories, valves and specialties to the extent shown on the drawings and as specified herein; furnishing all bolts, gaskets, etc., necessary for completing connection of the piping to the equipment or to piping installed by others, and connection thereto, unless specified otherwise.

6.5.2. Workmanship. Piping and tubing shall be carefully handled to avoid kinks and flat spots, and all flattened or kinked piping and tubing shall be removed from the job. All piping and tubing shall be installed in accordance with the requirements of the applicable piping material Specification, ANSI B31.1, and the additional requirements specified herein.

6.5.3. Detailed Location. When the drawings neither indicate the general routing or provide locational dimensions for a pipeline, the Contractor shall establish all dimensions required to install the piping in a proper, neat and workmanlike manner. In addition, if the piping penetrates concrete or metal floors, masonry or metal walls the Contractor shall cut the necessary openings, provide sleeves, flashing, banding, calking and repairs as required, at his expense. When installed, the piping shall not create obstructions,

shall provide acceptable clearances to building components and other work, shall in general be parallel to other piping and building structural members and shall be in compliance with applicable codes and standards as specified herein. All pipelines shall be so erected to preserve accurate alignment. Care shall be taken in the installation of pipeline runs where drainage is required, such that the pipeline slopes down toward the point of drain. Piping for vents and drains shall be properly valved and shall terminate in a manner precluding injury to personnel or unsightly or hazardous accumulations. All valves shall be located so that they are accessible for operation and maintenance.

6.5.4. Valves. All valve glands shall be tightened as the pipelines are erected. Additional valve gland packing rings shall be furnished and added by the Contractor if necessary to assure proper seal in service. Additional packing for each valve shall be identical to that originally installed in the valve.

6.5.5. Connections.

6.5.5.1. General.

6.5.5.1.1. Connections to equipment and in-line pipe components shall be made in strict accordance with the manufacturer's recommendations.

6.5.5.1.2. The joining of all pipe ends shall be subject to the Construction Manager's approval. The Contractor shall obtain specific approval from the Construction Manager prior to assembly when any one of the following dimensions are exceeded:

6.5.5.1.2.1. Internal misalignment of 1/16 inch.

6.5.5.1.2.2. Linear tolerance of $\pm$ 1/8 inch for pipe sizes 10 inches and smaller.

6.5.5.1.2.3. Linear tolerance of $\pm$ 3/16 inch for pipe sizes 12 inches thru 36 inches.

6.5.5.2. Threaded Connections.

6.5.5.2.1. Pipe threads on pipe and fittings shall conform to ANSI B2.1 for tapered pipe threads.

6.5.5.2.2. Threaded joints shall have clean machine cut threads and shall be made up with a suitable compound, applied to the male threads only. If it is necessary to back off a joint after it has once been made up with compound, the threads shall be cleaned and new compound applied before remaking the joint.

6.5.5.2.3. Threaded joints which are to be subsequently seal or back welded shall be made up dry.

6.5.5.3. Flanged Connections.

6.5.5.3.1. When a flanged joint has been made up and subsequently loosened the gasket shall be inspected by the Construction Manager and replaced if necessary. Thread lubricant shall be used on bolt threads and for coating gaskets for service temperatures up to 500 F.

Anti-seize thread compound shall be used on bolt threads and for coating gaskets for service temperatures ranging from 501 to 1050 F.

6.5.5.3.2. Bolts shall be tightened in accordance with the Crane Company procedures for "Assembly and Maintenance of Flanged Joints" as specified in Crane Catalog No. VC-1900.

6.5.5.4. Sweated Connections. Tube ends shall be cut square and burrs shall be removed. Both the inside of fittings and the outside of tubing shall be well cleaned with steel wool before sweating. Care shall be taken to prevent burning of fittings and tubing when making connections. Solder for sweated joints shall be solid string or wire type, of the composition specified. Flux shall be noncorrosive paste type. Cored solder will not be permitted.

6.5.6. Connections to Installed Piping. When cutting, or otherwise opening installed piping, every possible care shall be taken by the Contractor to prevent or minimize entry of cuttings, slag and other foreign matter into the existing piping, and to thoroughly clean such foreign matter from the piping before the opening is closed. Burning of such openings will not be permitted. Adequate support of the existing piping shall be maintained at all times, and any required changes or additions to existing piping supports shall be provided by the Contractor.

6.5.7. Fire Protection Main Header Systems. All fire protection piping and equipment shall be installed in accordance with Article 8.0, FIRE PROTECTION.

6.5.8. Temporary Piping. The Contractor shall as a part of his work, furnish and install all temporary piping required by his operations, including that for testing and cleaning permanent piping or other work installed by him. When the need for temporary pipeline has been satisfied, that line shall be removed by the Contractor, and any connections to permanent work that were required by the temporary piping shall be plugged, capped or otherwise closed as required by the service.

6.5.9. Flow Nozzles and Orifices. Flow nozzles and orifices shall be installed at the exact locations shown on the drawings. Flow nozzles and orifices shall not be installed by the Contractor without adequate and proper drawings and instructions, nor in any manner not in full and accurate compliance with those drawings and instructions. Unless specifically approved by the Construction Manager, all machining of pipe for flow nozzles and orifices and all drilling of pipe for the required pressure tap connections shall be done in a suitably equipped machine shop.

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6.5.10. Temporary Strainers. Temporary strainers shall include the furnishing and installation of all flanges, spool pieces, unions or similar items required for a strainer during construction testing. When advised by the Construction Manager, the Contractor shall remove the temporary strainers and install the necessary permanent material such as pipe, fittings, flanges, gaskets, bolts, etc.

6.5.11. Steam Traps. The Contractor shall install a steam trap or condensate drainer at the low points in the steam and drain lines as shown on the drawings.

6.5.12. Cleaning.

6.5.12.1. Field fabricated piping and tubing shall have all welding icicles, cuttings, beads and burrs removed and accessible internal weld surfaces ground smooth. Pipe shall then be rapped to loosen dirt, scale, etc., and blown out with air.

6.5.12.2. Nitrogen, air and chemical lines shall be thoroughly blown clean with air.

6.5.12.3. Water lines shall be thoroughly flushed clean and completely drained.

6.5.12.4. During the installation of pipe and tube, ends and branch connections where the connecting pipe or tube will not be immediately installed shall be temporarily sealed and protected, and any sand, mud or other foreign material that inadvertently enters the piping and tubing during further assembly shall be carefully removed.

6.5.13. Miscellaneous Items. The Contractor shall install all piping, high point vents and low point drains and miscellaneous items supplied with equipment and necessary for proper operation of this equipment. Unless otherwise instructed by an equipment manufacturer, all equipment piping shall be erected and installed as specified herein.

6.5.14. Equipment Terminals. Piping connections to equipment terminals shall not be attached until the equipment has been rough set to its foundation or supporting structure. Piping connections to equipment terminals shall at all times be installed and supported in a manner that prevents detrimental forces on the equipment and its supports.

6.6. Inspections and Tests.

6.6.1. General.

6.6.1.1. The Contractor shall notify the Construction Manager prior to inspection and test related to the work performed hereunder by manufacturers, shop fabricators and the Contractor in order that the Construction Manager may schedule such representation as they may desire to witness the inspections and

tests. A minimum of two (2) weeks notice is required for shop inspections and tests and a minimum of twenty-four (24) hours notice is required for field inspections and tests.

6.6.1.2. All pipe and fittings shall be inspected and tested by the manufacturer in accordance with the supplementary requirements specified in the applicable Piping Material Specification Sheet.

6.6.1.3. The extent, techniques and acceptance standards for all specified inspections and tests of materials and welds (shop & field) shall be in accordance with ANSI B31.1 and as further specified herein.

6.6.1.4. Should the Construction Manager elect not to have a representative present during shop and/or field tests, such decision shall in no way relieve the Contractor from full responsibility for the quality and correctness of the work nor shall anything contained in the above Paragraphs in any way void, restrict, or limit the right of the Construction Manager to later conduct such tests or rights under any warranty or guarantee.

6.6.2. Fire Protection System Tests and Approval After Installation. All Fire Protection Tests shall be in accordance with Article 8.0, FIRE PROTECTION.

6.6.3. Safety Valve Discharge Elbows.

6.6.3.1. Weld joints on high pressure and/or high temperature safety valve discharge elbows shall all be radiographed in accordance with Article 2 of Section V of the ASME Boiler and Pressure Vessel Code. High pressure shall be defined as systems in which the design pressure is equal to or greater than 600 psig. High temperature shall be defined as all systems in which the design temperature is equal to or greater than 750 F.

6.6.3.2. Should the Construction Manager elect not to have a representative present during shop and/or field tests, such decision shall in no way relieve the Contractor from full responsibility for the quality and correctness o the work nor shall anything contained in the above Paragraphs in any way void, restrict, or limit the right of the Construction Manager to later conduct such tests or rights under any warranty or guarantee.

6.6.4. Field Inspections and Tests.

6.6.4.1. In addition to the inspection requirements of ANSI B31.1, the following field welds shall be radiographed:

6.6.4.1.1. Five (5) percent of all socket welds above 750 F (per system).

6.6.4.1.2. Five (5) percent of all butt welds (per system) in systems not requiring radiography in accordance with ANSI B31.1.

6.6.4.1.3. The Construction Manager will determine the welds that comprise the 5 percent as stated above.

6.6.4.2. All water, steam, condensate, oil, gas and air piping and tubing shall be hydrostatically or pneumatically field tested as specified on the Line Schedule Drawings.

6.6.4.3. When hydrostatic testing is performed, the Contractor shall perform all work necessary to vent the air from the system at the highest point in the system.

6.6.4.4. When pneumatic testing is performed, all joints shall be checked with soap suds. In no case shall the air test pressure exceed the maximum recommended air test pressure specified in ANSI B31.1.

6.6.4.5. The Contractor shall maintain the system under test at or above a temperature listed in the applicable code.

6.6.4.6. The Contractor shall install all temporary connections, closures and drains and obtain all necessary water from existing sources, as required to complete hydrostatic testing. Following satisfactory completion of work hereunder, the Contractor shall remove all temporary work and shall leave the piping drained and closed.

6.6.4.7. During the application of test pressure, care shall be taken to remove, isolate or otherwise protect all equipment, instruments, gages, safety valves, expansion joints and similar items from damage by the test pressure or fluid. Also existing pipeline valves which will be used as hydrostatic test boundaries shall be checked by the Contractor to assure that the valve pressure rating as defined in Specification E-1 is not exceeded. The Contractor shall submit to the Construction Manager detailed procedures to be used for isolating the above items during tests.

6.6.4.8. Hydrostatic and pneumatic tests shall be performed in accordance with the procedures defined in the applicable code.

6.6.4.8.1. Upon notification by the Construction Manager and prior to the hydrostatic and pneumatic tests, the Contractor shall plug and seal weld access holes in accordance with PFI Standard ES-16.

6.6.4.9. Where the Contractor's work interfaces with underground piping previously installed, the hydrostatic test shall include the interface connection using the closest shutoff valve of the previously installed pipe to complete his test.

6.6.4.10. Field welded joints shall be coated and wrapped after all leak tests and inspections are complete. Coating shall be applied in accordance with Engineering Standard SE02.0 as soon as practicable after inspection, testing and acceptance of the field weld.

6.6.4.11. Gravity drain lines shall be leak tested with a minimum 10-foot head of water in accordance with the latest edition of the National Plumbing Code. Pumped drain lines shall be hydrostatically tested to the design pressure listed in the line schedule.

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6.6.4.12. The Contractor shall provide a qualified welding inspector who shall be present during all field welding. The Contractor shall submit to the Construction Manager, a minimum of thirty (30) days prior to any field welding, the name of the welding inspector, the procedures he proposes to use, and a listing of the inspector's qualifications. This submittal shall be in duplicate and will not be returned to the Contractor.

6.6.4.13. The Contractor's welding inspector shall document all examinations and inspections as outlined in Paragraph 6.3.2.7 of this Specification.

6.7. Documentation. Documentation shall be furnished in accordance with Engineering Standard No. FJ60.60 as follows:

6.7.1. Manufacturer's Drawings and Reports.

6.7.1.1. Item 1 of Engineering Standard No. FJ60.60 shall include manufacturer's equipment outline drawings for each piece of equipment showing all necessary dimensions and locations of piping and/or electrical connections.

6.7.1.2. Item 1 of Engineering Standard No. FJ60.60 shall include weld end details.

6.7.2. Shop Fabricator's Drawings.

6.7.2.1. Item 2A of Engineering Standard No. FJ60.60 shall include spool sheet (shop fabrication) drawings as specified herein for 2-1/2 inch and larger shop fabricated pipe. Spool sheet drawings shall as a minimum indicate the following:

(1) Locations and identification numbers of all field welds.

(2) Locations of all shop welds.

(3) Identification by line number and shop weld number of shop welds that have been radiographically examined.

(4) Piece numbers, line numbers, and weights.

(5) Weld end preparation details.

(6) Location of hanger lugs.

(7) Location of insulation nuts.

(8) All related details.

(9) Bills of material.

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6.7.2.2. Item 2B of Engineering Standard No. FJ60.60 shall include field erection drawings as specified herein for 2-1/2 inch and larger shop fabricated pipe.

The Contractor will be provided reproducible copies of the contract drawings for the 2-1/2 inch and larger piping. The Contractor shall utilize these reproducible drawings to indicate the necessary field erection information as described hereinafter and reissue to the Construction Manager. The drawings shall indicate the following field erection information:

(1) Locations and identification numbers of all field welds.

(2) Piece numbers and line numbers.

(3) All other related details.

6.7.2.3. The Contractor shall not prepare erection or spool sheet drawings until he receives the Drawings designated "APPROVED FOR CONSTRUCTION."

6.7.2.4. The Contractor shall not begin fabrication until his erection and spool sheet drawings have been returned marked "REVIEWED/NO COMMENTS."

6.7.2.5. One (1) copy of each erection and spool sheet drawing will be returned to the Contractor with comments.

6.7.2.6. The Contractor shall then revise the erection and spool sheet drawings in accordance with comments and reissue two (2) reproducibles and one (1) print.

6.7.2.7. After all fabrication has been completed, the Contractor shall show all piping spools on the latest revised drawings.

6.7.2.8. The Contractor shall be held responsible for all details shown on his drawings. The review by others does not relieve the Contractor of this responsibility.

6.7.3. Contractor's Drawings. Item 2B of Engineering Standard No. FJ60.60 shall include isometric (erection) drawings for all 2 inch and smaller (including heat traced) piping. Isometrics will not be required for uninsulated 2 inch and smaller piping which is dimensioned on the drawings.

The isometric drawings shall as a minimum indicate the following:

(1) Line Number
(2) Hanger Locations
(3) Bills of Material
(4) All related details
(5) Actual field routing

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These isometric drawings shall be submitted to the Construction Manager for use by other Contractors (insulation, heat tracing, etc.).

6.7.4. Shop and Field Fabrication Procedures.

6.7.4.1. Item 3E of Standard No. FJ60.60 shall include the following shop and field fabrication procedures for the Construction Manager's review and/or comments:

(1) Complete and detailed description of the welding procedures.

(2) Qualification test report(s) for each welding operator.

(3) Preheat and postheat treatment procedures.

(4) Radiography, liquid penetrant and magnetic particle examination procedures.

(5) Detailed description of quality control procedures including extent of inspection.

6.7.4.2. The Construction Manager's review of the above procedures and reports shall in no way relieve the Contractor of the full responsibility for satisfactory welding, heat treating, radiographing, examining by liquid penetrant or magnetic particle or the proper correction of any defects, or of otherwise fulfilling all other requirements of this Specification.

6.7.5. Shop and Field Reports.

6.7.5.1. Item 3F of Standard No. FJ60.60 shall include certified reports of the following types of fabrication, inspections and/or tests:

(1) Preheat and postheat treatments for shop welds including postheat temperature charts.

(2) Weld repairs complete with evaluations.

(3) Evaluations of radiographic films, and liquid penetrant and magnetic particle inspections. Radiographic films shall be made available for review by the Construction Manager upon request.

(4) Leak tests performed in the field. Leak test reports shall include the following data:

System description

Test medium

Test pressure

Test temperature

Duration of test

Results of tests

6.7.5.2. The above reports shall be submitted to the Construction Manager upon completion of the heat treatment, weld repair, inspection and/or test.

6.7.5.3. Item 2 of Standard FJ60.60 shall include the following:

The Contractor shall provide and maintain a complete set of "as-built" drawings for the work within the scope of this Contract. All drawings furnished to the Contractor shall be updated as necessary to show current as-built conditions. Two complete sets of reproducible as-built drawings, current with all changes and corrections through the time the work is complete, shall be delivered to the Construction Manager within thirty (30) calendar days after acceptance of the work.

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7.0 HANGERS AND SUPPORTS

This Article describes specific requirements for the pipe hanger and support work to be performed by the Contractor. The requirements set forth in this Article 7.0 are in addition to those requirements specified in Article 5.0, GENERAL REQUIREMENTS.

7.1. General.

7.1.1. Extent of Work.

7.1.1.1. Hanger and support work under this Contract shall include installation of the Government-furnished primary pipe hangers, supports and seismic restraints for 2-1/2 inch and larger piping as shown on Hanger Volumes P60-1 and -2 and the Rocketdyne Piping Drawings.

7.1.1.2. Hanger support work shall include fabricating, furnishing and installing all secondary pipe hangers and supports for all Contractor-furnished piping. Secondary hanger details will be furnished by the SFDI. These hangers shall be shown in Hanger Volumes P14-1, -2, -3 & -4 and as shown on the Rocketdyne Piping Drawings.

7.1.1.3. The work hereunder shall also include designing, fabricating, furnishing and installing all pipe hangers, supports, restraint assemblies and supplementary support steel for all 2 inch and smaller piping not shown on P14-3. Typical hangers for 2 inch and smaller piping are also shown in Hanger Volume P14-3.

7.1.1.4. The hanger work hereunder shall include furnishing documentation as specified hereinafter.

7.1.2. Drawings.

7.1.2.1. All primary pipe supports will be designed and fabricated by others, and will be delivered to the Contractor at the jobsite.

7.1.2.2. Design drawings for all secondary pipe supports will be furnished to the Contractor, who shall furnish detailed shop drawings and furnish and install the hanger assemblies. The SFDI's drawings may be used by the Contractor to provide the detailed shop drawings. See APPENDIX 6, DRAWINGS AND DATA furnished herewith.

7.1.2.3. Except as noted on the hanger details, ITT Grinnell figure numbers have been utilized in preparation of the hanger details however, equivalent products of the following hanger manufacturers shall also be considered as SFDI approved equals:

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Bergen-Patterson Pipe Support Corporation

Corner and Lada Company Incorporated

F and S Central

Basic Engineers Division of National Valve and Manufacturing Company

Elcen Metal Products Company

7.1.2.4. Bidders shall state with their bid whose hanger and support components each intends to supply.

7.1.2.5. Primary pipe hangers will be furnished to the Contractor at the jobsite. Pipe support drawings are included herewith for the Contractor's reference as to quantity, type, size, weight, etc., of the primary pipe hangers. See APPENDIX 6, DRAWINGS AND DATA.

7.1.3. Definitions. Unless otherwise specified herein, these definitions shall apply to the secondary pipe supports.

7.1.3.1. Pipe Supports: As used herein, pipe supports shall mean the types of secondary hangers, and supports, guides, anchors, or restraints including seismic restraints or vibration control devices. Hangers as used herein generally refers to suspension devices capable of resisting downward acting forces only. Hangers are included in the more general definitions of Pipe Supports.

7.1.3.2. Assembly: As used herein, assembly shall mean the entire supporting or restraining device including all the pipe support, bolting, supplemental structural steel, clip angles, slide or stationary bases, etc., necessary to attach the piping to the structure. The definition is independent of the contract scope.

7.1.3.3. Structure: As used herein, structure shall mean the system of primary members of the building or other supporting structure.

7.1.3.4. Supplemental Structural Steel: As used herein, supplemental structural steel shall mean those necessary additional structural members which are components of a pipe support assembly as defined above.

7.2. Design and Construction.

7.2.1. General.

7.2.1.1. It is the intent of this Specification to establish the engineering design criteria for complete workable assemblies capable of performing as specified herein.

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7.2.1.2. The equipment to be Contractor-furnished hereunder shall meet or exceed the requirements of this Specification and all supplements furnished herewith. Materials shall be new and of first-line quality, and shall be free of all defects which would affect performance or service life of the equipment, or which would cause unsightly or unworkmanlike appearance.

7.2.1.3. The hot load for each spring, as it appears on the Pipe Support Details, does not include the weights of the lower components. The Contractor shall add the weight of the lower components to the operational (hot) and cold loads shown on the Pipe Support Schedules. All components shall be adequate to support the hydrostatic load specified on the Pipe Support Details.

7.2.1.4. Pipe supports and accessories to be furnished hereunder shall, as a minimum, meet the requirements of Paragraphs 120 and 121 of ANSI Standard Code for Pressure Piping, ANSI B31.1.

7.2.1.5. Component materials shall meet the requirements of ANSI B31.1, Paragraph 121.1.2 except that cast and malleable iron components are not acceptable.

7.2.1.6. The material, design and fabrication criteria to be used in the manufacture of the pipe support assemblies and components shall be in accordance with MSS-SP-58.

7.2.1.7. Supplemental structural steel design shall be in accordance with the standards as prescribed by the latest edition of the Manual of Steel Construction of the American Institute of Steel Construction.

7.2.1.8. Welding symbols shall be in accordance with S-R Engineering Standard EJ14.37.1.

7.2.1.9. The hangers and support assemblies shall, where practical, incorporate commercially available, load rated and tested component parts.

7.2.1.10. Pipe and structural steel attachments shall be located such that pipe support rods are vertical when the piping system is hot unless otherwise shown.

7.2.1.11. Hanger components shall be designed to accommodate not less than 4 degrees of swing from the vertical without bending or binding the hanger rod.

7.2.1.12. Horizontal travellers or dual directional rollers shall not be used. Where pipe movement exceeds 4 degrees of swing, the Contractor shall contact the Construction Manager for resolution.

7.2.1.13. Variable springs and constant support devices weighing in excess of 90 pounds shall be furnished with lifting lugs.

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7.2.1.14. Supports furnished for service located in a corrosive environment shall be constructed or protected such that the environment will not corrode or otherwise interfere with their intended function.

7.2.1.15. Hanger and support components shall be designed to the following criteria:

Excessive heat transmission to the structure shall be avoided.

Bending stresses in hanger rods and post type supports shall be avoided.

Support of one pipe from another shall be avoided.

Rigid and spring type assemblies shall be designed to provide at least plus or minus 2 inches of vertical adjustment. Where additional adjustment for cold pull is required, it will be so indicated.

7.2.1.16. Any field welds shown on the detail drawings may be revised to shop welds at the Contractor's discretion.

7.2.2. Flexible Pipe Supports.

7.2.2.1. Flexible pipe supports shall allow thermal expansion of the piping in a normal manner and in no way restrict pipe movement. Variable type spring support units used as part of the hanger assemblies shall be of the enclosed and guided type and shall conform to MSS-SP-58. In no case shall eccentric loading of the spring be permitted.

7.2.2.2. Variable springs shall be provided with a means of adjusting the support through the full load range.

7.2.2.3. Variable springs shall have at least one (1) position indicator on the side of the spring can for ease in observation and adjustment after installation. Each spring assembly shall have hot and cold position indicators installed to ensure proper support loading.

7.2.2.4. Variable springs shall not exceed 25 percent variability between hot and cold positions.

7.2.2.5. Travel stops shall be provided on variable springs for hydrostatic testing purposes and shall be installed in the cold position. Variable spring travel stops shall be suitably affixed to the assembly by cable or chain to prevent loss after removal so that they may be reengaged in the event future hydrostatic testing or maintenance is required.

7.2.2.6. Constant support type hangers shall have a total travel equal to or greater than the calculated actual travel plus 20 percent or 2 inches whichever is less, but in no case less than actual travel plus 1 inch. Each constant support hanger shall have a minimum of plus or minus 10 percent calibrated load adjustment feature.

7.2.2.7. The supporting force of any constant support shall not deviate more than 6 percent of the calibrated load throughout its full working range.

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7.2.2.8. Unless specified otherwise, travel stops shall be provided on all constant support devices for hydrostatic test purposes, and shall be installed with the device set in the cold position. Travel stops shall be of the type that can be engaged at any point through the full working range of the support, minimizing field readjustment of supports during future hydrostatic test and maintenance procedures.

7.2.3. Rigid Pipe Supports.

7.2.3.1. Anchors and guides shall be designed to protect the full thickness of insulation.

7.2.3.2. Riser supports shall be designed so that the load is always equalized, and at no time can one side of the support be completely unloaded by the riser moving out of plumb.

7.2.3.3. Rigid riser supports shall be designed to carry an additional load in the event of the failure of an adjacent support.

7.2.3.4. Lateral box guides shall be limited to a maximum clearance of 1/8-inch.

7.2.4. Hanger Rods.

7.2.4.1. Hanger rods shall be solid round section and of material suitable for the maximum operating temperature that will be encountered. Rods shall have sufficient thread length for full adjustment of springs and turnbuckles.

7.2.4.2. The use of wire, chain, cable, strap iron or rectangular bar in substitution for solid round steel rods will not be permitted.

7.2.4.3. Solid round steel rod shall be used as a tension member only. Where tension-compression members are required, suitable strut assemblies shall be used. Strut assemblies shall provide for field adjustment.

7.2.4.4. Rods less than 1/2-inch diameter will not be permitted except that rods for 2 inch and smaller piping shall be 3/8-inch diameter in size.

7.2.4.5. Continuous threaded rods up thru 7/8-inch diameter may be used.

7.2.4.6. Welded eyerods or weldless eyenuts shall be used for all loads over 1000 pounds.

7.2.5. Pipe Clamps.

7.2.5.1. Pipe clamps shall be made of sufficiently heavy material and/or stiffened to hold the loads, plus an allowance for hydrostatic test loads where steam piping is concerned.

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7.2.5.2. Clamp friction shall not be considered adequate for support of risers or restraints parallel to the axis of the pipe where the load exceeds 1000 pounds. The Contractor shall provide and install shear lugs for this purpose.

7.2.5.3. Rigid riser clamps shall be designed to carry the total operating load on either arm in the event of load shift due to pipe and/or hanger movement.

7.2.5.4. Pipe clamp material shall be, as a minimum, equivalent to the piping material. For stainless steel piping, the clamps shall be of the same stainless material grade as the pipe, or as an alternate, may be lined or coated with a material suitable for the loading service. The use of such alternates shall be subject to approval by the Construction Manager.

7.2.5.5. When the operating temperature of the supported pipe exceeds 750 F, all pipe clamps and welded attachments shall be of suitable alloy steel, and of heavy-duty construction. For insulated piping, pipe clamps and welded attachments shall be constructed such that support rod attachment bolt(s) will be external to the insulation, and the pipe clamps will be rigid relative to the pipe and insulation.

7.2.6. Bolts and Threaded Connections.

7.2.6.1. Threaded connections shall be designed to avoid having loads bear against threads. Where this is not completely avoidable, a maximum limit of 33-1/3 percent of the load bearing support length may bear against the threads. All bolts and bolt studs shall extend completely through the nut.

7.3. Supplementary Structural Steel and Attachments. Hangers and supports shall normally be attached to adequately sized steel channels, beams and columns which are primary members in the building or other supporting structure. When this is not possible, such additional structural steel has been designed as necessary for the safe and proper attachment of the pipe hangers and supports. Supplemental steel shall conform to ASTM A36. Angle clip bolt sizes, bolt locations, and weld sizes are shown on Engineering Standard EE16.01.9. Supplemental steel shall be furnished and installed by the Contractor.

7.4. Shop Painting and Protection. After fabrication, all exposed ferrous surfaces not excluded from painting, shall have burrs removed, sharp edges eased, and be shop prime painted in accordance with Article 16.0, PRIME AND TOUCH-UP PAINTING.

7.5. Erection and/or Installation.

7.5.1. General.

7.5.1.1. Hangers and supports for 2-1/2 inch and larger piping shall be installed as shown on the Drawings, and as specified herein.

7.5.1.2. Hangers and supports shall be installed in accordance with the manufacturer's instructions. Hangers shall be carefully adjusted to the cold position settings during erection. After plant startup, all supports shall be checked by the Contractor to confirm that spring load indicators have assumed the proper hot load position and that all hangers and supports which do not incorporate springs are in correct adjustment. After any required adjustments have been made, all threads shall be fully engaged and locked.

7.5.1.3. Careful attention shall be given to the arrangement and routing of parallel runs of piping and tubing to assure a neat and well planned installation and provide accessibility for good housekeeping and maintenance.

7.5.1.4. Proposed deviation from design and support selection criteria shall be submitted to the Construction Manager for review. All approved deviations shall be indicated on "As-built" drawings.

7.5.1.5. All pipe hangers and support stands shall be attached to the piping and structural supports such that they will be vertical when the piping is at normal operating temperature. Insofar as practicable, adjacent hangers and supports shall be of the same type and component assembly, with corresponding parts set in line and at the same elevation. Where reasonably possible, the use of trapeze type hangers shall be avoided. The Contractor shall procure and install the dampeners and/or supports subject to the Construction Manager's review and approval.

7.5.2. Attachment. Hangers and supports including supplemental structural steel as required shall be attached to steel channels, beams and columns which are primary members in the building or other supporting structure. Unless specifically required by the drawings, or approved by the Construction Manager, welding, torch cutting and burning of existing steel and the attachment of hangers and supports to building trusses or secondary structural members, such as angles, grating, floor plates and stair stringers is prohibited.

7.5.3. Location. All hangers and supports shall be located and arranged so as not to obstruct or otherwise interfere with plant equipment, equipment operation and maintenance areas, building and plant area lighting, other piping, ducts, raceways, stairways, walkways, platforms, operator headroom and other similar items. Hangers and supports shall be located near flanges, valves, strainers and similar points of concentrated piping loads, near elbows, bends, tees and other points of juncture with branching lines of similar size. Hangers and supports shall be spaced in accordance with ANSI

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B31.1 Paragraph 121.1.4. For piping smaller than one (1) inch nominal pipe size, hangers and supports shall be located such that the distance between any two of them will not exceed the values shown in the following table:

Nominal Pipe Size, Inches	Support Spacing, Feet (For Copper Tubing)	Support Spacing, Feet (For Steel Pipe)
Up thru 1/2-inch	5	5
3/4-inch	6	6

7.5.4. Level Devices. Each level device shall be supported so as to impose no undue stress on either its connecting piping or the vessel to which it is attached.

7.6. Documentation. Documentation shall be furnished in accordance with Engineering Standard No. FJ60.60 as follows:

7.6.1. Item 2A of Standard FJ60.60 shall include detailed shop drawings for each hanger for review and/or comment. The shop detail drawings shall show the following information for each hanger:

7.6.1.1. Manufacturer's figure number, type, size, arrangement and weight.

7.6.1.2. Details of integral pipe attachments required to be furnished by the Contractor.

7.6.1.3. All dimensions needed for installation.

7.6.1.4. Dimensioned location plan and elevation.

7.6.1.5. Design loads and movements plus cold load setting.

7.6.1.6. Complete list of parts referenced on the drawings.

7.6.1.7. Description of each piece of material including cut lengths.

7.6.1.8. Weld size, type, and location for field welds.

7.6.1.9. Dimensions shall be in English units of pounds, degrees, inches or feet and inches.

7.6.2. Operation and Maintenance Manuals. Item 4 of Standard FJ60.60 shall include performance characteristics and operation, erection, adjustment and maintenance instructions for each pipe support for the Construction Manager's review and/or comments.

7.6.3. Installation Instructions. Item 2C of Standard FJ60.60 shall include manufacturer's installation instructions and procedures.

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8.0. FIRE PROTECTION

This Article covers the requirements applicable to designing, furnishing, delivering, unloading, storing, installing, and testing of the fire protection equipment and systems forming a part of the work of this Contract.

8.1. General.

8.1.1. Scope of Work.

8.1.1.1. The Contractor shall furnish, deliver, unload, store, remove from storage, install and test all materials and equipment necessary to provide complete fire protection for the Core Area and outlying structures as shown on Drawings 40P7005133148 and 40P7005133247 including, but not limited to, the following:

(1) All underground fire mains complete with all piping, fittings, valves, operators, including trench and backfill, and all necessary accessories as specified elsewhere herein.

(2) Twelve (12) standard fire hydrants complete with all necessary components including control valves as specified elsewhere herein.

(3) A total of four (4) fire hydrant hose houses complete with all necessary accessories as specified elsewhere herein.

(4) One (1) foam hose cabinet complete with all accessories specified elsewhere herein.

(5) A total of two (2) monitor nozzles complete with all accessories as specified elsewhere herein.

(6) Three (3) fire department pumper/suction connections complete with all accessories as specified elswhere herein.

8.1.1.2. The Contractor shall also design, furnish, deliver, unload, store, remove from storage, install and test all materials and equipment for the fire protection systems shown on Drawings 40P7005133148 and 40P7005133247 as "by FPV" (Fire Protection Vendor) and described in APPENDIX 5, DETAILED SPECIFICATION FOR FIRE PROTECTION SYSTEMS.

8.1.1.2.1. APPENDIX 5, DETAILED SPECIFICATION FOR FIRE PROTECTION SYSTEMS is provided for the Contractor's information in securing the required services from a certified fire protection vendor and as the detailed description of the requirements for these systems.

8.1.1.2.2. The fire protection systems and components included in Appendix 5, but not limited to, are the following:

(1) Secondary Fire Pump Building Wet Pipe Sprinkler/Fire Hose System complete with piping, hangers, support, fittings, sprinklers, hose station and accessories as specified elsewhere herein.

(2) Warehouse (BL-703) Building Dry Stand Pipe System complete with automatic and manual control valves, piping, hangers, supports, fittings, hose stations, wall fire hydrant, pushbutton stations and accessories as specified elsewhere herein.

(3) Semi-automatic Foam Monitor System to protect the TSS equipment complete with piping (both above and below ground), hangers, supports, nozzles, four (4) monitor nozzles and accessories as specified elsewhere herein.

(4) Automatic Total Flooding Halon 1301 Systems for the Thermal Storage Control Buildings (BL-709 and BL-710) and the Electronics Rooms in the Receiver Tower. Systems shall consist of all piping, hangers and supports, agent storage containers, Halon 1301 gas plus 100 percent reserve, Freon 122 test gas, nozzles, detectors, controls and accessories as specified elsewhere herein.

(5) Warehouse Building (BL-703), Cooling Tower Remote MCC Building, Electrical Equipment Building (BL-712) and TSS Pump/Heat Exchanger Areas Fire Detection Systems complete with detectors, control panels and accessories as specified elsewhere herein.

(6) Fire extinguishers furnished and installed in accordance with Portable Fire Extinguisher Schedule (Table I), included as Appendix A of APPENDIX 5, DETAILED SPECIFICATION FOR FIRE PROTECTION SYSTEMS.

(7) Other equipment and services as specified in APPENDIX 5, DETAILED SPECIFICATION FOR FIRE PROTECTION SYSTEMS.

8.1.2. Definitions. Definitions applicable to various terms used in this Article are defined in Article 5.0, Paragraph 5.9, "Definitions."

8.1.3. Documentation. Plans and calculations for fire systems and equipment, specified in APPENDIX 5, DETAILED SPECIFICATION FOR FIRE PROTECTION SYSTEMS, are required for approval in accordance with Engineering Standard FJ60.60.

8.1.4. Fire Protection Systems Proposal Drawings. Included as part of the proposal shall be conceptual drawings of all protection and detection to be provided. These drawings shall be on standard 30 inch by 42 inch sheets, and shall show valving (from Contractor's interface), general pipe routing, monitor nozzle (both water and foam) and detector placement for all systems and components furnished.

8.2 Design and Construction.

8.2.1. General.

8.2.1.1. The Contractor shall design, furnish, deliver and install all pipe, valves, fittings, pipe hangers and supports, hydrants, fire hose houses, nozzles, fire department pumper/suction connections, foam and water monitor

nozzles, wall fire hydrants, hose racks, hoses, controls, detectors, local alarms, identification tags and labels, concrete foundations and supports, and all other accessories required for complete operation of the specified systems.

8.2.1.2. The Contractor shall design systems for the water supply flow and pressure as specified in Paragraph 5.2. of APPENDIX 5.

8.2.1.3. It shall be the Contractor's responsibility to calculate all hydraulic flow and pressure requirements from the fire pumps to all the Contractor's system water inlet terminals to determine if the specified water supply and pressure is hydraulically adequate for the system's operation and to so advise the Construction Manager. Contractor shall submit all calculations to the Construction Manager at time of drawing submittal for review. Submittal of these calculations to the Construction Manager will in no way relieve the Contractor of his responsibilities for complete and proper design of the specified fire protection systems.

8.2.1.4. It shall be the Contractor's responsiblity to design the systems so that no interferences exist between the fire protection piping and equipment, and systems designed and installed by others.

8.2.1.5. The design and construction of equipment specified herein is clarified by the naming of a specific acceptable manufacturer and model number of the equipment and the statement: "or SFDI-approved equivalent." Bidder shall be required to supply data to support his equipment selection with his bid. The Bidder shall show that alternate equipment is of equal design and quality or shall supply the specified equipment. A determination that the manufacturer and equipment selected by the Bidder is or is not an approved equal will be made by the SFDI.

8.2.1.6. Concrete work (when required) shall be in accordance with Article No. 17.3.

8.2.2. Piping.

8.2.2.1. All piping, valves and fittings shall conform to the latest issue of applicable NFPA Standard for each individual type of system.

8.2.2.2. National Standard threads shall be used throughout on fire department pumper connections, fire hose and associated valves or other fittings for the purpose of connecting plant and Barstow Fire Department fire protection equipment.

8.2.2.3. All underground piping shall be comparable to Engineering Standard No. SE00.CQA.

8.2.2.4. All other piping shall be comparable to Engineering Standard No. SE00.CBD.

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8.2.2.5. Drain Lines.

8.2.2.5.1. All low points in pipelines shall be provided with automatic or manual drain valves connected to drain lines when possible, or other approved means for complete drainage.

8.2.2.5.2. All deluge valve and system main and/or auxiliary drains shall be provided with the appropriate size valve per NFPA, or manufacturer's recommendation.

8.2.2.5.3. Sight glasses shall be provided on all drain lines where discharge cannot be seen.

8.2.2.5.4. Ultimate discharge points for all drain lines shall be coordinated with the Construction Manager during drawing approval submittal.

8.2.2.5.5. Drain lines discharging to open hub or funnel floor drains shall be provided with tight sealing cover plates (1/8-inch thick) should full flow installation acceptance tests produce splashing of water on the floor.

8.2.3. Hangers and Supports.

8.2.3.1. The Contractor shall provide hangers of the design and shape required for the specific installation and location, with all necessary supporting members and structures, where none now exist, to properly support and accommodate pipe hangers. The Contractor shall provide anchors and restraints as required to prevent misalignment or vibration of the piping caused by water hammer or pump pulsations. Pipe hangers, supports, anchors and restraints shall be in accordance with the latest issues of applicable NFPA Standards with locations subject to the Construction Manager's approval.

8.2.3.2. Attachment of hangers and supports shall be by beam clamps, mounting plates, brackets or clips bolted to the support steel. The drilling of, or welding to, structural members for attachment of hangers and supports shall be subject to prior approval by the Construction Manager. Cutting or burning of any structural steel will not be permitted.

8.2.3.3. Hangers, bolts and supports located outdoors or in a corrosive atmosphere shall be galvanized.

8.2.4. Installation.

8.2.4.1. When installed, the piping shall not create obstructions, shall provide acceptable clearances from other work, and shall, in general, be parallel to other piping in accordance with the existing plant piping grid system and parallel to the building structural members.

8.2.4.2. Trenching and backfill shall be in accordance with Article 12.0, EARTHWORK.

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8.2.4.3. Where drainage is required, care shall be taken to slope the pipe downward toward the point of drain.

8.2.4.4. Any completed construction or construction work in progress which is not part of the work of this Specification and which is damaged during installation shall be repaired, replaced or restored to its original condition at no additional expense. All such damaged areas which are repaired shall be subject to the Construction Manager's approval.

8.2.4.5. The Contractor shall coordinate the installation of his material with that of other contractors to ensure the required sequence and to eliminate delays in the completion of the work. All pipe, valves, fittings and other pipeline material delivered to the job shall be stored and protected as necessary to prevent damage, and to miminize the entry of foreign matter. All piping shall be cleaned and kept clean and free of foreign matter before and during erection. This shall include careful removal of dirt, scale, welding icicles or beads, cuttings, burrs, etc. Following erection, water lines shall be flushed out with water in accordance with information contained in attached Form No. 85 "Contractor's Material and Test Certificate," to the satisfaction of the Construction Manager.

8.2.4.6. All connections and pipelines shall be installed in a neat and workmanlike manner with materials and construction as specified for the pipeline to which connection is made.

8.2.4.7. Any pipelines, fittings, valves, etc., requiring maintenance or replacement shall be installed with unions and flanged connections and isolating valves to permit easy removal, whether specifically indicated on the drawings or not.

8.2.4.8. All valve glands shall be tightened as the pipelines are erected. Additional valve gland packing rings shall be added to all valve glands if necessary to provide a seal and assure tight working conditions after valves are placed in service. Packing supplied with all valves shall be as required for the design service conditions.

8.2.4.9. Attachments to concrete shall be of a design acceptable to the Construction Manager.

8.2.4.10. All pipelines with screwed construction shall be made up with as few joints as possible. Threads for all screwed fittings shall be American Standard Pipe Threads in accordance with ANSI Specification B2.1-1968. Screwed joints shall have clean machine-cut threads and shall be made up with a piping compound, the threads shall be cleaned and new piping compound applied before remaking the joint.

8.2.4.11. Flange bolts shall be evenly tightened with wrenches only. Hammering or bumping is not permitted. In tightening joints, care shall be taken to assure uniform pressure on the gasket and to avoid overstressing the bolts or dishing or breaking the flanges. Flanged joints that have been made up and broken shall be made with new, unused gaskets supplied by the Contractor at no cost.

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8.2.4.12. Floor and wall sleeves shall be provided by the Contractor, as necessary, for the installation for all pipelines, whether or not specifically called for on the drawings. The sleeves shall be set and aligned to receive pipelines and shall provide a 2-inch minimum annular space between the pipe and the sleeve. Pipe sleeves through floors shall extend 4 inches above finished floor. The installation of and any damage to existing work resulting from installation of sleeves shall be repaired by the Contractor to the satisfaction of the Construction Manager and at no additional expense. All voids between pipe and sleeve shall be filled with a noncombustible watertight material (Silicone RTV Foam) in floor openings and a noncombustible material in wall openings. Fire wall penetrations shall be sealed with Silicone RTV Foam - Dow Corning 3-6548 Silicone RTV Foam.

8.2.4.13. Welding of pipe shall be permitted. However, shop or field shop fabrication shall be performed for all pipe under 20 feet in length and shall be conducted outside of buildings. Final welding of pipe shall not take place inside without first obtaining permission from the Construction Manager, after assurance is made that no combustibles exist in the area, and a fire watch outfitted with fire hose and extinguishers will be present. 2

8.2.4.13.1. All welding shall be in accordance with ANSI Standard B31.1-1973 and Supplements where applicable.

8.2.4.13.2. Welded flanged fittings shall conform to ANSI Standard B16.9 "Wrought Steel Buttwelding Fittings" and Standard B16.25 "Buttwelding Ends for Pipe, Valves, Flanges and Fittings."

8.2.4.13.3. Welded sections of pipe shall not exceed 20 feet.

8.2.4.13.4. Piping 2 inch and smaller shall be screwed.

8.2.4.14. After erection, all galvanized surfaces that are damaged shall be touched-up as specified in Article 16.0, PRIME AND TOUCHUP PAINTING.

8.2.4.15. Flashing, rain-tight hoods and caps shall be provided for all pipelines passing through roofs. Flashing or noncombustible seals shall also be provided for all pipelines passing through exterior walls.

8.2.5. Gate Valves. A manual shut-off OS and Y gate valve shall be provided for each fire hydrant, wet pipe sprinkler system, dry standpipe and foam monitor systems. All valves (whether or not supplied by the Contractor) not within reach from all floor and platform levels shall be provided with chain operators. All hydrant control valves shall be provided with "T" handle operators mounted on 4" diameter post imbedded in concrete as shown on Drawing No. 40P7005133247. Gate valves shall be in accordance with Engineering Standards No. SE00.CBB, No. SE00.CBC, and No. SE00.CQA (E1-Piping Specification). 4

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8.2.6. Post Indicator Operators. All yard piping sectional control and low point drain valves shall be provided with post indicator (P.I.) operators. Such operators shall be in accordance with Engineering Standard No. SE00.CQA (E1-Piping Specification). 4

8.2.7. Fire Hydrants. All fire hydrants shall be in accordance with Engineering Standard No. SE00.CQA (E1-Piping Specification). 4

8.2.8. Fire Department Pumper/Service Connections. 4

8.2.8.1. One fire department pumper connection to be located at the valve pit in the Laydown/Construction Area shall be Model No. 156 as manufactured by Elkhart, or SFDI-approved equivalent. Thread size shall be 4 inch by 2-1/2 inch by 2-1/2 inch. A 4 inch U.L. listed underswing check valve and 3/4-inch automatic ball drip shall also be provided. 4

8.2.8.2. Two fire department pumper suction connections; one to be located at the 4" drain connection on the Raw Water Storage Tank in the Core Area and one to be located on the suction line at the Cooling Tower Basin both as shown on Drawing No. 40P7005133247 shall be Model No. 347 (4" inlet and outlet - 12" length). The strainer shown in Detail A on the previous referenced drawing shall be Model No. 320-4. All model numbers referenced are Elkhart Brass, or SFDI-approved equivalent, Contractor shall also fabricate and install suction pipe shown in Detail A. Pipe shall be in accordance with Engineering Standard No. SE00.CBB. 4

8.2.9. Underground Fire Mains. All underground piping shall be installed as shown on Drawings 40P7005133148 and 40P7005133247. Installation shall be in accordance with the latest issue of National Fire Protection Association (NFPA) Standard No. 24 "Outside Protection." 4

8.2.10. Fire Hydrant Hose Houses. Hose houses shall be provided at the hydrants shown on Drawing No. 40P7005133247. Houses shall be mounted on concrete pads furnished by others. All houses shall be Model 676 as manufactured by Elkhart Brass Co., or SFDI-approved equivalent. Each house shall be provided with the following equipment: 4

8.2.10.1. Hose. All hose shall be single jacket (polyester wrap) rubber lined rated for 300 psi pressure. Couplings shall be cast brass rocker, rocker lug type with National Standard thread. Hose shall be MH-300 as manufactured by Goodyear, or SFDI-approved equivalent, in lengths as follows: 4

(1) 100 feet of 2-1/2 inch fire hose
(2) 200 feet of 1-1/2 inch fire hose.

8.2.10.2. Nozzles. 4

8.2.10.2.1. Hose houses at fire hydrant Nos. 11 and 13 shall have the following nozzles: 4

(1) One (1) 2-1/2 inch non-shock spray nozzle
(2) Two (2) 1-1/2 inch non-shock spray nozzles

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Nozzles shall be Model Nos:

2-1/2 inch - No. 205 EB-2-1/2" with standard discharge (170 gpm) and No. B-279-2-1/2 inch playpipe
1-1/2 inch - No. HN-4-LE-1-1/2" Lexan

All nozzle model numbers referenced are Elkhart Brass, or SFDI-approved equivalent.

8.2.10.2.2. Hose houses at fire hydrant Nos. 2 and 5 shall have the following nozzles: 4

(1) One (1) 2-1/2 inch - Combination spray nozzle
(2) Two (2) 1-1/2 inch - Combination spray nozzles

Nozzles shall be Model Nos:

2-1/2 inch - No. 205B-2-1/2" with standard discharge and No. B-279-2-1/2 inch playpipe
1-1/2 inch - No. HN-4-LB-1-1/2" Lexan

All nozzle model numbers referenced are Elkhart Brass, or SFDI-approved equivalent.

8.2.10.3. Miscellaneous Equipment as follows: 4

(1) One (1) Fire Axe - Model No. 627
(2) One (1) pair brackets for axe - Model No. 665-3
(3) One (1) hydrant wrench - Model No. S-454
(4) Four (4) Combination Spanners - Model No. S-465
(5) Two (2) 2-1/2 inch gaskets - Model No. 457
(6) Four (4) 1-1/2 inch gaskets - Model No. 457
(7) One (1) 2-1/2 inch by 1-1/2 inch by 1-1/2 inch Gated Wye - Model No. B-100
(8) Four (4) Brackets for Spanners - Model No. 665-4
(9) One (1) crowbar - Model No. 630
(10) One (1) pair crowbar brackets - Model No. 665-2

All model numbers referenced are Elkhart Brass, or SFDI-approved equivalent.

8.2.11. Foam Hose Cabinet. One foam hose cabinet shall be located adjacent to the foam monitor nozzle east of the TSS Storage Tank. Cabinet shall be provided with legs and mounted on concrete pad furnished by others. Cabinet shall be Model No. 1010 (steel) as manufactured by Elkhart Brass, or SFDI-approved equivalent. The cabinet shall be provided with the following: 4

8.2.11.1. Hose. Three hundred (300) feet of 1-1/2 inch fire hose as described in Paragraph 8.2.8.1. 4

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8.2.11.2. Foam Nozzles. Two (2) portable RP-6 foam nozzles as manufactured by National Foam, or SFDI-approved equivalent. 4

8.2.11.3. Miscellaneous Equipment as follows: 4

(1) Two (2) Combination Spanners - Model No. S-465.

(2) Six (6) 1-1/2 inch gaskets - Model No. 457.

All model numbers referenced are Elkhart Brass, or SFDI-approved equivalent.

8.2.12. Monitor Nozzles. Two (2) permanent/portable hydrant mounted monitors equipped with 2-1/2 inch, 350 gpm combination straight stream/spray nozzles. These monitors shall be mounted on fire hydrant Nos. 9 and 10. 4

Monitor shall be Model No. 292-6H with nozzle Model No. CJ. Both as manufactured by Elkhart Brass, or SFDI-approved equivalent.

8.2.13. Identification Tags and Labels. 4

(1) All control, shut-off, drain, test and alarm valves or devices; alarms; pushbutton stations and manual pull stations; and all other accessories supplied under this Contract shall have an identification tag with all pertinent operating information clearly inscribed thereon.

(2) Each identification tag shall be durable for the specified environmental conditions (metal, i.e., nonferrous or stainless steel, or phenolic plastic) and permanently attached (banding straps or screws) in a conspicuous place on or adjacent to each piece of equipment. Self-tapping screws are not acceptable.

8.2.14. All electrical equipment, fire hose stations, wall fire hydrants, semi-automatic foam monitor system, automatic total flooding Halon 1301 systems, detection systems, and portable fire extinguishers shall be provided and installed in accordance with APPENDIX 5, DETAILED SPECIFICATION FOR FIRE PROTECTION SYSTEMS. 4

8.3. Tests and Approval After Installation.

8.3.1. After all piping and above ground systems are installed, they shall be thoroughly tested by the Contractor and witnessed by the Construction Manager and the Barstow Fire Department. A minimum of two (2) weeks advance notice of the pending tests shall be given to the Construction Manager to permit his scheduling of required personnel and to prevent any disruptions to any other on-site activities. Any portion of the work which fails to function to the satisfaction of the Construction Manager, and any defects which are disclosed, shall be remedied by and at the expense of the Contractor. A complete record of all tests and their results shall be furnished to the Construction Manager by those making the tests. Form No. 85 described below

and attached as a supplement shall be filled out for record purposes. Decision by the Construction Manager not to witness field acceptance tests or inspections shall in no way relieve the Contractor from full responsibility for the quality and correctness of the work.

8.3.1.1. Acceptance tests, certification and approval for the work conducted in accordance with Scope of Work under Paragraph 8.1.1.1. shall be conducted in accordance with the latest issue of NFPA Standard No. 24.

8.3.1.2. Testing and approval for the work conducted in accordance with Scope of Work under Paragraph 8.1.1.2. shall be conducted in accordance with those NFPA Standards referenced in Appendix 5, Detailed Specification for Fire Protection Systems.

8.3.1.3. Form No. 85 - Contractor's Material and Test Certificate.

8.3.1.3.1. All piping shall be flushed and hydrostatically tested as specified in the attached Form No. 85, PART "A" GENERAL, TEST DESCRIPTION section. In addition, all other requirements specified in this Form No. 85 shall be complied with, and three (3) copies of the completed form, including the required witnessing signatures, shall be supplied to the Construction Manager.

8.3.1.3.2. The Contractor shall complete all applicable parts of the form. A separate PART "C" shall be provided for each riser and/or header that Contractor installs. If the entire riser/header system is tested at one time, then only one (1) form is required. Contractor shall complete a separate PART "C" for each system installed.

8.3.1.3.3. Form No. 85 and all other System acceptance forms are referenced and furnished under Appendix 5, Detailed Specification for Fire Protection Systems.

8.4. Finishing and Painting.

8.4.1. General.

8.4.1.1. All equipment surfaces shall be cleaned and all surfaces requiring painting shall be painted by the equipment manufacturer before shipment.

8.4.1.2. Exposed ferrous surfaces of piping and hangers shall be prime painted only. Any abraded or bare surfaces including work of others damaged by the Contractor shall have primer repaired by the Contractor at no additional cost.

8.4.1.3. Finish painting of piping and hangers will be by others.

8.4.2. Cleaning and Closures. All internal and external surfaces of the equipment shall be thoroughly cleaned of all mill scale, loose metal particles, weld spatter, slag, dirt and other foreign matter and shall receive

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a surface preparation compatible with that specified by the paint manufacturer as required for proper paint application. All burrs shall be removed and all sharp edges shall be eased. Following cleaning, all openings shall be sealed against entry of paint, water, dirt and debris during painting, shipment and field handling.

8.4.3. Painting. All exposed ferrous surfaces of the equipment shall, except as follows, be given one (1) shop coat each of equipment manufacturers standard rust-inhibitive primer and standard finish paint that are compatible with the maximum operating conditions that will be encountered.

8.4.3.1. Name and data plates and machined mating surfaces shall not be painted, but shall be coated with a slushing compound.

8.4.3.2. All instruments and control panels shall receive manufacturer's standard factory finish only.

8.4.3.3. All piping, pipe fittings, hangers and auxiliary steel will require priming unless galvanized or insulated.

8.4.4. Damaged Galvanized Touch Up.

8.4.4.1. Any galvanized surfaces that are damaged due to abrading, welding, cutting, etc., must have a touch up with a suitable paint. See Article 16.0, Prime and Touchup Painting.

8.4.4.2. All damaged areas must first be properly cleaned using the techniques described in SSPC-SP2, "Hand Tool Cleaning" and SSPC-SP3, "Power Tool Cleaning."

8.4.4.3. After proper cleaning, all areas requiring touch up will be coated with a paint meeting the minimum requirements of U.S. Government Specification MIL-P-21035, "Paint, High Zinc Content, Galvanizing Repair."

8.4.4.4. Application shall be in strict accordance with manufacturer's recommendations.

8.5. Preparation for Shipment. For shipment, each unit shall be disassembled only to such extent as may be necessary to facilitate field handling and prevent damage during shipment. Each assembly or component shall be skidded, crated, boxed or otherwise protected against damage or loss during shipment, and to facilitate field handling. All openings shall be closed with temporary closures to prevent entry of dust, dirt or other foreign matter.

8.6. Special Tools and Devices. One (1) complete set of all special tools or special devices, including any metric wrenches or other hand tools that are not standard in the United States, required for operation and/or maintenance of all equipment furnished under this Contract shall be provided and delivered with the equipment.

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8.7. Equipment Data. Contractor shall fill in all components and system equipment data furnished under Scope of Work in Paragraphs 8.1.1.1. and 8.1.1.2. in the Equipment Data Sheets contained in Appendix C of Appendix 5, Detailed Specification for Fire Protection Systems.

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9.0. RECEIVER TOWER ELECTRONICS ROOM

This Article covers fabricating, furnishing, delivering/unloading, storing and erecting all necessary components to provide, complete, the two Receiver Tower Electronic Rooms as shown on the Contract Drawings. The requirements in this Article are in addition to those requirements specified in Article 5.0, GENERAL REQUIREMENTS.

9.1. General. The various components shall consist of, but not be limited to, miscellaneous structural steel, removable insulated metal wall panel system, doors and door frames, builders hardware, caulking and sealants, insulation, ceiling panels and fluid applied pedestrian deck coating all as shown on the Contract Drawings and as specified herein.

9.2. Miscellaneous Structural Steel.

9.2.1. Miscellaneous structural steel associated with the Electronics Room shall conform to the requirements specified in Paragraph 17.1, Miscellaneous Structural Steel.

9.3. Removable Insulated Metal Wall Panel System.

9.3.1. Contractor shall furnish and install insulated metal wall panel system as follows:

9.3.1.1. Panels shall consist of an outer face of porcelain enameled steel, galvanized steel or prime painted aluminum (depending on manufacturer's recommendations regarding balance of panel), a face stabilizer of 1/8-inch thick oil tempered hardboard, manufacturer's standard insulating core designed to provide a thermal insulating value of 0.13 or better, a second stabilizer of 1/8-inch thick oil-tempered hardboard and an inner face of porcelain enameled steel. Color of inner face shall be manufacturer's standard "off-white."

9.3.1.2. Wall panels and grid-type framing shall be capable of safely withstanding design wind loads, either inwardly or outwardly, and shall be properly anchored to resist such suction and pressure loads without overstressing or other damage to the system and without deflection greater than 1/120 of the span.

9.3.1.3. The wall panels shall provide a weathertight seal and allow for maximum expansion when erected.

9.3.1.4. Panel manufacturer shall submit, with shop drawings, verification by design calculations that the proposed wall system meets the requirements of these Specifications. Any deviation from reference drawing details shall be shown on manufacturers shop drawings. Shop drawings shall indicate the methods of fabrication, connections, location, attachments, finishes, materials and installation details.

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9.3.2. Contractor shall furnish and install either steel or aluminum removable grid-type framing as shown on the Drawings. Samples of both panels and framing shall be submitted for SFDI's review. The Engineer shall be the sole judge as to the system accepted.

9.3.2.1. Steel grid-type framing shall be chemically or mechanically cleaned to remove mill scale, dirt, oil, and other foreign matter, followed by a zinc phosphate treatment. Then a coat of light gray epoxy primer shall be oven baked at 375 F for 12 to 15 minutes, resulting in a dry film thickness of not less than 1 mil, followed by a coat of polyester baked at 400 F for 12 to 15 minutes, resulting in a dry film thickness of not less than 1 mil. Color of finish coat shall be aluminum.

9.3.2.2. Aluminum finishes and aluminum grid-type framing shall comply with the Aluminum Association standards. Aluminum framing members shall be constructed of extruded sections of 6063-T5 aluminum alloy of the thickness required. Finished metal work shall be free of twists, bends, and open joints. Surfaces shall be smooth, clean and free of blemishes and surface defects. Aluminum grid-type framing members shall be clear anodized finish.

9.3.2.2.1. Fastening for aluminum to steel shall be stainless steel. Screw type fasteners for aluminum shall be aluminum alloy 2024-T4.

9.3.2.2.2. Jointing of aluminum shall be by a method compatible with the aluminum finish.

9.3.2.2.3. Aluminum shall be insulated for contact with dissimilar materials in strict accordance with manufacturer's written instructions.

9.3.3. All panels shall be designed for installation and removal from the interior of the spaces to be protected.

9.3.4. Contractor shall furnish and install closed cell vinyl foam or urethane foam tape, 1/8-inch thick-capable of being compressed to 1/16-inch thickness without losing resiliency, with an adhesive type pressure sensitive backing; around the grid-type framing as shown on the Drawings.

9.4 Doors and Frames.

9.4.1. Doors and frames may be, at Contractor's option, formed from either steel or aluminum. In either case doors shall be stiffened, insulated and sound deadened by means of a three pound density per cubic foot, foamed in place, polyurethane core completely filling the inside of the door and laminated to the inside of both face panels. Door sizes, swings and hands shall be as indicated on the Drawings. Finish for aluminum doors and frames shall be Aluminum Association AA-M32C12A31.

9.4.2. Steel doors and frames shall conform to the current issue of U.S. Department of Commerce Standard PS-4 and the Steel Door Institute Specification SDI-100, Type III, Style 2.

9.4.3. Steel doors and frames shall be zinc-coated (galvanized) by the electrodeposit method to meet the requirements of ASTM-A164, coating class G.S., phosphatized and coated with Manufacturer's standard baked-on primer.

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9.5. Doors.

9.5.1 Steel doors shall be 1 3/4-inches thick, seamless, full flush type not less than 18 gage.

9.5.2. The top and bottom reinforcing channels shall be formed from 14 gage steel, spot welded to the stiles to form horizontal rigidity. The top and bottom of each door shall be closed and made weathertight with a 20 gage steel cap. Caps shall be sealed so as to permanently retard moisture collection inside the doors.

9.5.3. Door lock stiles only shall be beveled 1/8-inch in 2-inches to provide easy unobstructed operation against the door frame stops. All doors shall be provided with minimum 3/16-inch thick steel hinge reinforcement. Lock box shall be not less than 16 gage steel and shall be welded into the lock stile. Reinforcing for mortised hardware shall be factory drilled and tapped to receive the Builders Hardware specified. Top rails of doors shall be reinforced for door closers.

9.5.4. Aluminum doors shall be 1-3/4 inch thick, seamless, full flush type. Tubular stiles and rails shall be extruded from 6063-T5 alloy. Face sheets shall be 5005 alloy sheet aluminum 0.062 thick with 1/8-inch hardboard backing behind each face sheet. Doors shall be sealed top and bottom to permanently retard moisture collection inside doors. Lock stiles shall be beveled 1/8-inch in 2-inches to provide easy unobstructed operation against the door frame stops. Doors shall be reinforced per manufacturer's standard for mortise hardware as shown in Paragraph - Builders Hardware.

9.6. Door Frames.

9.6.1. Door frames may be, at Contractors option, formed from either steel or aluminum. Frame components shall consist of two (2) continuous jamb pieces, full height of the adjacent panels with knock down header bars designed to fit between the jambs, as shown on the Drawings, so the entire assembly may be easily removed and replaced as required.

9.6.2. Steel door frames shall be of sizes, styles and types as shown on the drawings, not less than 16 gage steel. Frames shall have factory primed finish suitable for field painting. The lock stile stop of each door frame shall be drilled for silencers to be furnished under Paragraph - Builders Hardware.

9.6.3. Frames shall be furnished with floor clips for anchoring frames to floor and with manufacturer's standard fastening devices for fastening frames to wall panels.

9.6.4. Cut-outs for hinges, strikes, silencers, etc., shall be provided with mortar guards.

9.6.5. Aluminum frames shall be formed from 0.125 6063-T5 extrusions and shall conform to the requirements for steel frames, as specified above, in all other respects.

9.7. Transom Panels. Transom panels shall be of same material as the doors, insulated in the same manner and shall be designed to be removable and replaceable, as required.

9.8. Hardware Preparation.

9.8.1. All necessary cut-outs, reinforcements, drilling and tapping for hardware shall be performed at the factory in accordance with the hardware manufacturer's templates and instructions. The Contractor shall obtain the proper templates and instructions from the hardware supplier in accordance with the hardware to be used for each opening, and shall be responsible for the correct preparation of the doors and frames.

9.9. Builders Hardware.

9.9.1. It is the intent of this Specification, and the following schedule, to provide correct and sufficient hardware to fully equip each door. The Contractor shall verify the correctness of all items listed. If any item is found to be unsuitable for he opening for which it is intended, such item shall be changed, subject to the approval of the Construction Manager. Door closers shall be of the full rack and pinion type and shall have a prime coat finish for field painting to match adjacent door trim. Closers mounted on metal doors and/or jambs shall be furnished templated with proper machine screws. It shall be the responsibility of the hardware supplier to furnish all necessary hardware templates without delay in order that the door and frame manufacturer may properly prepare his product for the builders hardware to be applied thereon. The Contractor shall ensure that the door and frame and hardware manufacturers comply with the requirements herein.

9.9.2. The Contractor shall furnish all builders hardware, complete with screws and other fastening required for proper installation, in accordance with the Drawings and these Specifications. Where items of builders hardware specified below are specified by brand name and type, such designation is intended to facilitate description and establish the level of quality desired. Such designation is not intended to restrict selection of products of other manufacturers. The respective equivalent products of other manufacturers will, if proposed, receive full consideration. In such matters of equivalency, the approval of the Construction Manager will be required.

9.9.3. Keying. Doors shall be keyed alike and master keyed to the Project Master keying system. Master keying will be coordinated with the Construction Manager.

9.9.4. Hardware Schedule.

HW1 Each door to have:

1-1/2 pr Butts Lawrence BB4101-A 4-1/2 x 4-1/2 - US26D

1 Closer LCN 4114-H-CUSH - P.C.

1 Lockset Brand Name TBD, Entrance Function - US26D Keying Data TBD

1 Threshold Pemko 171A

1 Sweep Pemko 315AN

Weatherstripping Pemko 315 AR

9.9.5. Installation. The Contractor shall furnish and install the builders hardware set in the respective openings indicated. Each item of hardware shall be examined before installation and determined to be complete and free from damage and blemishes. Incomplete, damaged or blemished items shall not be installed and shall be replaced with satisfactory items. Only workmen who are skilled in the installation of builders hardware shall be permitted to perform installation of builders hardware. Upon completion of installation of builders hardware, hardware requiring lubrication shall be lubricated with graphite, and all moving parts checked and adjusted to free and smooth operation. After the building is complete, final adjustment of builders hardware shall be performed by the Contractor to compensate for air movement and other conditions such that all items operate properly under actual conditions of service. Following final adjustment, all special tools required to adjust and maintain the hardware shall be tagged with proper identification and delivered to the Construction Manager.

9.10. Calking and Sealants.

9.10.1. General.

9.10.1.1. Materials furnished for the work hereunder shall be delivered to the Project Site in sealed original containers labeled with the brand name and name of manufacturer. Materials specified herein by trade name and manufacturer are products of approved or recommended quality. Similar materials of equivalent quality and characteristics produced by other manufacturers may be used with the prior written approval of the Construction Manager.

9.10.1.2. All sealants and joint primers shall be compatible with the joint surfaces and backing or filler materials as stated in the manufacturer's published data, or as certified to by the manufacturer for the application shown.

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9.10.2. Materials.

9.10.2.1. Primers shall be as recommended by the manufacturer of the sealant for the specific joint surface and condition in each case.

9.10.2.2. Calking for sealing joints between 3/8-inch floor plates at the 15th level shall be a two component low modulus polyurethane compound, corresponding to Dyntrol II, as manufactured by Pecora Chemical Co., or Engineer approved equal.

9.10.2.3. Sealants for use around the perimeter of door frames shall be clear silicone sealant, corresponding to General Electric Silicone Sealants 1200 and 1300 or SFDI approved equal.

9.10.3. Application.

9.10.3.1. The polyurethane calking compound shall be applied into the joints between floor plates only in the area to be roofed over with fluid applied roofing system. Calking shall be applied so as to fill the joints completely and shall then be tooled to leave a concave surface. In areas where the calking is around materials protruding above the metal plate deck, the calking shall be tooled to a 45° angle.

9.10.3.2. Application of sealant shall be in strict accordance with manufacturers' written instructions. Sealants shall not be applied at temperatures below 40 F.

9.10.3.3. Sealant shall be applied continuously to joints where indicated on the Drawings, where required in order to provide complete weather protection, and where required for finished appearance.

9.10.3.4. Joints which are to be filled with sealants shall be cleaned of loose particles, dirt, dust, oil, grease and other foreign matter. The joint shall be completely dry prior to application of primer or sealant.

9.10.3.5. Where priming is recommended by the manufacturer of the sealant, those surfaces which will be in contact with the sealant shall be thoroughly coated with the primer recommended by that manufacturer.

9.10.4. Cleaning and Protection.

9.10.4.1. Upon completion of the work, all excess sealant shall be removed and adjacent surfaces cleaned of all smears or other soiling resulting from the work. Finished joints shall be protected against damage until their final set.

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9.11. Floor Insulation.

9.11.1. Insulation for application under the steel floor plate at levels 13 and 14 shall meet the requirements of Federal Specification HHI-558B, Form A, Class 2, 6 pound density not less than 2-inches thick. Installed insulation shall have a U value of 0.13 or better.

9.11.2. Insulation shall be applied to the underside of the steel plate as shown on the Drawings. Contractor shall furnish and weld into place pins, on which the insulation shall be impaled and then fastened into place by means of washers, in sufficient quantity and in a pattern that will insure the permanence of the installation under the wind conditions existing at these levels. Pins shall correspond to A-H Jones Insul-Pins or Engineer approved equal.

9.11.3. Floor insulation exposed to the weather, shall be lagged with flat aluminum, alloy 3003, 0.020 inch thick and smooth finish. All seams in the lagging shall be watertight.

9.12. Ceiling Panels.

9.12.1. Ceiling panels shall be manufacturer's standard nominally flat profile liner panels, not less than 18 gage. Panels shall have manufacturer's Standard factory installed insulation which shall be securely fastened to the interior of the liner panel. Panel shall be of sufficient depth that the insulated panel shall have a U value of 0.13 or better.

9.12.2. Panels shall be formed from steel sheets conforming to ASTM A611, Grade C (Fy=33,000 psi) minimum. Before being formed, the steel shall have been zinc-coated (galvanized) by the hot dip process in accordance with ASTM A525, coating designation G90.

9.12.3. Panels shall be of the proper width to span without deflection greater than 1/120 of the span.

9.12.4. Panels shall be of interlocking design and shall be furnished with concealed factory applied calking designed to provide a weathertight seal and allow for maximum expansion when in place.

9.12.5. Panel fasteners shall be of corrosion resistant steel or shall be galvanized as standard with the manufacturer of the panels furnished.

9.12.6. Liner panels shall receive a factory applied baked on coating as follows:

9.12.6.1. Surfaces shall be thoroughly cleaned and prepared to receive a 2-coat thermal-setting polyester finish.

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9.12.6.2. Final coating shall meet the following requirements:

Dry film thickness: 0.9 to 1.2 mils nominal

Dry film hardness: HB to H pencil hardness.

Color: Color shall be manufacturers standard off-white.

Gloss: 30 or above in accordance with ASTM D523.

9.13. Fluid Applied Pedestrian Deck Coating.

9.13.1. General.

9.13.1.1. The coating to be applied to the surfaces of the 15th level which is shown as having an elastomeric deck coating shall be a one-component moisture curing polyurethane elastomer applied in strict accordance with manufacturer's instructions.

9.13.1.2. The deck coating specified is based on 3M Co's pedestrian deck coating. Equal deck coatings as manufactured by Tremco, Cleveland, Ohio 44104; Dexotex Floors by Crossfield Products Corp., Roselle Park, New Jersey; or other SFDI approved deck coating will be acceptable.

9.13.1.3. Contractor shall be or shall employ the services of a firm having not less than five (5) years experience in the application of "Regular traffic" elastomeric pedestrian type deck coatings and who is acceptable to the selected decking manufacturer as an approved applicator.

9.13.2. Materials.

9.13.2.1. Woven, uncoated fiberglass mesh for use as flashing reinforcement and over calked joints between metal deck segments.

9.13.2.2. Base coat 3M No. 5872, gray

9.13.2.3. Top coat 3M gray standard top coat No. 5793

9.13.2.4. Silicone Carbide grit, 24 mesh

9.13.2.5. Grit preprimer No. 5859 grit primer

9.13.2.6. Steel deck primer No. 5896B/A

9.13.3. Surface Preparation.

9.13.3.1. Steel surfaces to be coated with pedestrian deck coating shall be thoroughly solvent cleaned in accordance with the requirements of SSPC-SP1.

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9.13.4. Prime Coating of Steel.

9.13.4.1. Galvanized steel surfaces shall be prime coated with 5896B/A primer at the rate of one gallon per 400 square feet and back rolled with a minimum 3/4-inch nap roller.

9.13.5. Application of Fluid Applied Pedestrian Deck Coating.

9.13.5.1. After prime coating has cured for at least 8 hours, the uncoated fiberglass mesh coating shall be laid, not less than 6-inches in width, at all joints between metal deck segments, at overlapping edge of aluminum, target enclosure plate over metal deck, and at the junction of horizontal and vertical surfaces and immediately embedded in a base coating of No. 5872 at 25 mils dry film thickness and back rolled with a 3/4-inch nap roller.

9.13.5.2. A coat of 5872 shall then be applied over the entire area at a minimum of 25 mils dry film thickness and back rolled as per above.

9.13.5.3. Finally, one coat of gray standard No. 5743 top coat shall be applied at 13 mils dry film thickness. While still fluid, silicone carbon grit, 24 mesh, which has been preprimed with 5859 grit primer, shall be embedded at approximately 5 pounds per square. The surface shall then be immediately back rolled with minimum 3/4-inch nap roller to evenly distribute and completely cover the aggregate.

9.13.5.4. The top coat shall be allowed to cure for a minimum of 24 hours before permitting traffic on surfaces.

9.13.6. In order to provide a straight line cut-off between areas to be coated and uncoated areas, at least a portion of the uncoated area shall be masked off.

9.13.7. Clean-Up.

9.13.7.1. Any stains on adjacent surfaces shall be cleaned with Toluene, Trichloroethylene, Xylene or commercial tar remover.

9.13.7.2. Foreign matter shall be removed from finished coated surfaces.

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10.0. MECHANICAL EQUIPMENT INSTALLATION AND ERECTION

This Article covers requirements applicable to receiving, unloading, storing, erecting/installing, inspecting and testing of mechanical equipment, both Government-furnished and Contractor-furnished, forming a part of the work of this Contract.

10.1. Definitions. Definitions applicable to various terms used in this Article 10.0 are defined in Article 5.0, Paragraph 5.9. "Definitions."

10.2. Government-Furnished Equipment. The following items of equipment will be Government-furnished to the Contractor for installation under this Contract. The following is intended merely as a listing for the Contractor's convenience. For additional data concerning these items of equipment, refer to APPENDIX 1, GOVERNMENT-FURNISHED EQUIPMENT.

10.2.1. Receiver System (RS)

Area	File Index	Nomenclature	Qty.	Tag No.
200 (RS)		Receiver Preheater Modules	6	RP-201,202 203,222 223,224
		Receiver Boiler Modules	18	RB-204,205, 206,207, 208,209, 210,211, 212,213, 214,215, 216,217, 218,219, 220,221
		Receiver Flash Tank	1	V-201
		Pipe Hangers PS-2, PS-3, PS-13, PS-14, PS-16, PS-17, PS-18, PS-19, PS-20, PS-21, PS-24, PS-25, PS-27, PS-30, PS-31, PS-32, PS-33, PS-34, PS-35, PS-36, PS-37, PS-38, PS-43, PS-49 and PS-50, PS-52, shown on drawings 40M2005131962 40M2005131963 40M2005131964 40M2005131970 40M2005131971	33	

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Area	File Index	Nomenclature	Qty.	Tag No.
		Shock Arrestors PS-10, PS-22 & PS-42 shown on Drawings 40M2005131963 40M2005131964 40M2005131970	18	
		Module Horizontal Lifting Fixture	1	
		Threaded Hanger Rod 12 Ft. Lengths		
		1/2-inch Dia.	5	
		5/8-inch Dia.	3	
		3/4-inch Dia.	1	
		1-inch Dia.	1	

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Area	File Index	Nomenclature	Qty.	Tag No.	
		Valves 2-1/2" and Larger see Drawing P26-2 (Appendix 1)			2
		Motor & Pneumatic Actuated Valves see Drawing P26-3 (Appendix 1)			2
		Permanent Strainers see Drawing P26-4 (Appendix 1)			2
		Relief Valves see Drawing P26-7 (Appendix 1)			2
		Valves 2" and Smaller see Drawing P26-12			
		Instrumentation see Appendix 3			
		Modulating Control Valves see Appendix 3			
		Pressure Switches see Appendix 3			
		Pressure Regulator List see Appendix 3			
		Flow Orifices see Appendix 3			
		Pressure Gage List see Appendix 3			
		Incoloy 800 Pipe & Fittings			
		1" Sch 80 Pipe	22 ft.		3
		1" Sch 80 LR 90° Elbow	14 pcs.		2,3
		2" x 1" Sch 80 C Reducer	7 pcs.		2,3
		2" x 1" Sch 80 Cross	7 pcs.		2,3
		2" Sch 80 Pipe	88 ft.		3
		DELETED			2
		DELETED			2
		DELETED			2
		DELETED			2
		DELETED			2
		DELETED			2
		2" Sch 80 LR 90° Elbow	36 pcs.		3,4

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LINE LIST SPOOLED PIPE - APPROXIMATELY 29 FIELD WELDS

6"-MS-201-QEX
6"-MS-205-QEX
6"-MS-208-QEX
6"-MS-217-QEX
6"-MS-220-QEX
6"-MS-211-QEX
6"-MS-214-QEX
6"-MS-2 -QEB
4"-MS-205-RNX
4"-MS-208-RNX
4"-MS-217-RNX
4"-MS-220-RNX
4"-MS-211-RNX
4"-MS-214-RNX

LINE LIST SPOOLED PIPE - APPROXIMATELY 82 FIELD WELDS

3"-CO-201-QEX
4"-CO-201-KEX
3"-CO-203-MBX
3"-CO-222-QEX
4"-FW-200-MBX
2 1/2"-FW-201-MBX
2 1/2"-FW-202-MBX
2 1/2"-FW-203-MBX
4"-FW-228-MBX
3"-FW-228-MBX
2 1/2"-FW-231-MBX
2 1/2"-FW-232-MBX
2 1/2"-FW-233-MBX
2 1/2"-FW-234-MBX
2 1/2"-FW-235-MBX
2 1/2"-FW-236-MBX
4"-ST-202-QEX
4"-ST-203-KEX
4"-VT-201-KEX
3"-VT-208-QEX
4"-VT-1-QEX

NOTE: Material Per ASME SB407 or SB408 UNS-NO8800 as applicable.

This information is to clarify that all piping and fittings over 2" listed on Page T1-65 will be spooled piping. Under 2 1/2" listed on Page T1-65 will be cut to fit by the contractor. A line schedule is provided to determine the placement of this piping.

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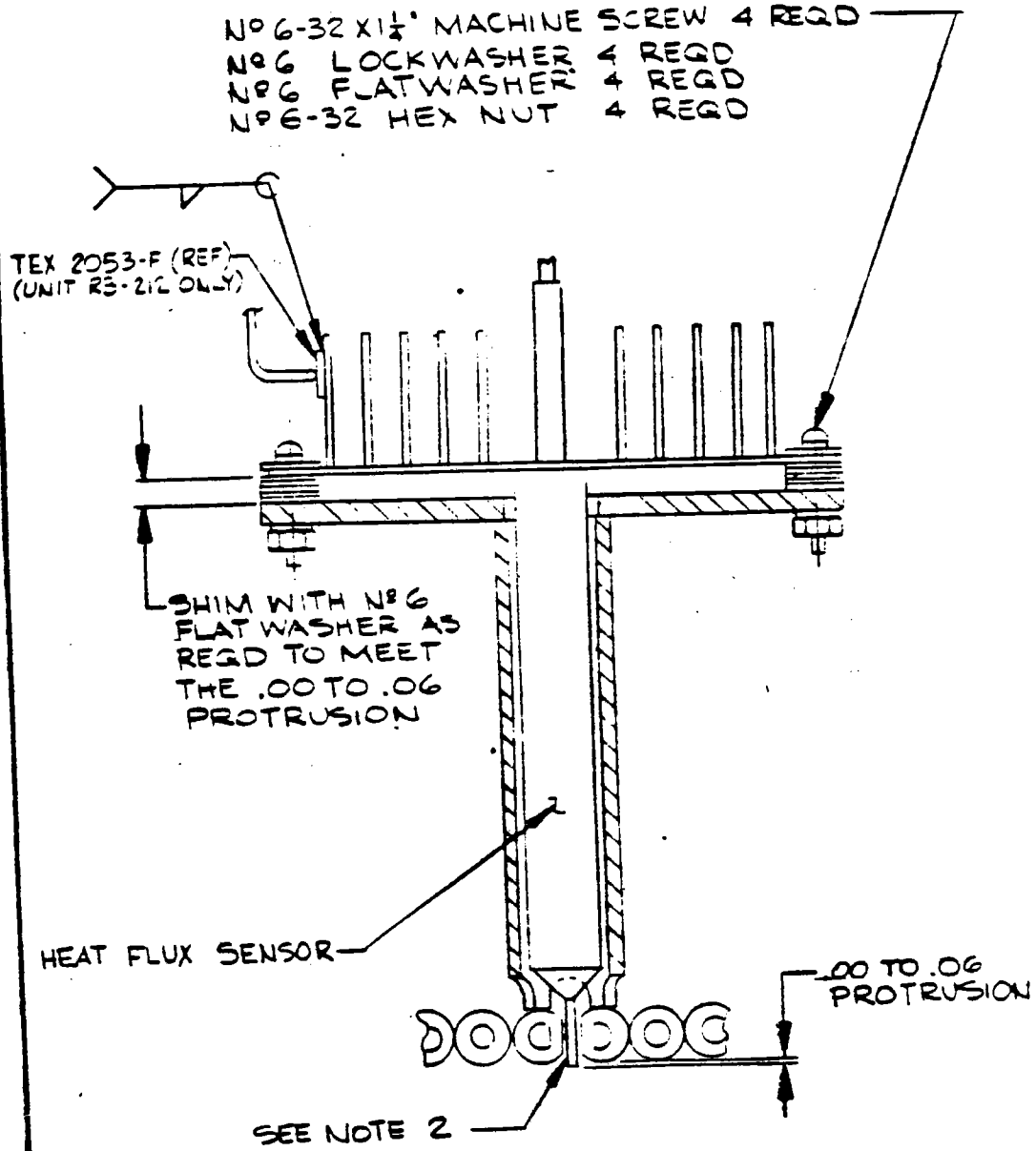
Heat Flux Sensors 4

Install 72 heat flux sensors, 3 per panel, in accordance with Figure 1 (Page TI-65c). Install heat flux sensor cable (2 c/s) through conduits described on reference drawings GA000-90908-E1 through E11. 5

Air Filters 2Z435 5

For installation details reference QTY 42 drawing no. 40M2005131955.

DWN	DATE	Rockwell International Corporation Rocketdyne Division Canoga Park, California
CHK	DATE	HEAT FLUX SENSOR INSTALLATION FIGURE 1
DSGN		
MATL		
STRUCT		



NOTES:

1. SEE DRAWINGS GA000-90908-E1 THRU E11 FOR HEAT FLUX SENSOR TAG IDENTIFICATION AND LOCATION.
2. IN ORDER TO PROTECT THE SENSOR'S PROBE PRIOR TO THEIR INSTALLATION REMOVE ANY PAINT OR OTHER DEBRIS BY HAND TURNING A TWIST DRILL OR EQUIVALENT THRU THE 0.125" HOLES IN THE PANEL.

TI-65c

FIGURE 1

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10.2.2. Thermal Storage System (TSS)

Area	File Index	Nomenclature	Qty.	Tag No.
300 (TSS)		Flash tank - Desuperheater Skid Assembly	1	SA-301
		Thermal Storage Heater Skid Assembly #1	1	SA-302
		Thermal Storage Heater Skid Assembly #2	1	SA-303
		Charging Pump Skid Assembly	1	SA-304
		Preheater Skid Assembly #1	1	SA-305
		Preheater Skid Assembly #2	1	SA-306
		Boiler and Superheater Skid Assembly #1	1	SA-307
		Boiler and Superheater Skid Assembly #2	1	SA-308
		Extraction Pump Skid Assembly	1	SA-309
		Ullage Maintenance Unit Skid Assembly	1	SA-311
		Valves 2-1/2" and Larger see Drawing P26-2		
		Motor Operated Valves see Drawing P26-3		
		Rocketdyne Valves 2" and Smaller see Drawing P26-12		
		Instrumentation see Appendix 3		

10.2.3. Plant Support Subsystems (PSS)

Area	File Index	Nomenclature	Qty.	Tag No.
700 (PSS)		Primary Electric Fire Pump	1	P-705

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Area	File Index	Nomenclature	Qty.	Tag No.
		Secondary Diesel Fire Pump	1	P-706
		Fire Maintenance Jockey Pump	1	P-707
		Alloy & Heavy Wall Piping	1-Lot	(Ref. Appendix 1)
		Pressure Seal Valves	9	(Ref. Dwg. P26-1)
		Control Valves	1-Lot	(Ref. Instrument Index)
		Beam Characterization System Target Panels	4	

10.2.4. Electrical Power Generation System (EPGS)

Area	File Index	Nomenclature	Qty.	Tag No.
900 (EPGS)		Receiver Feedwater Pump	1	P-917 (SCE Dwg. No. 40M900 5133310)

10.3. Contractor-Furnished Equipment. The following is a listing of the major items of equipment to be furnished and installed by the Contractor. This listing is intended for the Contractor's convenience, to specify design criteria and parameter and shall not be deemed as all-inclusive of Contractor furnished equipment. The Contractor shall furnish and install all material and equipment as shown on the drawings and/or as specified herein and APPENDIX 4, that is required to provide a complete and operable installation. The design drawings are based on specific items of equipment as indicated. If the Contractor elects to purchase equipment of another Manufacturer it will be his responsibility to adapt that equipment to existing piping and foundations so that there is no degradation in performance.

Area	File Index	Nomenclature	Qty.	Tag No.
700 (PSS)		Raw/Service Water Pumps	2	P-703,704
		Caloria Make Up Pump	1	P-306

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Area	File Index	Nomenclature	Qty.	Tag No.
		Thermal Storage Blowdown Tank	1	V-308
		Demineralized Water Transfer Pump	1	P-710
		Oil/Water Separator and Pumps	1	SE-701 P-711,712, 716, 714
		TSU Area Sump Pump	1	P-717
		TSS Flash Tank Drain Pump	1	P-307
		Maintenance Oil Sump Pump	1	P-718
		Raw/Service Water Pump Bldg Sump Pump	1	P-715
		Heat Flux Transducer	1	(Ref. Appendix 4)
		Cooling System		
		HVAC Equipment		
		Receiver Tower Electronic Room	2	(Ref. Dwg. M4-1)
		Thermal Storage Control Buildings	2	(Ref. Dwg. M4-1)
		Thermal Storage Electrical Equipment Building	1	(Ref. Dwg. M4-1)
		Piping	1-Lot	(Ref. Dwg. P1-2)
		Heat Transfer Fluid	260,000 gals.	(Ref. Appendix 4)
		DELETED		

10.4. Equipment Installation and Erection.

10.4.1. General.

10.4.1.1. All equipment, assemblies and components within the scope of work of this Contract (either Government Furnished or Contractor Furnished) shall be installed and erected in accordance with the requirements specified herein.

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10.4.1.2. Installation and erection shall conform to equipment manufacturer's drawings and instructions and the Contract drawings (Contract drawings shall be those included with these Specifications), which are approved for construction and furnished to the Contractor. In addition and where applicable, installation and erection shall conform to the technical directions of equipment manufacturer's field personnel. In the absence of such drawings, procedures or instructions, the installation and erection of equipment shall be as approved by, the Construction Manager.

10.4.1.3. The Contractor shall install all associated instrumentation, electrical control panels, equipment and devices that are contained within or mounted on the Government and Contractor-furnished mechanical equipment, tank, vessel or heat exchanger and are within the manufacturer's scope of supply.

10.4.1.4. The Contractor shall install and connect all power, control and instrumentation wire and cable that is furnished with the equipment supplied by the mechanical equipment, tank, vessel or heat exchanger manufacturer and is connected between the associated instrumentation, electrical control panels, equipment and devices that are contained within or mounted on the mechanical equipment, tank, vessel or heat exchanger.

10.4.1.5. The Contractor shall install and connect all wiring that is completely internal to a particular piece of electrical equipment or device that is associated with the mechanical equipment, tank, vessel or heat exchanger that has been installed by the Contractor.

10.4.2. Equipment Manufacturer's Field Personnel Assistance. The Contractor shall, without additional compensation, comply with all technical directives of the equipment manufacturer's field personnel when installing and erecting equipment which is furnished with this technical direction included.

10.4.3. Equipment Locations and Assembly Tolerances. All equipment shall be located, leveled and aligned to accurately maintain all lines and grades shown on the applicable drawings.

10.4.3.1. Where assembly tolerances are established either by qualified equipment manufacturer's field personnel or written instructions provided by the equipment manufacturer, such tolerances shall be strictly adhered to. If assembly tolerances are not provided by the equipment manufacturer, such tolerances shall be normal for the class of fit and the type of work involved.

10.4.3.2. Rotating shafts alignment shall be as nearly perfect as practicable. Unless otherwise recommended by the equipment manufacturer, offset between shaft centers measured shaft-to-shaft at couplings shall not exceed 0.001 inch with required allowance for expansion of the driving and driven units when operating. Faces of coupling halves, with couplings square on their shafts, shall be parallel within 0.001 inch. The Contractor's alignment procedures shall be submitted to the Construction Manager for his review and approval.

10.4.4. Equipment Doweling. After final alignment, all pumps, blowers, motors and other rotating equipment mounted in a fixed position on baseplates or bedplates shall be doweled to the base upon which mounted. Dowels shall, unless otherwise recommended by the equipment manufacturer and approved by the Construction Manager, be a standard taper jack nut type and shall be accurately fitted in taper reamed holes. Final alignment records will be submitted to the Construction Manager for each piece of rotating equipment installed by the Contractor.

10.4.5. Bracing and Shoring. Throughout installation and erection, the Contractor shall provide and install all blocking, bracing, shoring, guying and miscellaneous support necessary and as directed to protect equipment and construction from damage or displacement, and as required to ensure safety of personnel and to prevent damage to equipment. Repair of any damage or displacement shall be at the Contractor's expense.

10.4.6. Receiver Module Erection and Installation. Procedures for the erection and installation of the receiver module are to be found in Appendix 1, Vol. II.

10.5. Welding.

10.5.1. General. All welding required for installation and erection of equipment shall to the greatest extent practicable, be completed in the fabricator's or manufacturer's shop before shipment of the equipment to the jobsite. Where field welding is required by the Contractor, it shall conform to all requirements herein and to the requirements of the applicable Codes.

10.5.2. Qualification of Welders and Welding Procedures. Before commencing any shop or field production welding on work for installation and erection hereunder, all welders, welding operators and welding procedures to be used on the work shall have been qualified by test and shall have been certified as being so qualified. The qualification tests shall have been performed in accordance with the governing Codes and Standards. No welder shall be assigned work for which he has not been qualified and certified.

10.5.3. Field Welder Certification.

10.5.3.1. Before commencing any field welding, the Contractor shall submit to the Construction Manager, in accordance with Engineering Standard FJ60.60, photostats or other legible reproduced copies of the certified qualification test report(s) for each welder for each class of work to be done. Each certified test report shall show welder's name, methods and materials for which qualified, date of qualification, code(s) under which qualified and organization or individual certifying the qualification.

10.5.3.2. The Construction Manager's review and acceptance of welder qualification test reports shall in no way relieve the Contractor of full responsibility for satisfactory welding, proper correction of welding defects or of otherwise fulfilling all requirements of these Contract Documents.

10.5.4. Governing Codes and Standards.

10.5.4.1. All structural and general welding, except for pressure vessels, tanks and piping; shall be in accordance with the current issue of AWS D1.1 and applicable revisions, and as shown on approved-for-construction drawings.

10.5.4.2. All welding required on code vessels and pressure piping shall be in accordance with ASME Boiler and Pressure Vessel Code, Section IX, 1977 Edition with addenda through Winter 1979. All welding required on pressure piping shall be in accordance with ANSI B31.1, 1977 Edition with addenda through Winter 1979.

10.5.5. Welding Instructions, Procedures and Reports.

10.5.5.1. The Contractor will be furnished all available printed equipment suppliers' instructions and recommendations relating to the applicable procedures for welding and for any required preheating, stress relieving and radiographing of field welds connecting component parts and attachments to the Government-furnished equipment. The Contractor shall rigidly adhere to these procedures.

10.5.5.2. Written welding procedures shall be submitted to the Construction Manager for review, a complete and detailed description of the welding procedures, equipment and materials he proposes to use for each class of work, including any required preheating and stress relieving. Four (4) copies of these submittals shall be required with two (2) copies for the Construction Manager and two (2) copies for the applicable equipment manufacturer's representative. Subsequently, a copy of all stress relieving and temperature charts shall be delivered to the Construction Manager within seven (7) calendar days after the date on which the work is performed.

10.5.5.3. The Construction Manager's review of welding procedures, stress relieving records and similar data shall in no way relieve the Contractor of full responsibility for satisfactory welding, preheating, stress relieving, proper correction of any defects or of otherwise fulfilling all other requirements of these Contract Documents.

10.6. Testing. All equipment shall be tested as directed by the equipment manufacturer's representative unless otherwise waived by the Construction Manager. Water for testing will be provided at low pressure and ambient temperature, without cost to the Contractor. The Contractor shall heat and pressurize as necessary. Compressed air of the required quality for testing shall be provided by the Contractor. All equipment shall be tested as directed by the equipment manufacturer's representative unless otherwise waived by the Construction Manager.

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10.7. Equipment Cleaning.

10.7.1. General. All equipment surfaces shall be cleaned prior to assembling, installing and erecting. All internal surfaces shall be maintained clean and free of dirt, water, loose scale and all other foreign matter during assembling, installing and erecting and shall be thoroughly cleaned prior to initial operation or use. After assembling, installing and erecting, all exposed surfaces shall be thoroughly cleaned.

10.7.2. Methods and Procedures.

10.7.2.1. All equipment installed and erected under the direction of equipment manufacturer's representatives shall be cleaned as prescribed by the equipment manufacturer.

10.7.2.2. All equipment shall be cleaned before and during installation and erection in accordance with the manufacturer's recommendations, or in the absence of such recommendations, as approved by the Construction Manager.

10.7.2.3. All cleaning after installation and erection shall be in accordance with methods and procedures specified herein, as shown on the drawings, or in the absence of such information, as approved by the Construction Manager.

10.8. Guards.

10.8.1. Government-furnished equipment will include all normally associated guards for couplings and similar moving portions of the equipment. The Contractor shall install the guards furnished with the Government-furnished equipment, and shall furnish and install all guards required by the Contractor-furnished equipment.

10.8.2. If guards do not completely enclose moving parts, or do not completely meet statutory safety requirements, the Contractor shall extend, modify or furnish OSHA-approved guards as required. Modifying or furnishing additional guards for Government-furnished equipment, will be at the expense of the Contracting Officer.

10.8.3. All guards shall be so arranged that the moving parts cannot be touched by hand except by removal of the guard or guard sections or by opening doors or handholes in the guard enclosure.

10.8.4. Guards shall be installed with means for ready removal and/or be provided with hinged sections, doors, handholes and other openings that are required to facilitate the inspection and/or service of the components being guarded.

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10.9. Lubrication.

10.9.1. Lubrication of all moving parts (except sealed parts) shall be performed by the Contractor with lubricants recommended by the respective equipment manufacturers and supplied by the Contractor.

10.9.2. Rotating equipment which has been shipped dismantled for assembly in the field or is not shipped with lubricants, shall have the bearings flushed clean and lubricated with recommended lubricants when erection is complete. Written lubrication procedures shall be followed precisely to ensure proper equipment lubrication.

10.9.3. All sleeve bearing motor and driven equipment bearings shall be opened and inspected by the Contractor before equipment is lubricated or placed in operation. All lube oil reservoirs shall be cleaned and filled with the required type of oil following inspection of reservoirs.

10.9.4. All equipment with circulating lubrication systems shall be cleaned and flushed by the Contractor in accordance with the manufacturer's recommendations and witnessed by the Construction Manager.

10.10. Inspection and Repair. The Contractor shall be responsible for the condition of equipment within the scope of this Contract. The Contractor shall notify the Construction Manager immediately upon detection of any defect or damage, and shall repair same at the direction of the Construction Manager. All repair work shall be performed under the provisions of this Contract. Backcharges for major repair work may be made at the sole discretion of the Contracting Officer. Minor repairs and adjustments shall be considered to be within the scope of the erection/installation provisions of this Contract. The decision of the Contracting Officer regarding disposition of repairs, classification as major or minor, and backcharges, shall be considered final.

10.11. Installation of Motors. Rough setting of motors will be by the Contractor. The Contractor shall perform final alignment and coupling of motors if factory mounted. The Contractor shall furnish any hardware necessary for the final alignment process. Only calibrated tools will be used to record final alignment data.

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11.0. GROUTING

This Article covers grouting of equipment bases and sole plates requiring grouting under this Contract.

11.1. General.

11.1.1. Grouting of an item of equipment shall not be performed until the item is in final position. Final position shall be deemed to mean at required elevation, leveled, aligned within required tolerances, with anchor bolts tightened.

11.1.2. Only nonmetallic, non-shrink grout shall be used for grouting equipment.

11.2. Grout Materials.

11.2.1. The grout shall be a dry, premixed, nonmetallic nonshrink type requiring only the addition of water and proper mixing, and which develops a compressive strength of not less than 3000 psi at 7 days and not less than 5000 psi at 28 days. The grout shall be "5 Star Grout" as manufactured by U.S. Grout Corporation, Old Greenwich, Connecticut, or a Construction Manager approved equal.

11.2.2. Water for use in the grout shall be clean, potable water.

11.3. Preparation of Surfaces.

11.3.1. Concrete surfaces which will be in contact with the grout shall be chipped as necessary to remove all laitance, unsound concrete, and oil- or grease-stained concrete, and shall be roughened to provide for good bonding. Anchor bolt sleeves shall be carefully cleaned out. The resulting concrete surfaces shall then be scrubbed with wire brushes and clean water until the water in the surface irregularities remains clear.

11.3.2. Metal surfaces which will be in contact with grout shall be cleaned of oil, grease, dust and flake rust.

11.3.3. Prepared concrete surfaces which will be in contact with grout shall be saturated with water and kept constantly wet for no less than 24 hours prior to placement of grout.

11.3.4. The base plates and surfaces to be grouted shall be within the temperature range recommended by the manufacturer of the grout product.

11.4. Proportioning and Mixing.

11.4.1. Grout shall be of flowable consistency, prepared in strict accordance with the grout manufacturer's recommendations. Mixing shall be accomplished using a mechanical mixer. Hand mixing shall not be permitted. Grout shall be mixed as near as practicable to the location being grouted.

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11.4.2. Water shall be accurately measured or weighed, and shall be added slowly to assure efficient mixing and obtain the desired consistency. Mixing shall be continued for a minimum of 5 minutes after adding the water, or longer if necessary to obtain uniformity throughout the batch. Water in excess of the maximum amount recommended by the grout manufacturer shall not be added.

11.4.3. No more grout shall be mixed at one time than can be placed before start of initial set. Retempering of grout shall not be permitted. Grout that has stiffened prior to placement shall be discarded.

11.5. Forms. Forms will be required for flowable nonshrink grouting, and shall conform to the grout manufacturer's recommendations for meeting the following conditions. The method of forming shall permit rapid and complete filling of the spaces to be grouted, and shall keep the grout in full contact with the underside of the base plate until the grout has hardened.

11.6. Placing.

11.6.1. Grout shall be placed only when the temperature of the concrete, base plates and grout are within the temperature range recommended by the manufacturer of the grout product. Temperatures shall be maintained within this range for not less than 48 hours after grouting. The Contractor shall furnish and install temporary enclosures and heating or cooling as necessary to meet this temperature requirement.

11.6.2. The grout for each base plate shall be placed quickly and as continuously as practicable, avoiding entrapment of air beneath the base plate, entirely filling the spaces to be grouted. As placing progresses, the grout shall be maintained in full contact with the underside of the base plate until the grout has hardened.

11.7. Finishing, Curing and Protecting.

11.7.1. After the grout has taken initial set, the forms shall be removed, excess mortar removed and the shoulder of the grout cut back to form a uniform angle of approximately 45 degrees, such that the top of the slope is at the bottom edge of the base plate. The finished grout edge around each base plate shall be free from voids, compacted and relatively smooth.

11.7.2. After edge finishing, and before any dry spots appear, all exposed grout surfaces shall be covered with burlap and shall be kept wet for a period of not less than 7 days. During this curing period, the grouted equipment shall not be operated.

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12.0. EARTHWORK

This Article is applicable to excavating, dewatering, disposal, trenching, ditching, filling, backfilling, hauling, placing, scarifying, wetting or drying, compacting, shaping, grading and other earthwork operations necessary for performance of the work of this Contract.

12.1. General Requirements.

12.1.1. Lines and Grades.

12.1.1.1. All earthwork shall be performed to the lines, grades and sections shown and/or specified.

12.1.1.2. The Contractor shall maintain stakes and other established survey markers until authorized to remove them. Where such markers are destroyed by the Contractor or lost through his negligence prior to their authorized removal, the Construction Manager may require that they be replaced by and at the expense of the Contractor.

12.1.2. Drainage Control and Dewatering. The Contractor shall maintain drainage in the various work areas to prevent ponding, erosion, and excessively wet or unstable soil conditions. Operations shall include the following:

12.1.2.1. Water accumulating in excavations, from whatever source, shall be promptly removed by the Contractor. Dewatering operations shall be continued as necessary for maintaining suitable conditions in the excavations during backfilling operations. Disposal of drainage water shall be performed in a manner acceptable to the Construction Manager.

12.1.3. Weather Limitations. Earthwork compaction operations shall not be performed during periods when freezing temperatures, excessive moisture, or similar factors cause doubt that satisfactory results will be obtained. Should prevailing temperatures induce frost in backfill or subgrade, placement shall be suspended and shall not be resumed until conditions are favorable.

12.1.4. Compaction Control.

12.1.4.1. Moisture-density relations of soils will be determined in accordance with ASTM D1557 which will be referred to hereafter as control density. Field in-place density tests of compacted backfill and subgrade will be performed in accordance with ASTM D1556, D2167 or D2922. Where in-place densities fall below specified minimums, the Contractor will be required to rework those zones until the required densities are obtained.

12.1.4.2. During placing and/or compacting operations, the moisture content of material in the layer being compacted shall be near optimum (optimum +1, -3 percent) and shall be uniform throughout the layer. The Contractor shall perform all operations necessary to insure the proper moisture content, including sprinkling, scarifying, aeration, or drainage.

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12.1.4.3. Settling of bedding or backfill by puddling with water will not be permitted.

12.1.5. Testing. Testing to determine moisture-density relations, suitability of materials, and degree of compaction obtained will, except as follows, be performed at no cost to the Contractor, by a Testing Agency retained by the Construction Manager. The Contractor shall coordinate his work with the Construction Manager to permit proper inspection as the work progresses. In the event that tests show that rework is required, the Contractor shall perform the necessary rework at no additional compensation. Additional costs for testing necessary to verify that the work is in compliance with the specifications shall be borne by the Contractor.

12.1.6. Equipment. Should any equipment not be maintained in satisfactory working order or prove inadequate for obtaining the prescribed results, such equipment shall be repaired or replaced immediately upon notification to the Contractor that the work performed by the equipment is unacceptable and does not meet the requirements of the plans and specifications.

12.1.7. Stockpiling. When excess suitable materials result from the excavation work hereunder, or when excessive moisture in excavated material, construction procedure, or other factors make stockpiling of temporarily unusable materials advisable, the materials shall be placed in temporary stockpiles as approved by the Construction Manager. Different classes of materials shall be stockpiled separately. Stockpile areas shall be self-draining. Stockpile areas shall be prepared and maintained by the Contractor at no additional compensation.

12.1.8. Construction Water. Raw water in the quantities required for the Contractor's use in construction operations, will be available without charge at a single plant area source designated by the Construction Manager. The Contractor shall be responsible for providing the equipment for transporting and utilizing the water to meet his construction needs.

12.1.9. Sources of Earthwork Materials. Materials for use as fill or backfill material shall be obtained by the Contractor from the project site excavations for the work of this Contract, or from on-site stockpiles designated by the Construction Manager. Bedding material shall be Contractor-furnished from a Construction Manager approved source of material meeting the specified requirements for use as bedding material.

12.2. Materials.

12.2.1. Soils. To be considered suitable for use in the work, soils other than bedding material shall be free from perishable matter, trash, debris, frost or frozen material, and stones and hard cemented pieces larger than 3 inches, and shall be compactible with or without blending, to the

required densities. In addition, all material placed within 18 inches of finished grade shall swell less than 3 percent when tested in accordance with Uniform Building Code Test Method 29-2. In general, the material removed from excavations for work of this Contract will meet the above requirements.

12.2.2. Bedding Material. Material for bedding and initial cover over buried piping, and for bedding the Oil/Water Separator, shall be clean sand or sandy soil, all of which will pass a No. 4 sieve, and shall be free from perishable matter, trash, debris, frost and frozen material.

12.3. Excavation.

12.3.1. General.

12.3.1.1. Excavation shall consist of the removal and disposition of materials, to the lines, grades, and dimensions shown on the Drawings and specified herein. Except as specified, overexcavation shall be avoided. Undercutting will not be permitted.

12.3.1.2. Unauthorized overexcavation and the corrective measures necessitated thereby will not be considered as a basis for claims by the Contractor for additional payment.

12.3.1.3. Overexcavation for installation of bedding beneath piping and beneath the Oil/Water Separator shall be performed as specified below.

12.3.2. Excavating for Oil/Water Separator. Excavation for the Oil/Water Separator shall extend horizontally a sufficient distance to permit access and inspection of the Oil/Water Separator before backfilling, and to permit proper use of the Contractor's compacting equipment. Excavation shall be carried a minimum of 6 inches below the required elevation of the bottom of the Oil/Water Separator when installed. The bottom of the excavation shall be flat, in undisturbed earth. All loosened material shall be compacted or shall be removed. Banks shall be sloped or shall be shored as necessary for protection of the work and workmen in compliance with applicable codes and regulations.

12.3.3. Trenching for Piping. Trenches for buried piping shall be excavated such that the installed piping will be at the invert elevations indicated on the Drawings. Pipe trenches shall be overexcavated sufficiently to permit not less than 4 inches of compacted bedding beneath each installed pipe. Trench widths shall be kept to the minimum necessary for make-up of pipe joints, bedding of the pipe, and proper compaction with the Contractor's equipment. Tunneling or undercutting of banks will not be permitted.

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12.4. Bedding.

12.4.1. Oil/Water Separator. The overexcavated depth of the excavation for the Oil/Water Separator shall be brought up to the required elevation of the bottom of the Oil/Water Separator with compacted bedding material. Bedding material meeting the specified requirements shall be placed in a horizontal layer and compacted to not less than 95 percent maximum density. The completed compacted surface shall be horizontal and flat. Immediately prior to setting the Oil/Water Separator in the excavation, approximately 1/2 inch of loose sand shall be spread on the compacted surface and raked smooth.

12.4.2. Buried Piping. All buried piping shall be installed on bedding material and covered with bedding material in accordance with the following:

12.4.2.1. The overexcavated depth of the pipe trench shall be backfilled with materials meeting the requirements specified for bedding material. The bedding material shall be placed evenly along the trench bottom and compacted to not less than 95 percent maximum density. The compacted bedding material shall provide a smooth, flat, stone-free surface upon which the pipe will be laid. Immediately ahead of pipe laying in the trenches, depressions may be excavated in the bedding material as necessary for making the particular type of pipe joint.

12.4.2.2. Piping shall not be concealed until leak-tested, inspected and released by the Construction manager for concealment. Approved and released piping shall have the specified bedding material placed evenly along both sides of the pipe in layers not exceeding 6 inches in uncompacted thickness. The bedding material shall be worked under the haunches of the pipe, eliminating voids. Each layer shall be compacted before placement of the next layer. Placing and compacting shall be continued until the pipe has a cover of not less than 6 inches of compacted bedding material. Backfilling the remaining trench depth shall be accomplished as specified in Paragraph 12.5.2., "Buried Piping."

12.4.2.3. Care shall be taken throughout placing and compacting bedding material to prevent damage or displacement of installed piping or damage to its protective coatings. Any damage to the pipe or its protective coatings shall be satisfactorily repaired by and at the expense of the Contractor before proceeding with the work.

12.5. Backfilling.

12.5.1. Oil/Water Separator. After the Construction Manager's release for backfilling, the Oil/Water Separator shall be backfilled in accordance with the following:

12.5.1.1. Backfilling shall be with material removed from the excavation. Backfill shall be placed, compacted and brought up evenly around the Oil/Water Separator to prevent eccentric loading against the unit.

12.5.1.2. During backfilling and compacting, all stones larger than 1 inch in any dimension shall be removed from contact with the Oil/Water Separator.

12.5.1.3. Backfill shall be placed in lifts not exceeding 8 inches in uncompacted thickness, and each lift compacted to not less than 90 percent maximum density before placement of the succeeding lift. This procedure shall be followed until finish grade is reached. Reconstruction of basecourse shall be per Paragraph 12.8.

12.5.2. Buried Piping. That portion of each trench remaining above the compacted pipe bedding shall be backfilled to finish grade in accordance with the following, using material excavated from the trench.

12.5.2.1. Backfill shall be placed along the run of the trench in layers not exceeding 6 inches in uncompacted thickness, and each layer compacted to the required density before placing the succeeding layer. This procedure shall be followed until finish grade is reached.

12.5.2.2. The required compacted density is 90 percent of maximum density, except that within roadways, and for a distance of 3 feet either side of roadways, the backfill shall be compacted to not less than 95 percent maximum density. Reconstruction of base course shall be per Paragraph 12.8.

12.6. Grading. After completion of backfilling, and before the work will be given final acceptance, the Contractor shall finish grade all areas disturbed by work of this Contract. The graded surfaces shall be reasonably smooth, compacted, and free from irregular surface changes and areas where ponding of runoff could occur. The degree of finish required shall be that ordinarily obtainable from either blade grader or scraper operations. The finished and graded surfaces shall be not more than 0.1 foot above or below the established grades and sections.

12.7. Maintenance. The earthwork performed under this Contract shall be maintained in satisfactory condition, as determined by the Construction Manager, until completion of Contract. Any erosion, rutting or undue settlement occurring prior to completion of Contract shall be promptly corrected by the Contractor.

12.8. Reconstruction of Base Course. Base course disturbed by trenching and excavations under this Contract shall be reconstructed in accordance with the following:

12.8.1. Preparation of Surfaces to Receive Base Course. The subgrade of areas to receive aggregate base course shall be brought to finished subgrade elevations and tolerances and to near optimum moisture content.

12.8.1.1. The prepared subgrade shall be compacted to not less than 95 percent maximum density, shall be smooth, and shall not vary more than 0.1 foot above or below the required grade.

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12.8.1.2. Subgrade that does not conform to the above requirements shall be reconstructed to the specified density and tolerances.

12.8.1.3. Should elapsed time, or a period of precipitation or freezing temperatures occur between completion of an area of subgrade and construction of aggregate base course thereon, the subgrade will be reinspected and, if necessary, shall be reconditioned by the Contractor to conform to the foregoing requirements.

12.8.2. General. Aggregate surfacing constructed hereunder shall be compacted aggregate base courses conforming to the requirements of Section 26 of the "Standard Specifications of the State of California, Department of Transportation," Class 2 Aggregate Base, 3/4-inch maximum aggregate size, except that the compaction and tolerance requirements specified hereinafter shall govern.

12.8.2.1. The aggregate base materials shall meet the gradation quality and other requirements of Article 26-1.02B of the referenced Standard Specification.

12.8.2.2. All aggregate base materials required for the work hereunder shall be reclaimed from the excavated area or furnished by the Contractor from off-site sources. The aggregate base material furnished from off-site sources shall not be used in the work until certification by the supplier indicates its compliance with Article 26-1.02B of the Standard Specification.

12.8.2.3. In-place density of both compacted subgrade and compacted aggregate base course will be determined by the Testing Agency in accordance with ASTM D1556 (Sand-Cone Method) or ASTM D2922 (Nuclear Method).

12.8.3. Subgrade Requirements. Immediately prior to commencing base course construction thereon, the subgrade surfaces shall be inspected by the Construction Manager's Testing Agency to verify the density and tolerance requirements of Paragraph 12.8.1. At the time of commencing aggregate base course construction,the subgrade of the area to be surfaced shall be near optimum moisture content as determined in accordance with ASTM D1557.

12.8.4. Construction.

12.8.4.1. Aggregate base material shall be placed only on finished subgrades meeting the specified requirements for section, density, uniformity and smoothness, and which are free from loose or frozen material. Aggregate base material shall not be placed on the prepared subgrades when the moisture content of the top 6 inches of the subgrade exceeds optimum.

12.8.4.2. The aggregate base material shall be placed in uniform mixtures and shall be spread in layers or windrows without segregation. Segregated materials shall be mixed until uniform.

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12.8.4.3. The aggregate base material shall be spread, watered, processed, shaped and compacted as specified. Where the required thickness of the completed course is 6 inches or less, the material may be spread and compacted in a single layer. Where the required thickness of the completed aggregate base exceeds 6 inches, the base material shall be spread and compacted in layers of approximately equal thickness, providing the compacted thickness of a layer shall not exceed 6 inches.

12.8.4.4. After the top surface of each course has been spread and shaped, and before compaction is completed, all surface transverse and longitudinal irregularities shall be eliminated.

12.8.4.5. Each layer of aggregate base material shall be uniformly compacted throughout to a density of not less than 95 percent of maximum density at optimum moisture content as determined in accordance with ASTM D1557.

12.8.4.6. The finished and compacted surface of the compacted aggregate surfacing shall conform to the grade and typical sections shown on the Drawings, or with authorized modifications thereof. When tested in any direction with a 10 foot straightedge, the finished base course shall not show a deviation in excess of 3/8-inch.

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13.0. HEATING, VENTILATING AND AIR CONDITIONING

13.1. Description of Work.

13.1.1. This Article covers and shall be applicable to all work associated with furnishing, delivering, installing, testing and balancing and start-up of the Heating, Ventilating and Air Conditioning Systems for the various structures associated with the 10 MWe Solar Pilot Plant Facility in accordance with the drawings, specifications, standards and supplements referenced herein.

13.1.2. The drawings indicate the extent and general arrangement of the systems and equipment. All items shall be coordinated to provide complete, properly functioning systems. Equipment, ductwork and piping shall fit into the spaces allotted and shall allow adequate and acceptable clearances for access, servicing and maintenance.

13.1.3. The Contractor shall furnish, assemble, store, install, clean, lubricate, balance, test and start all the materials, equipment, controls and accessories associated with the HVAC Systems shown on drawings and specified herein, including but not limited to;

a) HVAC ductwork, duct supports, internal duct lining, dampers, registers, diffusers and other ductwork accessories
b) Controls
c) Refrigerant piping
d) Air handling units
e) Condensing units
f) Single packaged air conditioning units
g) Exhaust fans
h) Supply fan 5
i) Electric duct heaters 5
j) Electric unit heaters 5
k) Louvers
l) Humidifiers 5
m) Relief dampers 5
n) Air filters 4
o) Incidental and miscellaneous items for complete installation. 5

13.1.4. HVAC work shall be coordinated with the work of others, as required. When in the course of installation, interferences are found to exist, the Contractor shall, with the prior written approval of SFDI, make the changes necessary to accomplish the installation satisfactorily.

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13.2. Submittal of Drawings and Data. The Contractor shall submit for SFDI's review, shop drawings of all proposed equipment and detail control drawings. Any purchasing by the Contractor of HVAC equipment or controls prior to the SFDI's review of the proposed items shall be entirely at Contractor's risk.

13.3. Protection of Material and Equipment. Regardless of how shipped or where stored, the equipment, pipe, pipe fittings, valves, ductwork and accessories shall be adequately protected against loss, damage, entry of dirt and dust and against deterioration due to any cause. The Contractor's methods of complying with foregoing will be subject to the approval of the Construction Manager.

13.4. Environmental Conditions:

a)	Plant Location	Daggett, California
b)	Plant Elevation	1950 feet above mean sea level
c)	Air Temperature Range, Outdoors, Summer	113 F DB, 77 F WB
	Winter	16 F DB
d)	Barometric pressure:	13.7 psig

13.5. Work Furnished by Others. The following equipment and services will be provided by others:

a) All concrete, anchor bolts and grouting to meet Vendor's requirements.

b) Electrical field wiring including power and control.

c) Motor control centers, disconnect switches, motor starters and circuit breakers, unless noted otherwise.

13.6. Equipment and Materials.

13.6.1. General.

13.6.1.1. Capabilities, sizes, characteristics, performance and accessories for each item of equipment shall be as shown on the equipment schedules on Drawing No. 40M7005133123. 4,5

13.6.1.2. Each item of equipment shall have the manufacturer's name, address, manufacturer's model number and equipment tag number permanently inscribed on a metal plate securely attached thereto.

13.6.1.3. All rotating equipment shall be factory balanced statically and dynamically. Vibration values of self-excited vibration velocity shall be less than 0.10 inch per second when measured with a vibration meter on the frame, housing or bearings of the equipment in the vertical, horizontal and axial directions. The vibration meter shall be a calibrated Model 308, as manufactured by International Research and Development Corporation, or SFDI-approved equal.

13.6.1.4. Electric motors shall have enclosures as specified on the Equipment Schedules. The motors furnished shall be designed, manufactured and routinely tested in accordance with the latest applicable NEMA, IEEE and ANSI Standards. The continuous horsepower nameplate rating shall be greater than or equal to the maximum brake horsepower required by the driven equipment when the equipment is operating at the rated load conditions specified in the Equipment Schedule.

13.6.1.5. All motors shall conform to Engineering Standard JF16.02.02, attached hereto as a supplement. 5

13.6.1.6. Noise emission from each item of equipment furnished hereunder, excluding background noise, shall not exceed values specified by OSHA as maximum permissible noise exposure for eight (8) hours per day, when measured parallel to the equipment axis and at any point that is five (5) feet vertically above the equipment operating level and five (5) feet horizontally from the equipment surface. The noise emission shall be measured with a calibrated Model 308 vibration meter, as manufactured by International Research and Development Corporation, or SFDI-approved equal.

13.6.1.7. Manufacturer's name, trade name, type or model number specified herein are used for convenience in facilitating description and establishing a standard of quality, type, arrangement and design characteristics of the equipment desired. If the equipment of other manufacturer(s) is furnished, such equipment shall be of the same general arrangement and shall be compatible with and fit into the space available, as the item specified. All reference to manufacturer and trade names shall be assumed to be followed by the words "or SFDI-approved equal."

13.6.1.8. Vibration eliminators shall be used to prevent transmission of vibration and noise to building structures.

13.6.1.9. Belts, pulleys, couplings, projecting set screws, keys and other rotating parts shall be fully enclosed and properly guarded.

13.6.1.10. The paint system for all equipment ferrous surfaces shall conform to Stearns-Roger Incorporated Engineering Standard JC10.80 Painting Specification for HVAC Equipment.

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13.6.2. Design and Construction.

13.6.2.1. Air-Cooled Condensing Units (ACCU-1 thru ACCU-4). 4

13.6.2.1.1. General. Each condensing Unit shall be assembled as a single unit and shall include compressor, condenser coil, condenser fan(s) and motors, sight glass, service access valves, unit controls, filter drier and holding charge of R-22. All units shall be designed for outdoor application. Units shall be rated in accordance with ARI Standard No. 210.

13.6.2.1.2. Casing. The casing shall be fabricated from 18-gage minimum thickness hot dipped galvanized sheet steel (ASTM A525, A526 or A527) or electrolytic zinc-coated sheet steel, commercial quality, coating, Class C, phosphatized and painted. The unit shall be designed for weatherproof operation in accordance with UL Specification No. 465.

13.6.2.1.3. Compressor. Compressor shall be welded hermetic or serviceable hermetic type with spring isolator mountings. Overloads and inherent winding thermostat protection shall be provided for hermetic motor protection. Crankcase heater shall be provided. Unit for ACCU-3 shall be furnished with two (2) step capacity control, self-reversing positive displacement oil with filters and magnetic plugs.

13.6.2.1.4. Condenser Coil. Condenser coil shall be fabricated from aluminum plate (0.090 minimum thickness) fins bonded to seamless 3/8-inch O.D. copper alloy tubes. Fins shall have full self-spacing collars drawn belled and bonded to tube by ball or bullet expansion. Coils shall be leak tested under water 425 psig. Coil shall be single circuit type. The coil shall be protected on all sides by a heavy-duty grille. Refrigerant coil shall be circuited for subcooling.

13.6.2.1.5. Fans and Motors. Fan(s) shall be propeller type with aluminum blades and electro-zinc plated steel hubs, statically and dynamically balanced. Vibration limits shall conform to Paragraph 13.6.1.3. Drive shall be direct and fan guards shall be provided conforming to OSHA requirements. Fan motors shall be totally enclosed, permanently lubricated type. Motors shall have built-in thermal overload protection. Motor selection shall be based on 130 F ambient temperature.

13.6.2.1.6. Controls. Control circuit shall be 115 volt and shall include control circuit fusing and control power transformer. All refrigeration pressure controls shall be located in unit compressor compartment. Unit shall be wired complete with magnetic contactors for both compressor and condenser fan motors, and three-leg compressor overload protection, high and low pressure cutouts, oil pressure switch, and short cycling timer. Across-the-line starter shall be used for unit.

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13.6.2.2. Air Handling Units (AHU-1 thru AHU-4). 4

13.6.2.2.1. General. The air handling units shall be of sectional design with all components factory assembled in one compact cabinet. The units shall be internally insulated and supplied with all components as shown on drawing and specified on the Air Handling Unit Schedule and herein, and shall be tested as complete operating units.

13.6.2.2.2. Casing.

13.6.2.2.2.1. Casing shall be fabricated cold rolled steel ASTM A366, ASTM A525 hot dipped galvanized or ASTM A591 electrolytic zinc coated steel sheets.

13.6.2.2.2.2. Casing shall be chemically cleaned, phosphatized, primed and painted. Casing shall be reinforced and braced with steel angle framework. Casing shall be of sectional design, comprised of a fan section, a coil section and a filter mixing box section. Fan and coil section shall be insulated with 1-inch, 3/4 lb/cu ft density glass fiber blanket insulation fastened with SFDI-approved adhesive.

13.6.2.2.2.3. All hanger or bolt holes in the unit casing shall be prepunched at the factory.

13.6.2.2.3. Cooling Coil Section.

13.6.2.2.3.1. Direct expansion type cooling coils shall be furnished with aluminum plate ASTM B209, Alloy 1100-0 (0.090 minimum thickness) fins firmly bonded to seamless 5/8-inch O.D. copper tubes. Fins shall have self-spacing collars, drawn, belled and bonded to tubes by mechanical expansion. Fin spacing shall be as specified on Air Handling Unit Schedule.

13.6.2.2.3.2. The tubes shall be silver brazed into die-formed extruded holes in headers. Headers shall be seamless copper tube 0.065-inch minimum wall thickness. Header caps shall have minimum thickness of 0.125-inch.

13.6.2.2.3.3. Coils shall have a galvanized steel casing ASTM A526 or A527, G-90 coating (16 Ga USS 0.0635 minimum thickness). Coils shall be removable from the air handling unit through removable panels.

13.6.2.2.3.4. Sealing strips shall be provided between the coil frame and the casing, to eliminate air bypass and moisture carry-over.

13.6.2.2.3.5. Venturi type refrigerant distributors of low pressure drop design, arranged for down feed, shall be incorporated. There shall be a minimum of one distributor for every 12 circuits.

13.6.2.2.3.6. Coils shall be circuited so as to ensure equal distribution of refrigerant to all coil circuits. Circuiting shall be arranged so that air flow is counterflow to the refrigerant flow.

13.6.2.2.4. Fan Section.

13.6.2.2.4.1. Fans shall be double width, double inlet, multiblade centrifugal type. All fans shall be statically and dynamically balanced after being installed on fan shaft in accordance with Paragraph 13.6.1.3 of this specification. Fan shafts shall not pass through their first critical speed as unit comes up to rated rpm.

13.6.2.2.4.2. Fan housing shall be fabricated with die-formed, streamlined inlets and side sheets. Fan bearings shall be grease-lubricated ball bearings selected for an AFBMA L-10 minimum life of 40,000 hours. Bearings may be mounted either externally or internally. Internally mounted bearings shall have extended grease line brought out to a convenient location, external to the fan cabinet. Fan and fan motor position shall be as indicated on the drawing.

13.6.2.2.5. Drain Pan Section. A drain pan shall be provided under the fan and coil section. Drain pan shall be insulated with seamless 1/2-inch cellular, sprayed, foamed-in-place insulation. Insulation shall be covered by 16 gauge (0.0635) minimum thickness hot dipped galvanized steel sheet or SFDI-approved equal.

13.6.2.2.6. Filter Mixing Box (For AHU-1 thru AHU-3 only). 4

13.6.2.2.6.1. The mixing box shall have duct connection flanges on both inlet and outlet openings.

13.6.2.2.6.2. The leaving side of the unit shall have bolt holes compatible with the air handling unit casing and permanently match-marked for proper assembly.

13.6.2.2.6.3. The mixing box shall be constructed of 18-gage mill-galvanized steel, with reinforcing angles.

13.6.2.2.6.4. An access door shall be provided on the side of the mixing box to permit access to the filters. The door shall be large enough to permit removal of all filters.

13.6.2.2.6.5. The filters shall be 2-inch fiberglass and of the throwaway type. The air filters shall be of 36.5 percent efficiency when tested on NBS type test. Filters shall be type 30/30 as manufactured by Farr or SFDI-approved equal.

13.6.2.2.6.6. The dampers shall be 0.125-inch 6063-T5 extruded aluminum of opposed blade design. The blades shall be approximately 4-inches wide, and seals shall be provided at all meeting surfaces. Leakage shall be less than 2.5 cfm per square foot at 0.435 inches WG.

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13.6.2.2.6.7. Draft gage connections shall be provided for the combination filter mixing box consisting of static pressure fitting No. A-308, complete with plugs, as manufactured by Dwyer Instruments, Inc., or SFDI-approved equal. The location of the fittings shall be selected by the manufacturer and shall be in the most turbulent-free area. The location shall be subject to SFDI review.

13.6.2.2.7. Vibration Isolators. Hanger type isolators shall be provided by the Air Handling Unit manufacturer. Isolators shall be combination spring and fiber glass hangers, incorporating 2-inch thick neoprene-jacketed precompressed molded fiber glass inserts in series with springs, all encased in welded steel brackets. The spring shall have a minimum travel of 50 percent between the design height and solid height.

13.6.2.2.8. Drives and Motors.

13.6.2.2.8.1. Motor shall be furnished by air handling unit manufacturer. Motor enclosure shall be as specified on Air Handling Unit Schedule. Motor shall be mounted on a structural steel adjustable base with at least 3 inches of axial adjustment.

13.6.2.2.8.2. Multigroove V-belt drive of the adjustable pitch type shall be furnished sized for 1.5 times the fan motor horsepower. An open expanded metal belt guard having sides of hot dipped galvanized steel sheet and expanded metal face with opening for tachometer shall be furnished. Belt guard shall conform to OSHA rules and regulations.

13.6.2.3. Roof Top Air Conditioning Unit (ACU-1). 4

13.6.2.3.1. General. Unit shall be designed for outdoor roof top installation on a full roof curb. Unit shall be complete with direct expansion cooling coil, compressors, evaporator fan, drive, condenser coil, condenser fans and motors, filters outside air system, return air system, nonfused disconnect switches, and all operating and safety controls, all assembled in one piece unit, fully charged with R-22, prewired, tested and ready to operate. Electric wiring shall be in accordance with National Electric Code NFPA-70-75.

13.6.2.3.2. Casing. Exterior panels shall be fabricated from hot dipped galvanized steel sheet ASTM A525, A526 or A527 with minimum coating thickness G90 (commercial). Painting shall conform to Stearns-Roger Engineering Standard JC10.80, Painting Specification. Neoprene washer screws shall be coated with zinc plus zinc chromate where sealing is required. Latched and gasketed access doors shall be 22 Ga (0.0336-inch) minimum thickness, hot-dipped galvanized steel sheet, and shall provide access to control panels, compressors, filter sections on both sides, outside/return air damper sections, evaporator coils and supply fan. Interior surfaces of exterior casing members in contact with air stream shall have 1-inch minimum thickness

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fiberglass insulation. Roof assembly shall be one piece curved for natural drainage, with modified lock seam joints filled with sealant over all but condenser section. Two drains shall be provided on each side of condenser section. Unit base shall be a one-piece welded assembly with 14 Ga (0.0785-inch) minimum thickness hot dipped galvanized steel formed load bearing members, formed recess with factory installed flexible base-to-roof curb sealing gasketing and roof overhang for water run off. Unit shall be provided with lifting lugs to accept chains or cables for rigging.

13.6.2.3.3. Electrical. Wiring shall be installed in accordance with National Electrical Code (NFPA-70) tested in individual component assemblies and rechecked during final factory run test. Wiring in air flow path shall be enclosed. Internally vented main control panel on condenser end shall have supply overload protector, fuses for supply condenser fans, dead front panel and factory mounted unit disconnect switch. Factory wiring shall be complete to load side of unit disconnect switch. Remote control panel shall be Class II wiring. ELectrical controls identification shall be stenciled in control panels. 4

13.6.2.3.4. Roof Mounting Curb. Curb shall be fabricated from 12 Ga (0.0785-inch) minimum thickness hot dipped galvanized steel sheet (ASTM A525, A526 or A527 G-90) with a nominal two inch by four inch wood nailer strip. Supply/return air opening gasketing shall be provided.

13.6.2.3.5. Compressor. Compressors shall be welded shell hermetic reciprocating type running at 3600 rpm with spring isolators. Provide non-immersion type crankcase heater in crankcase well and discharge and suction service valves. Motor shall be suction gas cooled and sized for operation with voltage fluctuations ±10 percent of nameplate voltage. Solid state overload sensors shall be imbedded in each stator winding. Compressor safety controls shall include high and low pressure cutouts and reset relay. Motor starter shall be across-the-line type. Reset relay shall protect the compressor against cycling by automatically locking out system operation when interrupted by compressor overload, compressor motor winding temperature, or high pressure cutout. Relay shall be manually reset on unit.

13.6.2.3.6. Evaporator Coil and Drain Pan.

13.6.2.3.6.1. Evaporator coil shall be three-row seamless 3/8-inch OD copper tubing (0.009-inch minimum wall thickness) mechanically bonded to full collar aluminum fins. Coil shall be factory leak tested at 300 psig under water. Coil shall be provided with thermostatic expansion valve. A liquid line filter-drier shall be provided. Suction line shall be insulated.

13.6.2.3.6.2. A fully insulated drain pan extending into fan section shall be furnished. Threaded drain connection on each side of unit shall be provided.

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13.6.2.3.7. Condenser Coil. A multi-row air cooled V-type coil with seamless 3/8-inch OD copper tubing 0.025-inch minimum wall thickness mechanically bonded to full collar convoluted aluminum fins (0.009 inch minimum thickness). A subcooling circuit with accumulator shall be incorporated. Coil shall be factory leak tested at 425 psig under water.

13.6.2.3.8. Condenser Fans and Motors. Vertical discharge broad blade propeller fans, balanced to meet limits of vibration outlined in Paragraph 13.6.1.2. when mounted on direct drive motor shaft shall be furnished mounted in deep bell mouth orifices. Driving motors shall be single phase with permanently lubricated bearings, UL Listed for outdoor use.

13.6.2.3.9. Supply Fan. Double inlet, double width, forward curved bladed fan shall be furnished with adjustable sheave drive. Fan's shaft and sheave shall be factory balanced, both statically and dynamically, to conform to limits given in Paragraph 13.6.1.2 after assembly. Fans shall reach rated rpm before fan shaft passes through first critical speed. Fan shaft shall be mounted on sealed permanently lubricated ball bearings. Fan motor and fan assembly shall be mounted on common base to allow consistent belt tension with no relative motion between fan and motor shaft. The entire assembly shall be completely isolated from unit and fan board by double deflection, rubber-in-shear isolators.

13.6.2.3.10. Filters. Two inch thick throw away glass fiber filters shall be furnished and mounted within unit and shall be accessible through access panels. Filters shall be type 30/30 as manufactured by Farr or SFDI-approved equal.

13.6.2.3.11. Drives and Motors.

13.6.2.3.11.1. Evaporator fan motor shall be open drip proof ball bearing type, 460V, 3 phase, 60 hertz, 3450 rpm. Motor shall be mounted on a structural steel adjustable base with at least 3-inch adjustment range.

13.6.2.3.11.2. A multigroove V-belt drive of the variable pitch type shall be furnished, sized for 1.5 times the fan motor horsepower.

13.6.2.3.12. The unit shall be furnished with "Economizer Cycle" package including dampers, outside air intake hood and fully modulating controls capable of introducing up to 100 percent outdoor air for cooling.

13.6.2.3.13. Control Panel. The panel shall provide control of fan operation, and signal lights indicating fan operation, cooling malfunction and dirty filters.

13.6.2.3.14. Controls. All necessary control components shall be provided for the operation of the unit as indicated on the drawings and specified herein. All controls shall be factory installed, wired and tested before shipment.

13.6.2.4. Packaged Air Conditioner (ACU-2 & ACU-3). 4,5

13.6.2.4.1. Unit shall be air-cooled, thru-the-wall type air conditioner of the capacity indicated on the Equipment Schedule. Unit shall be complete with compressor, evaporator fan and coil, condenser fan and coil, motor, intake and discharge grilles and controls all factory assembled in a thru-the-wall sleeve.

13.6.2.4.2. Compresser shall be hermetically sealed and internally spring mounted for quiet operation.

13.6.2.4.3. Evaporator and condenser coils shall have copper tubing as primary surface and aluminum fins for the secondary surface. A capillary restrictor shall be the metering device for the refrigeration system.

13.6.2.4.4. Evaporator and condenser fans shall be direct driven from a common motor. Evaporator fan shall be centrifugal type, condenser fan may be centrifugal or propeller.

13.6.2.4.5. The front panel shall be insulated with heavy glass fiber insulation for sound deadening.

13.6.2.4.6. Sleeve casing shall be one piece, U-channel reinforced fabricated from minimum 18 gauge galvanized steel. The casing shall be chemically cleaned and coated with an anti-rust phosphate.

13.6.2.4.7. Controls shall be accessible from the front, factory wired and completely enclosed within the unit. Adjustable thermostat shall automatically cycle the compressor to maintain the set temperature. Fan control shall be a three position switch for high, medium and low fan speeds.

13.6.2.4.8. Unit shall comply with the NEC Standards and rated in accordance with ARI Standard 310. The sealed in refrigeration system shall have a five year warranty on parts.

13.6.2.5. Exhaust Fans (EF-1 thru EF-3). 4

13.6.2.5.1. General.

13.6.2.5.1.1. The fans shall be designed and constructed in accordance with the equipment schedule and as specified herein. 4

13.6.2.5.1.2. All fan units shall be rated to comply with the requirements of the AMCA certified rating program and shop tested in accordance with AMCA Standard Test Code No. 210. Fans shall produce the specified cfm at the required static pressure while not exceeding the specified maximum horsepower. Fans performance shall not differ from curves of the model by more than ± 10 percent variation in volume. 4

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13.6.2.5.1.3. All fans shall be of nonoverloading design to prevent motor overload regardless of static pressure. 4

13.6.2.5.1.4. Fan blades shall be one piece cast aluminum alloy ASTM B26 alloy 319-F or SFDI approved equal. 4

13.6.2.5.1.5. Fan tip speed shall not exceed 11,000 fpm. 4

13.6.2.5.1.6. Safety guards shall be provided on units with exposed fan blades regardless of fan location. Fan guards shall be fabricated from 1/2-inch mesh wire screen in which the wires are securely fastened at every cross point by galvanizing after wearing of screen. Wire shall be not smaller than AWG 14 (0.080 inch). Guard shall conform to OSHA rules and regulations. 4 5

13.6.2.5.2. Propeller Fans.

13.6.2.5.2.1. Propeller fan assemblies shall be constructed of aluminum and/or steel. Fiberglass or plastic construction is not acceptable.

13.6.2.5.2.2. Fans shall be of the panel type with die-formed steel venturi rings. Motor base shall be fabricated from 3/16-inch minimum thickness steel plate. Motor base shall be supported by steel bar (3/8-inch minimum diameter) or steel tube (3/8-inch O.D. by 0.065-inch wall minimum dimension) or steel plate support (3/16-inch minimum thickness) welded to motor base and venturi ring designed to minimize vibration.

13.6.2.5.2.3. DELETED. 4

13.6.2.6. Supply Fan (SF-1). 5

13.6.2.6.1. The fan shall be designed and constructed in accordance with the equipment schedule and as specified herein. 5

13.6.2.6.2. Fan performance shall be based on tests conducted in accordance with AMCA standard test codes for Air Moving Devices and shall be licensed to bear the AMCA certified Air Rating Seal. 5

13.6.2.6.3. Wheel diameters, outlet areas and arrangements shall be in accordance with standards adopted by AMCA for industrial fans. All housings shall be welded and of heavy gauge steel suitably braced to resist vibration or pulsation. Wheel shall have heavy steel backward inclined blades welded to heavy steel plate backplate and wheel cone. 5

13.6.2.6.4. Shafts shall be 1040-45 SAE steel and shall not operate beyond 70 percent of the first critical speed. 5

13.6.2.6.5. Bearings shall be heavy duty ball or roller type sized to produce a B10 life of not less than 40,000 hours, and an average fatigue life of 200,000 hours. 5

13.6.2.6.6. Fans shall be provided with a weather-proof cover enclosing the motor and drive assembly and drain located at the lowest point of the scroll, with plug. 5

13.6.2.7. Electric Duct Heater (EDH-1) 5

13.6.2.7.1. General. Electric Duct Heaters shall be listed by Underwriters' Laboratories for zero clearance to combustible surfaces and shall meet 1978 National Electrical Code requirements. Heaters shall be suitable for installation in both unlined ducts and ducts with 1-inch of internal insulation. Heaters to be installed in hazardous locations shall be in accordance with Article 500 of the NEC and shall bear UL listing for such locations. Voltage, size, wattage, number of control steps and control voltage shall be in accordance with the equipment schedule and as specified herein. 5

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13.6.2.7.2. Type. Electric duct heater shall be of the slip-in type similar in design to Indeeco, Type QUA. Unit shall be provided with a NEMA 4 weathertight terminal box for outdoor installation. 5

13.6.2.7.3. Elements. Elements shall be 80 percent nickel, 20 percent chromium open resistance coils, insulated by ceramic or phenolic bushings. Bushings shall be recessed into supporting brackets spaced on 3-1/2 inch maximum centers. Terminals shall be stainless steel, machine crimped to elements and held in place with stainless steel nuts and shakeproof washers. The maximum watts persquare inch of wire surface shall be 35 watts. Steps shall be arranged to prevent stratification when operating at less than full capacity. 5

13.6.2.7.4. Casings. Frames shall be formed from ASTM A525 and A526 or A527, coating G-90, galvanized sheet steel 18 gauge (0.0516-inch) minimum thickness or aluminized steel 18 gauge (0.050-inch) minimum thickness, per ASTM A463, commercial quality Type 1 coating, T140 and designed for slip-in mounting for a 1-inch internally insulated duct. Construction shall conform to Underwriters' Laboratories Standard 1096. 5

13.6.2.7.5. Heater Terminal Compartment. 5

13.6.2.7.5.1. Terminal box shall be of the recessed type for installation in a duct with 1-inch internal insulation. The terminal box shall be fabricated from 18 gauge (0.0516-inch) galvanized sheet steel, manufacturer's standard minimum thickness or aluminized steel of same gauge. 5

13.6.2.7.5.2. Automatic and manual cut-outs, pressure differential type cut-outs, and safety interlock components shall be mounted in the terminal compartment. 5

13.6.2.7.5.3. The compartment box shall be provided with knock-outs compatible with amperage rated cable size of the heater and controls, terminal blocks and wiring gutters for all field wiring. 5

13.6.2.7.5.4. A detailed wiring diagram shall be furnished with the box. The cover shall be solid, single hinged, 18 gauge manufacturer's standard (0.0478-inch) aluminized steel. 5

13.6.2.7.6. Safety Interlock Components. Safety interlock components are to meet the requirements of the Underwriters' Laboratories and the National Electrical Code. The following components shall be supplied and prewired by the supplier: 5

13.6.2.7.6.1. Airflow Interlock. A fan relay for field connection to fan starter holding coil. 5

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13.6.2.7.6.2. Temperature Limiting Controls. Heater shall be equipped with disc-type automatic reset thermal cut-out for primary protection, and load carrying, disc-type manual reset thermal cut-out wired to each heater circuit for secondary protection. Heater limiters or similar fusible devices are not acceptable. 5

13.6.2.7.6.3. Contactors. Contactors shall be of the de-energizing type and meet all requirements of NEMA Standard No. ICS2-211A. 5

13.6.2.7.6.4. Overcurrent Protection. 5

13.6.2.7.6.4.1. For Heaters Drawing More Than 48 Amps. Overcurrent protection in each heater circuit shall be of fuse block type with dual element fuses, installed in phenolic or ceramic blocks with reinforcing springs. 5

13.6.2.7.6.4.2. For Heaters Drawing Less Than 48 Amps. 5

13.6.2.7.6.4.2.1. A magnetic circuit breaker shall protect the entire load and shall be externally resettable. A fused disconnect switch with door interlock to disconnect all underground conductors. 5

13.6.2.7.6.4.2.2. A control transformer with primary fusing. 5

13.6.2.7.6.4.2.3. Pilot lights to indicate when each circuit is on and when air flow is insufficient. 5

13.6.2.7.7. Multi-Stage Controllers. 5

13.6.2.7.7.1. The number of heating stages shall be furnished in accordance with the Electric Duct Heater Schedule on the Drawing. 5

13.6.2.7.7.2. Step controllers of the electric type shall be furnished by the manufacturer. 5

13.6.2.7.7.3. The electric step controller shall be suitable for 150°F ambient operation. Time cycle for 10 switches to come on shall be 13 minutes maximum. A built-in cycle relay shall prevent entire load from coming on at once, after power failure. Switches shall be rated for pilot duty (up to 240 volts) and shall be used to control magnetic contactors. For 480 volt line applications, a built-in 480 volt/120 volt or 240 volt transformer shall be furnished. A separate built-in transformer shall provide 24 volts for thermostat circuit. 5

13.6.2.8. Electric Unit Heaters EUH-1, EUH-2, EUH-5 thru EUH-18). 4,5

13.6.2.8.1. General. All unit heaters shall be of size kw, cfm, motor hp, fan rpm, and type of air discharge indicated on the Equipment Schedule. 5

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13.6.2.8.2. Fans. Propeller fans shall be broad bladed with a minimum of four blades. Fan blades shall be fabricated from aluminum and securely riveted to an electro-zinc plated steel spider which in turn is secured to an electro-zinc plated steel hub provided with a minimum of two set screws for attachment to motor shaft. 5

13.6.2.8.3. Fan Drives. All unit heaters propeller fans shall be directly driven by driving motors. 5

13.6.2.8.4. Motors. 5

13.6.2.8.4.1. Motors shall be manufactured by a reputable motor manufacturer in accordance with NEMA standards. Motor winding insulation class shall be selected for ambient temperature as called for in Motor Specification. 5

13.6.2.8.4.2. Motors of subfractional horsepower sizes (1/20 hp, 1550 rpm and under) shall be sleeve bearing 115V/60/1 totally enclosed air-over with thermal overload protection. Motors of fractional horsepower sizes (1/15 hp, 1550 rpm up to 1/2 hp, 1100 rpm) shall be of the permanent split capacitor type, totally enclosed air-over ball bearings, with built-in overload protection and 120V/60/1 electrical characteristics. An alternate totally enclosed air-over polyphase squirrel cage, sealed ball bearing motor may be used from 1/2 hp, 1140 rpm through integral horsepower sizes. Where single phase motors are required in the 3/4 hp and 1 hp sizes, motors shall be dual voltage 120/230-60-1, 208/220-60-1 or 230/460-60-1 ball bearing capacitor start totally enclosed air-over with built-in overload protection. Where specified in Equipment Schedule explosion-proof motors air-over rated shall be used in horsepower size 1/20 hp and over in either single phase or polyphase types. 5

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13.6.2.8.5. Ratings. All unit heaters shall be rated in accordance with AMCA Standard No. 210. 5

13.6.2.8.6. Enclosure. 5

13.6.2.8.6.1. Enclosure shall be fabricated from electro-zinc coated 18 gauge USS (0.0478 inch) minimum thickness steel. Enclosures shall contain heating elements, contactors and control transformers. 5

13.6.2.8.6.2. Air shall be drawn in the back of the heater and discharged through independently adjustable horizontal louvers on front of casing. A control compartment shall be provided for easy wiring and inspection of controls. An access door shall be provided for ready access to the compartment and shall have wiring diagram permanently attached to door. Motor shall be mounted on 14 gauge B&S minimum diameter formed wire protective guard conforming to OSHA requirements for fan guards. Motor mount shall be isolated from the casing by neoprene vibration isolators. 5

13.6.2.8.7. Heating Element. 5

13.6.2.8.7.1. Element shall be fabricated from coiled nickel chromium alloy resistance wire embedded and completely surrounded in magnesium oxide, enclosed and swaged into corrosion resistant steel sheaths to which are furnace brazed corrosion resistant steel fins. 5

13.6.2.8.7.2. Element assembly shall be enclosed in a steel shroud to assure uniform air distribution over heating element. Element shall be guaranteed for 5 years. 5

13.6.2.8.8. Wiring. 5

13.6.2.8.8.1. Heater shall be designed for a single supply circuit, with element motor and control circuits subdivided and fused to conform to the National Electric Code, OSHA Rules and Regulations and UL Standard 573. All three phase heaters shall have balanced phases. 5

13.6.2.8.8.2. Contactors and control circuit transformer and thermostat shall be factory assembled and wired with only one direct line supply required in the field. Thermostat shall be mounted on front panel of unit. 5

13.6.2.8.9. Thermal Overload Protection. All heaters shall be equipped with a manual reset thermal cut out which disconnects elements and motor in the event normal operating temperatures are exceeded. 5

13.6.2.9. Louvers (L-1 thru L-7). 4,5

13.6.2.9.1. General. 5

13.6.2.9.1.1. All fixed, and operable louver frames and blades shall be fabricated from ASTM B221 aluminum alloy 6063-T52. 5

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13.6.2.9.1.2. The air pressure drop across fixed louvers equipped with bird screen at free air velocity of 625 fpm in either intake or exhaust mode, shall not exceed 0.08-inches of water. 5

13.6.2.9.1.3. Mist or small droplets of water shall not entrain at free area velocities of less than 800 fpm. Tests shall be conducted in accordance with AMCA Standard No. 500. 5

13.6.2.9.1.4. All louvers shall be designed to withstand a wind pressure of 45 pounds per square foot. Maximum blade deflection measured at mid span shall be limited to 1/180 of blade span at 11.0 lbs/sq ft wind pressure. No permanent set will be tolerated. 5

13.6.2.9.2. Fixed Louvers (L-4 Thru L-7). 4,5

13.6.2.9.2.1. Fixed louvers shall have minimum free area as indicated on the Equipment Schedule, Drawing No. 40M700513323. 5 4,5

13.6.2.9.2.2. Fixed louvers shall have 4-inch or 6-inch (see schedule) deep frame fabricated from 0.125-inch minimum thickness aluminum alloy. Heads, jambs, sills, and mullions shall be one piece structural members with integral calking slot and retaining beads for installation inside channel steel wall opening. Mullions shall be designed with internal drains capable of draining 12 feet length of blade under conditions outlined in AMCA Standard No. 500 and Standard No. 511. Frame shall be welded construction with corner bracing using gussets or straps on all sizes 10 square feet or larger. Other methods of assembly must be SFDI-approved. 5

13.6.2.9.2.3. Blades shall be of the stormproof drainable type. Drain gutters shall have sufficient capacity to drain blades 12 feet long under conditions outlined in AMCA Standard No. 500 and Standard No. 511. Blade shall be extruded aluminum alloy with minimum thickness of 0.081-inch. 5

13.6.2.9.2.4. Louver blades shall have a maximum unsupported span of 5 feet-0 inches. 5

13.6.2.9.2.5. Allowance for thermal expansion shall be provided at the jambs. 5

13.6.2.9.2.6. A bird screen fabricated from 3/4-inch aluminum or hot-dipped galvanized flattened expanded metal with minimum thickness of 0.051- or 0.500-inch mesh, 0.062-inch diameter aluminum or galvanized steel wire intercrimp. Expanded metal (or 1/2-inch mesh screen) shall be mounted in 12 gage (0.104-inch) minimum thickness aluminum or galvanized steel frame mounted to inside of louver frame. 5

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13.6.2.9.3. Operable Dual Combination Louvers (L-1, L-2 & L-3). 4,5

13.6.2.9.3.1. Operable louvers shall have a minimum free area as indicated on the Equipment Schedule, Drawing No. 40M7005133123. 5 4,5

13.6.2.9.3.2. THe louvers shall be of the drainable dual combination type. The louver shall have a 6-inch deep frame fabricated from 0.125-inch minimum thickness aluminum alloy. 5

13.6.2.9.3.3. Heads, sills, jambs and mullions shall be one piece structural members, 0.125-inch minimum thickness aluminum alloy with integral calking slot and retaining beads. Corner bracing using gussets or straps on all sizes 10 square feet and larger shall be provided. Other methods of assembly shall be SFDI-approved. 5

13.6.2.9.3.4. The drainable fixed blade shall be 0.081-inch minimum thickness with front lip gutter designed to catch and direct water to jamb and mullion drains. Blade and drain gutters shall have sufficient capacity to drain blades 12 feet long under conditions outlined in AMCA Standard Nos 500 and 511. Head, sills, jambs and mullions shall be heliarc welded at corners. 5

13.6.2.9.3.5. Movable blades shall be 0.125-inch minimum thickness aluminum alloy. Pivots shall be 1/2-inch diameter ASTM B211 aluminum alloy 6061-T6 or SFDI-approved equal, operating in self-lubricating nylon or Cycoloy 800 bearings. Clearance between blade ends and jamb shall not exceed 0.0625 inch. 5

13.6.2.9.3.6. The movable blades shall be operated by concealed drive arms at each jamb, the arms shall be fabricated from 0.125-inch minimum thickness 1 inch wide formed ASTM B211 aluminum alloy 6061-T6 or an equivalent section of equal stiffness. 5

13.6.2.9.3.7. Linkage shall be assembled with stainless steel shoulder rivets or aluminum alloy 6061-T6 shoulder rivets operating in oil impregnated sintered stainless steel bushings. The linkage actuating arms shall not indicate noticeable deflection under maximum torque or thrust of operator. 5

13.6.2.9.3.8. Movable blade swing shall not be less than 39 degrees or more than 45 degrees in open position. Drive arms on either end of driving blade shall be connected by 5/8-inch minimum diameter ASTM B211 aluminum alloy 6061-T6 torsion bar. 5

13.6.2.9.3.9. Mullions shall be sliding interlock type with integral drains. 5

13.6.2.9.3.10. All movable blade edges shall be equipped with field replaceable extruded vinyl material selected for maximum resistance to sunlight, heat and weather. Seal material shall be exterior grade, UV stabilized and weatherable. Seals attached to jambs are preferred over seals attached to blade ends. 5

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13.6.2.9.3.11. A bird screen fabricated from 1/2-inch mesh, 0.063-inch diameter wire intercrimp secured with a 12 gage B&S (0.071-inch) extruded or formed aluminum frame. Screening shall be replaceable within frame. As an alternate, screen material may be fabricated from 3/4-inch aluminum or hot dipped galvanized flattened expanded metal. 5

13.6.2.9.4. Electric Louver Operators 4,5

13.6.2.9.4.1. Electric operators shall be furnished assembled to all electrically operated louvers. Operators shall include mounting brackets, fasteners and linkage for connection to jack shaft for multisection operable louvers where required. 5

13.6.2.9.4.2. The operators shall be the two position (on-off) spring return type. The gear train shall be oil immersed and sealed in a die cast aluminum (ASTM B85, Alloy 380) or die cast zinc alloy (ASTM B86, Alloy AG40A) case. The drive shaft shall be hardened steel with a minimum cross section of 3/8-inch square or 1/2-inch splined. All gears shall be of the precision hobbed type. A mounting base integral with die cast housing shall be provided. A dust tight and splash proof connection box integral with die cast case with minimum of two 1/2-inch conduit knockouts shall be provided. 5

13.6.2.9.4.3. The actuator output shaft shall return to the full limit closed position upon interruption of the power supply to the actuator. The spring mechanism shall be protected by a die cast housing. 5

13.6.2.9.4.4. Supply voltage to the motor shall be 115 volts, single phase (single phase, permanent split capacitor or shaded pole type), 60 hertz. The motor shall be short time (5 minute) rated in accordance with NEMA Standard MG-1 Paragraph 10.35. The rated torque and operating speed developed by the motor at the output of the gear train shall be in accordance with Table I of this Specification. The breakaway torque shall be 140 percent of running torque minimum. 5

13.6.2.9.4.5. Controls. All 115 volt operators over 1/8 horsepower shall have built-in, factory wired disconnect switches. 5

13.6.2.9.4.6. Accessories. If step down transformer is required, it shall be supplied by operator manufacturer. Brackets, fasteners, crank arm (adjustable), connectors and push rod for the interconnecting of the actuator crank arm with the louver shaft shall be supplied in accordance with louver manufacturer's requirements. 5

13.6.2.9.4.7. Performance Requirements. Electric operators shall operate at any ambient temperature range between 0 F and 150 F. Rated torque and minimum sq ft of louver area at 1-inch static pressure (or 2000 ft/min velocity-Std. air) shall be in accordance with the following Table I: 5

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TABLE I

SPRING RETURN MOTORS

Rated Torque (Running) In. Lbs.	Square Foot of (Louver)(Damper) Parallel Blade	Min. Operating Speed Travel 90 Degrees, Seconds	Nominal Travel Adjustment, Degrees
16	9	10	90-140
30	35	35	90-140
40	40	30	90-140
50	42	45	90-140
150	70	45	90-140
175	120	10	90-140
220	150	35	90-140

13.6.2.9.5. Specific Tests. Air leakage on operable louvers when closed, with louver operator imposing a torque on the driving blade at a value set by manufacturer and tested in accordance with AMCA certification procedure No. 511 shall not exceed 10 cfm per square foot of face area at a static pressure differential of 0.435-inch H_2O gage (30 mile per hour wind velocity). 5

13.6.2.10. Dampers 4,5

13.6.2.10.1. General 4,5

13.6.2.10.1.1. The dampers shall be of the size and type as shown on equipment schedules and as specified herein. 4,5

13.6.2.10.2. Automatic Backdraft Dampers 4,5

13.6.2.10.2.1. The backdraft damper shall be designed to operate as a pressure relief damper allowing air passage in only one direction. 4,5

13.6.2.10.2.2. The frame shall be fabricated from 0.090 inch minimum thickness ASTM B221, aluminum alloy 6063-T5 with mitered corners. 4,5

13.6.2.10.2.3. Blades shall be of the parallel type fabricated from 0.050 inch minimum thickness extruded ASTM B221, aluminum alloy 6063-T5. Blades shall overlap frame and shall be low leakage, less than 12 cfm/sq ft at 1/2-inch W.G. 4,5

13.6.2.10.2.4. Seals shall be locked into extruded blade slots without use of cement and shall be easily replaceable in the field. Polyurethane seals will not be acceptable. 4,5

13.6.2.10.2.5. The shafts shall be 1/4-inch cold-rolled precision machined steel. The bearings shall be Zytel, Teflon, nylon or delrin, and shall be permanently lubricated and sealed against dust and corrosion. 4,5

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13.6.2.10.2.6. All ferrous metal parts shall be protected from corrosion by factory applied aluminum paint. 4,5

13.6.2.10.3. Control Dampers 4,5

13.6.2.10.3.1. The frames shall be fabricated from 0.125 inch minimum thickness extruded ASTM B221, aluminum alloy 6063-T5, suitable for duct mounting. 4,5

13.6.2.10.3.2. The damper blades shall be of the opposed airfoil type, fabricated from 0.080 inch minimum thickness extruded ASTM B221, aluminum alloy 6063-T5. The blades shall be center pivoted having 1/2-inch minimum diameter or 7/16-inch across flats, hexagon shaft ASTM B221, aluminum alloy 2024, operating in Cycloloy 800, Teflon, nylon, or oil impregnated sintered bronze or sintered stainless steel bearings. 4,5

13.6.2.10.3.3. Blades shall include extruded vinyl, butyl rubber or other SFDI approved double edge seals. Polyurethane seals are not acceptable. In closed position, blades shall seal against jamb seals of the same material as blade seals. 5

13.6.2.10.3.4. All blades shall be operated by concealed linkage. The operating linkage shall be assembled with stainless steel shoulder rivets and oil impregnated sintered stainless steel bearings. Damper blades shall be equipped with ASTM B308, aluminum alloy 6061-T6 drive arms. 4,5

13.6.2.10.3.5. Damper shall be of corrosion resistant construction, and shall be assembled and tested by the manufacturer prior to shipment in accordance with AMCA Standard 500. 4,5

13.6.2.11. Humidifiers 5

13.6.2.11.1. Duct Humidifiers (H-1 thru H-3) 4,5

13.6.2.11.1.1. Humidifiers shall be of electric pan type consisting of a pan, a water control valve and float, an integral low water level safety cut-off switch and electric heater. 4,5

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13.6.2.11.1.2. Heater shall be of the water immersion, copper sheathed type. 5

13.6.2.11.1.3. The pan shall be constructed of 24 ounce sheet copper of size indicated on the Equipment Schedule. 5

13.6.2.11.1.4. The type, capacity and size shall be as indicated on the Equipment Schedule Drawing No. 40PM7005133123. 5 4,5

13.6.2.11.2. Area Humidifiers (H-4). 4,5

13.6.2.11.2.1. Area humidifiers shall be complete, self-contained units, factory assembled and tested. 5

13.6.2.11.2.2. The unit shall have a float valve to maintain a constant water level in the reservoir. Water shall be discharged at high velocity through a stainless steel grid to create fine mist. 5

13.6.2.11.2.3. The unit shall be provided with discharge shields for directional distribution. 5

13.6.2.11.2.4. The unit shall be furnished with a humidistat to automatically control the unit operation. 5

13.6.2.11.2.5. The type, capacity and size shall be as indicated on the Equipment Schedule Drawing 40M7005133123. 5 4,5

13.6.2.12. Filter Assembly with Side Servicing Housings (F-1 Thru F-3). 4,5

13.6.2.12.1. General. The filter unit shall utilize a side servicing housing and filter cartridges filter cartridges, and shall be similar to Cambridge Filter Corp. "Glass Cap 45GHC." 4,5 4,5

13.6.2.12.2. Housing 4,5

13.6.2.12.2.1. The unit shall be a complete factory-assembled housing with upstream and downstream outwardly-turned flanges for insertion into ductwork system as specified on the drawings. The housing shall be manufactured of suitably reinforced heavy 16-gauge galvanized steel. The housing shall be provided with integral prefilter tracks to accommodate 2-inch throw-away or cleanable prefilters. 4,5

13.6.2.12.2.2. Access doors with continuous gasketing on the perimeter and positive locking devices shall be provided at both ends of the housing. 4,5

13.6.2.12.2.3. Leakage shall be prevented between cartridges, and cartridges and doors with factory-installed gasketing. Filter cartridges shall be capable of being loaded or unloaded through either access door. 4,5 5

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13.6.2.12.3. Filter Cartridges 4,5

13.6.2.12.3.1. Filters shall be similar to Cambridge Filter Corp., "Glass Cap Series Filters." 4,5

13.6.2.12.3.2. Each filter shall consist of a permanent corrosion resistant holding frame and a replaceable factory-assembled filter element incorporating a fine-fibered all glass medium. The permanent holding frame shall be supplied with a gasket and retaining clips to maintain a positive pressure seal between the frame and replaceable filter element. The holding frame shall include matching rivet holes to facilitate installation. 4,5

13.6.2.12.3.3. Filters shall operate at maximum face velocity, and shall have an initial resistance of not more than 0.40 inches w.g. at this operating face velocity. The average efficiency of the filter shall not be less than 35 percent by ASHRAE test (Std. 52-68) using atmospheric dust. 4,5

13.6.2.12.3.4. The type, capacity and size shall be as indicated on the equipment schedule Drawing 40M7005133123. 4,5 5

13.6.2.13. Ductwork, Hangers, and Accessories 4,5

13.6.2.13.1. General Requirements 4,5

13.6.2.13.1.1. All ductwork, complete with fittings and transitions, turning vanes, splitters, dampers, diffusers, registers, grilles, air extractors, flexible connectors, supports and hangers, internal lining and other accessories, shall be in accordance with the Engineer's Drawings and Specifications. 4,5

13.6.2.13.1.2. Ductwork shall conform to the dimensions shown on the drawings, except as otherwise noted herein, and shall be smooth on the inside. Duct sizes shown on the drawings including lined ducts are outside dimensions of the sheet metal duct. 4,5

13.6.2.13.1.3. Construction of ductwork shall be in accordance with specified Engineering Standard JC10.15 Series attached hereto as supplements. 4,5

13.6.2.13.1.4. Deviations from approved drawings and specifications may be made only with the written consent of the SFDI. 4,5

13.6.2.13.1.5. Bolts, nuts, washers and fasteners shall be cadmium plated steel. Rivets shall be galvanized steel. 4,5

13.6.2.13.1.6. Each fabricated duct section shall be marked with mark numbers and direction of air flow, using permanent black paint. 4,5

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13.6.2.13.2. Ductwork and accessories to be installed by the Contractor shall include, but not be limited to the following: 4,5

a) Ductwork, low pressure, complete with fittings
b) Hangers
c) Turning vanes
d) Air extractors
e) Access doors
f) Flexible connections
g) Flexible duct
h) Supply air diffusers
i) Supply registers
j) Return, transfer and exhaust grilles and registers
k) Duct lining

13.6.2.13.3. Ductwork Design and Construction 4,5

13.6.2.13.3.1. Ductwork Coating. All ductwork sheet steel shall be hot-dipped galvanized (ASTM A525, A526, or A527), coating G90 and shall be marked with an identifying stamp. 5

13.6.2.13.3.2. Duct Size and Required Gage, Low Velocity and Low Pressure Ductwork. Duct size and required gage shall conform to Engineering Standards JC10.15.01.1 and JC10.15.01.2. 4,5

13.6.2.13.3.3. Longitudinal, Transverse, Joint Connection and Reinforcing for Low Velocity and Low Presure Ductwork. Duct joint and reinforcing design shall conform to Engineering Standards JC10.15.01.1, JC10.15.01.2 and JC10.15.02, Figure B., Figure E or Figure G, except all transverse joints for ducts 18-inches and larger shall be constructed as per Figure "M," Companion Angles, as shown on Engineering Standard JC10.15.02. Gasket material shall be 1/8-inch thick neoprene. The companion angles shall be the same size as the reinforcing angles and shall be bolted together on 6-inch centers with gasket between. Longitudinal seams shall be as per Figure "N," Pittsburgh lock as shown on Engineering Standard JC10.15.03. 4,5

13.6.2.13.4. Hangers for Low Velocity and Low Pressure Ductwork 4,5

13.6.2.13.4.1. General. Strap hangers shall not exceed 4 feet in length. All hanger rods shall be mild steel, threaded and cadmium plated. The rods shall be furnished complete with couplings, hex nuts, and self-drilling anchor bolts for concrete mounting or Nelson threaded studs for steel mounting. The anchor bolts shall be "Phillips Red Head" or approved equal, and shall have a pull-out load capacity of 4000 pounds minimum. The Nelson studs shall be stainless steel Type 304, 3/8-inch diameter by 2-inches long. Couplings shall be cadminum-plated steel 3/8-inch diameter by 2-inches long. 4,5

13.6.2.13.4.2. Rectangular Ductwork Hanger Schedule. Rectangular ductwork hangers shall conform to Engineering Standard JC10.15.15. 4.5

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13.6.2.13.5. Ductwork Components 4,5

13.6.2.13.5.1. Elbow Design. Elbow design shall be of the standard radius type and shall conform to Engineering Standard JC10.15.04. 4,5

13.6.2.13.5.2. Vaned Elbow Design. Vaned elbow design shall be of the double vane type and shall conform to Engineering Standard JC10.15.05, Figure B and Figure C. 4,5

13.6.2.13.5.3. Transitions. Transition design shall conform to Engineering Standard JC10.15.06. 4,5

13.6.2.13.5.4. Register and Grille Connections. Register and grille connections shall conform to Engineering Standard JC10.15.08. 4,5

13.6.2.13.5.5. Air Extractors. Air extractors shall conform to Engineering Standard JC10.15.08 and Titus AG-225 with Operator No. 1 or SFDI-approved equal. 4,5

13.6.2.13.5.6. Flexible Connections and Fan Connections. Flexible connections shall be provided and installed between all fans and air handling units and their connecting ductwork, and wherever shown on the drawings. Connectors shall be of 15 ounce per square yard tightly woven asbestos cloth, or of neoprene-coated glass fabric. Connectors shall be 10 inches long maximum, and shall be securely fastened to the unit and adjacent ductwork in a manner that provides a leaktight connection while permitting easy adjustment or removal. Misalignment between equipment and its connecting ductwork shall not be taken up in a flexible connection. Installed flexible connectors shall show slack on all faces. Construction shall conform to Engineering Standards JC10.15.09 and JC10.15.10. 4,5

13.6.2.13.5.7. Access Doors. Airtight access doors shall be provided at all dampers, turning vanes, air extractors, filters, motor drives, heating coils, and other items requiring access for servicing and maintenance. Access doors shall conform to Engineering Standard JC10.15.12, Figures A and C or H. 4,5

13.6.2.13.5.8. Diffusers, Registers, and Grilles. Diffusers, registers and grilles shall be of the size, capacity, and discharge pattern shown and specified on the drawings for the location or use. All units, to the extent practicable, shall be constructed of aluminum. Steel diffusers, registers, and grilles shall be furnished with a factory applied rust inhibitive primer conforming to Engineering Standard JC10.80 and finish shall be as scheduled on Drawings. All diffusers, grille, and register ratings shall be certified by the Air Diffuser Council. 4,5

13.6.2.13.6. Internally Lined Ducts 4,5

13.6.2.13.6.1. All supply air ducts and outside air ducts and plenum where indicated shall be lined. Lining shall be 1-inch thick, 1-1/2 pound density glass, long fiber thermal insulation, coated on the airstream side with black vinyl specifically designed as a liner for sheet metal duct. 4,5

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13.6.2.13.6.2. Duct liner insulation shall be applied around the inner surfaces of the ducts with 100 percent coverage of fire resistant adhesive. The duct liner shall be cut to ensure snug corner joints. The surface designed to be exposed shall face the airstream. On horizontal runs, the liner on the top inside surfaces of ducts over 12-inches in width shall be additionally secured with mechanical fastenrs. On vertical runs, fasteners shall be placed on all width dimensions over 12-inches. All surfaces 18-inches and above shall be secured by fasteners. The fasteners shall be placed on a maximum of 18 inch centers with the first row of pins no more than 3-inches from the end or edge of the liner. Fasteners shall be virtually flush with the liner surface. The liner shall be fastened in accordance with Engineering Standard JC10.15.23. 4,5

13.6.2.13.6.3. All exposed edges and leading edges of all transverse and longitudinal joints of the liner shall be coated with a suitable fire resistant adhesive. The exposed mechanical fasteners shall be coated with a suitable fire resistant adhesive. The upstream end shall be continuously bonded for a 6-inch width. 4,5

13.6.2.13.6.4. Adhesives, stick clips, coatings and sealants shall have a flame spread rating not exceeding 25, and a fuel contribution and smoke development rating not exceeding 50 when subject to the fire tunnel test procedures of ASTM E84 (NFPA No. 255; UL 723). 4,5

13.6.2.14. Refrigerant Piping 4,5

13.6.2.14.1. Material and Construction 4,5

13.6.2.14.1.1. The Contractor shall furnish and install all refrigerant piping, fittings, valves, insulation and R-22 refrigerant in accordance with the drawing. 4,5

13.6.2.14.1.2. Refrigerant piping shall be Type L hard temper seamless copper pipe with wrought copper fittings. Silver solder in accordance with ANS-ASTM B CuP-5 shall be used for all refrigerant piping connections. 4,5

13.6.2.14.1.3. Special care must be used during fabrication and installation, to keep all pipe, valves, fittings, filters, etc., as clean as possible. Use nitrogen purge while soldering all piping. Shutoff valves shall be bronze-alloy body, globe type, solder connections with 450 psi working pressure. Henry Wing Cap Shut-off valves or equal. Charging and purging valves shall be Henry Packless Angles Valves, Catalog No. 6433 or equal. 4,5

13.6.2.14.1.4. All refrigerant lines shall be insulated with Armstrong Armalok 1/2-inch thick insulation with vapor barrier jacket. Insulated piping installed outdoors shall be furnished with aluminum jacket fastened with 16 gauge aluminum straps 9-inches on centers. Insulation shall be applied, only after pipe testing has been completed, in strict accordance with manufacturer's recommendations. 4,5

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13.6.2.14.1.5. Piping shall be pitched in accordance with the trade practices. All wall penetrations for piping shall be made by the Contractor and sealed after the completion of the work. Provide pipe sleeve for each wall penetration. All piping shall be adequately supported using pipe hangers from structural steel. Metal straps will not be permitted. Pipe hangers for insulated pipes shall have corrosion resistant sheet metal shields positioned between the insulation surface and the pipe hangers. 4,5

13.6.2.14.2. Testing and Refrigerant Charging. All sections of the refrigeration systems shall be pressure tested after piping has been completed. The system shall be pressurized with dry nitrogen, 150 psig low side and 400 psig high side, and all joints shall be checked for leaks with either a soap solution, or during nitrogen pressure testing, a small amount of refrigerant shall be pressurized with the dry nitrogen, and a halide torch leak detector used to determine leaks. After the system is found to be free of leaks by the above methods, it shall be allowed to stand for 24 hours under test pressure. If the system is still free of leaks, and there is no change in pressure allowing for change in ambient air temperature, the system shall be evacuated of the dry nitrogen for 12 hours, and charged with full charge of refrigerant. 4,5

13.6.2.14.3. Condensate Piping. The condensate piping from the air-conditioning unit drain pan shall be type M seamless copper tubing, provided with a trap at the unit and insulated with Armstrong Armalok 1/2-inch thick insulation with vapor barrier jacket or approved equal. 4,5

13.6.2.15. Control Systems 4,5

13.6.2.15.1. General 4,5

13.6.2.15.1.1. The Contractor shall install HVAC control systems that are complete and operable as specified herein and indicated on drawings. 4,5

13.6.2.15.1.2. The HVAC control systems equipment to be installed shall be designed, detailed, fabricated and tested in complete accordance with the requirements of the Specifications and applicable supplements included herewith. The Subcontractor shall provide drawings, data books and operating procedures specified herein and in the attached supplements. 4,5

13.6.2.15.1.3. All equipment shall be the manufacturer's standard products which are available on the open market and shall be arranged to provide convenient access for operation and maintenance, and to minimize space and spare parts requirements. 4,5

13.6.2.15.1.4. All electrical terminal points and terminals at all internal locations where periodic testing and maintenance are practiced shall be in accordance with the applicable ANSI and NEMA Standards. 4,5

13.6.2.15.2. Systems Components. All HVAC control systems components and materials shall be standard catalog products of the manufacturer and shall be of the types that have been in satisfactory use for at least two (2) years, unless otherwise specified herein. Each item shall be of the type, size, 4,5

capacity and range best suited for the intended use. The components shall be compatible with other related control system equipment provided by the Subcontractor or others. All components shall have the mounting brackets, covers, control linkages and related articles required to provide complete and properly functioning items.

13.6.2.15.2.1. Thermostats (Temperature Switch). Thermostats shall be equipped with a thermometer, metallic cover and means of field calibration and repair, and shall be capable of operating on a change of plus or minus one degree F at the thermostat location. All thermostats shall have adjustable setpoint mechanisms and heavy duty metallic guards. 4,5

a) Ventilated or mechanically cooled area

Summer cooling thermostat	60°F to 100°F
Winter heating thermostat	40°F to 90°F

b) Air conditioned area 60°F to 90°F

13.6.2.15.2.2. Insertion Thermostats. (Temperature Switch). Insertion thermostats shall be of either the rod and tube type for well applications or the liquid filled averaging type for duct applications. The averaging elements shall have an effective length of 15 feet or longer. Insertion thermostats shall be installed in separable wells with a heat conductive compound between well and element. Devices with hysteresis greater than 1 percent will not be acceptable. Outside air thermostats shall have sunshields and a 5 to 8 degrees F temperature differential. 4,5

13.6.2.15.2.3. Firestats. Firestats shall be the fixed-temperature, manual-reset, limit-controls type, set to break contact as the space temperature rises above 125 degrees F; unless otherwise specified. 4,5

13.6.2.15.2.4. Humidistats. Room humidistats shall be electric, snap action, hair element type with 20 to 80 percent externally adjustable setpoint. The operating differential shall be 4 to 6 percent. 4,5

13.6.2.15.2.5. Duct Humidistats. Insertion type humidistats shall be electric snap action with moisture sensitive nylon ribbon sensing element protected by a metal support bracket. An external knob on face of control shall be provided for set point adjustment. The operating differential range shall be 4 to 6 percent. 4,5

13.6.2.15.2.6. Electric Damper Operators. All electric damper motors shall be 115 volt ac two-position or proportional type as required by application. Two-position type damper motors shall have an integral spring to return the motor to its starting position when the power fails or is interrupted. The spring mechanism shall be field removable. 4,5

13.6.2.15.3. Electrical 4,5

13.6.2.15.3.1. All control components such as transmitters, controllers, timers and relays for pressure, temperature, etc.; switches for pressure, 4,5

temperature, control, etc.; relays and solid-state logic blocks, etc., shall be of the heavy duty type suitable for the application. Decision of the SFDI on suitability shall be final.

13.6.2.15.3.2. All electrical contact devices shall be of adequate design for the application with good wiping action and, unless otherwise specified, shall be readily accessible for maintenance. In no event shall the current rating be less than 200 percent of the actual operating value. 4,5

13.6.2.15.3.3. All electrical contact devices such as electromagnetic relays, switches of all types and contactors shall be subject to approval by the SFDI. 4,5

13.6.2.15.3.4. All control devices, including terminal boxes, conduit and wiring, shall be installed and tested prior to shipment. The installation of these devices shall be such that conduit and cable connections will not cause misalignment or incorrect operation. 4,5

13.6.2.15.4. Wiring 4,5

13.6.2.15.4.1. All modules, devices and assemblies of components shall be completely wired to interface terminal blocks for interconnecting with remote devices by the Contractor. 4,5

13.6.2.15.4.2. All wiring shall utilize continuous conductors without splices. Wiring installed across hinged joints shall utilize special hinge wire suitable for the application. 4,5

13.6.2.15.4.3. Each conductor shall have a permanently affixed identification band on each end that clearly identifies the conductor with its representation on the associated schematic and wiring diagrams. 4,5

13.6.2.15.4.4. Individual wires and bundles of panel wiring shall not have sharp 90 degree bends, but shall have adequate radius bends to prevent possible wire damage. 4,5

13.6.2.15.4.5. All internal wiring shall be switchboard type, 600 volt, Type SIS, stranded, tinned-copper conductor not smaller than No. 14 AWG. All wiring shall be capable of passing the IPCEA flame resisting test as specified in the IPCEA Publication No. S-61-402, Section 6.5. 4,5

13.7. Testing, Adjusting and Balancing 4

13.7.1. The Contractor shall furnish labor, materials, and instruments and bear all costs in connection with all tests. 4

13.7.2. A written notice shall be given by the Contractor to all concerned, in ample time, of date when tests will be conducted. 4

13.7.3. All concealed or insulated work shall remain uncovered until required tests have been completed, but if construction schedule requires it, prior tests on parts of system may be arranged when approved by the Construction Manager. 4

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13.7.4. As soon as conditions permit, conduct preliminary test of certain equipment as required and as directed by the Construction Manager, to ascertain compliance with specified requirements. Make needed changes, adjustments and replacements prior to acceptance tests. 4

13.7.5. All equipment, fans, and motors shall run at their required speed without undue vibration, objectionable noise, or sparking. 4

13.7.6. Properly lubricate all equipment motors, bearings and journals. At no time shall these components be allowed to heat to a temperature of 40 C. above ambient temperature. 4

13.7.7. Test, adjust and balance Roof Top Air Conditioning Unit, Air Handling Unit, ductwork, and adjust all air distribution devices to deliver air quantities specified and indicated on the Drawings for each outlet and inlet, or as required, in accordance with the procedures and standards described in the latest "SMACNA Balancing and Adjusting Manual." 4

13.7.8. Submit test results in duplicate on SMACNA forms, indicating air quantities at each supply, return and exhaust openings, all motor nameplate data to the Construction Manager for review and approval. 4

13.7.9. Make adjustments, repairs, alterations, as required to meet specified system performance. 4

13.7.10. Operating tests of heating and ventilating and air conditioning systems shall be made during heating and cooling seasons of the first year of operation at times when directed by the Construction Manager, for periods of 6 hours minimum for each system. 4

13.8. Cleaning 4

13.8.1. The Contractor shall keep the premises in a clean and orderly condition during construction. Waste and unusable material shall be promptly removed from the site. 4

13.8.2. All nameplates of equipment shall be kept clean for easy reading. 4

13.8.3. Upon completion of work, the Contractor shall clean all equipment, remove dirt and rubbish from tops of ducts and inside of ducts (disconnect and reconnect ducts from equipment if necessary), clean piping, remove surplus material and rubbish of every description incident to the work, leaving the work in neat and clean order and complete working conditons. 4

13.9. Documentation. Documentation shall be in accordance with Specification No. FJ50.50 and Engineering Standard FJ60.60. 4

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13.10. Service and Guarantee 4

13.10.1. After completion of the installation, the Contractor shall adjust all thermostats, control valves, motors and other equipment provided under this Contract. He shall place them in proper operating conditon subject to the approval of the Construction Manager. Air temperature shall be calibrated and completely adjusted so that all room thermostats and temperture controllers are maintaining required temperature in all portions of the building. The HVAC system specified herein shall be free from defects in workmanship and material from normal use and service. If, within twelve (12) months from the date of acceptance, by the Construction Manager, any of the equipment herein described is proved to be defective in workmanship or material, it will be adjusted, repaired or replaced free of charge by the Contractor. 4

13.10.2 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 Article. 4

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14.0. INSTRUMENTATION

14.1. Description of Work. The overall instrumentation work to be performed hereunder shall include but not necessarily be limited to:

14.1.1. Procuring, receiving, checking, documenting, unloading, placing in protective storage, transporting to place of installation, and installing all Government and Contractor furnished instrumentation equipment and materials.

14.1.2. The furnishing, delivering, mounting, tubing and testing of instrumentation designated as Contractor-furnished and installed as per the Instrument Index supplement.

14.1.3. The mounting, tubing and installing of Government-furnished instrumentation equipment and materials indicated as Contractor-installed as per the Instrument Index supplement.

14.1.4. Engineering, designing, fabricating and installation of Local Instrument Panels (LIP's) as specified herein and on the Local Instrument Panel Drawings supplement.

14.1.5. Provding material takeoff and furnishing of all materials and labor necessary for the erection, installation, testing and proper operation of the instrumentation.

14.1.6. Performing functional testing and initial calibration of all loose instruments and control valves associated with all the TSS, RS and PSS systems (See Appendices 1 and 3) and all Contractor-furnished instrumentation equipment.

14.1.7. Because of the nature and complexity of this Contract, the Contractor shall be responsible for coordinating with the SFDI, through the Constrction Manager, all scheduling and coordination requirements with other Contractors and equipment contracts as they interface with the scope of this Contract. The Contractor shall review his upcoming coordination interface requirements and report them directly to the Construction Manager. Conflicts with scheduling construction, deliveries and other Contractors shall be immediately reported to the Construction Manager in order that such conflicts may be mutually resolved by all parties so as not to delay the orderly scheduled completion of the Contract. 5

14.2. Work Performed By Others. The following related services and items will be accomplished or supplied by others and, as such, do not constitute a part of this Contract.

14.2.1. Refer to Article 19.6. 5

14.2.2. All phases of work on instrumentation materials and equipment furnished on skid assemblies.

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14.2.3. Procuring Government-furnished instruments and/or controls or panels.

14.2.4. Procuring, installing and testing of all instruments and/or controls or panels furnished by SCE.

14.2.5. All interconnecting wiring, cables, electrical raceways and electrical connection materials between local panels or between local panels and control room panels.

14.2.6. All interconnecting wiring, cables, electrical raceways and electrical connection materials from locally mounted electronic or electrical instruments, controls and miscellaneous devices to LIP's, control panels or termination cabinets.

14.2.7. All heat tracing and on-site installation thereof, except for Contractor supplied instrument tubing. 5

14.2.8. Heat tracing wire and terminations, except for Contractor supplied instrument tubing. 5

14.3. Testing.

14.3.1. General. The Contractor shall perform testing of all Government and Contractor-furnished instrumentation installed under this Contract as follows:

14.3.1.1. Leak test all tubing and piping.

14.3.1.1.1. The Contractor shall blow all tubing and pipe clear and test for leaks using instrument air, demineralized water, or nitrogen. Test pressure shall be 75 psig and care shall be taken to make certain that no instruments, controls or miscellaneous devices are connected. Systems will only be acceptable if they exhibit a zero leakage test using a bubbler or test gage. Where leaks do exist, they shall be found by using commercially 5
compounded solutions made specifically for the test medium being used. During 5
preliminary start-up operations, systems placed in service will again be checked at up to 1-1/2 times system pressure. Any leaks found at this time will be the responsibility of the Contractor.

14.3.1.1.2. LIP mounted instruments may be leak tested using the above procedure. All water shall be drained after testing and tubing shall be forced air dried. All instruments, controls and miscellaneous devices shall be then connected and all ports, openings, tube ends, etc., shall be closed with a tight fitting, plastic plug or cap to prevent the entrance of foreign materials. Plugs will not be removed until field run tubing or pipe is to be connected.

14.3.1.1.3. After testing, the Contractor shall CLOSE all root valves, instrument isolation valves, manifold valves and instrument air supply valves. Blowdown valves, manifold bypass valves and vents on filter-regulators shall be OPENED. The Contractor shall attach a "DO NOT

OPERATE" tag to each valve immediately after it is positioned. When tagging is complete, all final connections shall be made to instruments, controls and miscellaneous devices.

14.3.1.2. Perform functional testing and initial calibration.

14.3.1.2.1. All instruments, controls and miscellaneous devices installed by the Contractor (either locally mounted or installed on LIPs) shall be functionally tested to determine whether any damage has occurred during installation or shipment. Further testing shall ensure that ranges are as specified in manufacturer's documents and nameplates, and that tubing and piping are correctly connected.

14.3.1.2.2. All shipping stops, ties, chocks, etc., shall be removed prior to functional testing.

14.3.1.2.3. The Contractor shall verify to the Construction Manager that all testing shall be performed only by workers experienced in testing instruments and controls and shall follow procedures and tolerances outlined in the manufacturer's instruction books. 5

14.3.1.2.4. No fluids other than demineralized water or instrument air shall be used for functional testing and calibration, except as noted in paragraph 14.3.1.2.5. 5

14.3.1.2.5. Until such time as the instrument air system is placed in continuous service, the Contractor shall provide bottled air or nitrogen and regulators as required for testing and calibration of instrumentation and controls.

14.3.1.2.6. It shall be the Contractor's responsibility to provide temporary freeze protection, during functional testing and calibration, for instruments and/or tubing where demineralized water is used.

14.3.1.2.7. The Contractor shall coordinate, through the Construction Manager, the functional testing of displacement and float operated level controllers, transmitters and switches.

14.3.1.2.8. Functional testing shall be witnessed by the Construction Manager. Documents shall show the type of testing, testing results, date of testing, name of tester and signature of the inspector indicating satisfactory or unsatisfactory results.

14.3.1.2.9. Items that have not tested satisfactorily shall be handled as follows:

14.3.1.2.9.1. Improperly tubed items shall be retubed by the Contractor and both pressure testing and functional testing will again be performed as originally specified.

14.3.1.2.9.2. Improperly supplied items purchased by the Contractor shall be Contractor's responsibility to correct.

14.3.1.2.9.3. Improperly supplied items furnished by the Government shall be referred to the Construction Manager for correction.

14.3.1.2.9.4. Items damaged due to improper handling or testing by the Contractor shall be the responsibility of the Contractor to replace. The Construction Manager will assist the Contractor in obtaining the correct replacement for Government-furnished equipment.

14.3.1.2.9.5. Items damaged due to faulty manufacture shall be referred to the Construction Manager if supplied by the Government or shall be followed up by the Contractor when under the Contractor's supply.

14.3.1.2.9.6. Any replacement item shall be functionally tested as originally specified.

14.3.1.3. After the system, or a portion of the system, has been started, the Contractor shall continue to provide, at no additional expense to the Government, all specialized personnel and support labor required to correct defective material and workmanship and corrections as required and the work retested until system operation performance is proven satisfactory and acceptable.

14.3.2. Calibration Assistance (Refer to Article 19.6) 5

14.4. Contractor-Furnished Instrument.

14.4.1. The Contractor shall purchase and install miscellaneous locally mounted instruments and control valves. These are listed by tag number and service on APPENDIX 3. Data sheets are included in Appendix 4.

14.4.2. The Contractor shall check and approve instrument manufacturer's drawings for correctness and adherence to the specifications. All purchases shall be based on the prior submission by the Contractor and approval by the SFDI of these drawings. Drawing submittal shall be as specified in Engineering Standard FJ60.60.

14.4.3. The Contractor shall follow up and expedite delivery from the manufacturers to maintain required construction schedules. Copies of the delivery schedules shall be provided to the Construction Manager on a weekly basis.

14.4.4. All final drawings, instruction manuals, data sheets and similar documents received with the instruments shall be detached and identified with the instrument tag number. These shall be turned over to the Construction Manager no later than at the completion of this Contract.

14.4.5. Each instrument purchased shall have attached to it a permanent laminated phenolic nameplate tag engraved with the instrument tag number, using black letters on a white background. The tag shall be fastened directly to the instrument if room allows, or attached with stainless steel wire.

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14.4.6. Unless otherwise noted on the Instrument Data Sheet, the Contractor shall purchase instruments as manufactured by one of the following manufacturers or an SFDI-approved equal.

14.4.6.1. Differential Pressure Indicators - DPI.

(a) Barton ITT
(b) Ashcroft Division of Dresser Industries

14.4.6.2. Differential Pressure Switches - DPS.

(a) Ashcroft Division of Dresser Industries
(b) Barton ITT
(c) Mercoid Controls
(d) Barksdale Controls Div.
(e) Static "O" Ring, Inc.

14.4.6.3. Flow Glasses (Sight Flow Indicators) - FG.

(a) Ametek - Schutte & Koerting Div.
(b) Fisher & Porter Company
(c) Eugene Ernst Products Co.

14.4.6.4. Flow Switches - FS.

(a) Barton ITT
(b) Dwyer
(c) McDonnell & Miller ITT
(d) Magnetrol, Inc.

14.4.6.5. Level Glasses - LG.

(a) Daniel Industries
(b) Jerguson Gage and Valve Company
(c) Penberthy Division of Houdaille Industries, Inc.

14.4.6.6. Level Indicator - LI.

(a) Rochester Gauges, Inc.
(b) Hersey Products, Inc.

14.4.6.7. Level Switches - LS.

(a) Magnetrol, Inc.
(b) Mercoid Controls
(c) MSW
(d) VAREC

14.4.6.8. Pressure Indicators - PI.

(a) Ametek U.S. Gauge Division
(b) Ashcroft Division of Dresser Industries
(c) Helicoid Gauge Division
(d) Weksler Instruments Corp.
(e) Crosby Valve & Gage Co.
(f) Pacific Scientific

14.4.6.9. Pressure Switches - PS.

(a) Ashcroft Division of Dresser Industries
(b) Mercoid Controls
(c) United ELectric Controls Company
(d) Static "O" Ring, Inc.
(e) Automatic Switch Co.
(f) Barksdale Controls Div.

14.4.6.10. Temperature Indicators - TI.

(a) Ashcroft Division of Dresser Industries
(b) Weksler Instruments Corp.
(c) Palmer Instruments, Inc.
(d) Rochester Gauges, Inc.

14.4.6.11. Temperature Switches - TS.

(a) Ashcroft Division of Dresser industries
(b) United ELectric Controls Company
(c) Barksale Controls DIv.
(d) Automatic Switch Co.

14.4.6.12. Test Wells (Thermowells) - TW.

(a) Ashcroft Division of Dresser Industries
(b) United Electric Controls Company
(c) Weksler Instruments Corp.
(d) Leeds & Northrup
(e) Thermowell Co.

14.4.6.13. Pressure Indicating Transmitters - PIT.

(a) Bailey Controls
(b) Leeds & Northrup
(c) Foxboro Co.
(d) Beckman
(e) Rosemount

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14.4.6.14. Pressure Transmitters - PT.

(a) Bailey Controls
(b) Leeds & Northrup
(c) Foxboro Co.
(d) Beckman
(e) Moore Industries
(f) Rosemount

14.4.6.15. Level Transmitters - LT.

(a) Bailey Controls
(b) Leeds & Northrup
(c) Foxboro Co.
(d) Beckman
(e) Rosemount

14.4.6.16. RTD and Thermocouples with Thermowells - TE.

(a) Thermetric
(b) Pyco Inc.
(c) Leeds & Northrup
(d) Hy-Cal Engineering

14.4.6.17. Conductivity Element/Transmitter/Switch - CE.

(a) Beckman Inst.
(b) Foxboro Co.

14.4.6.18. Solenoid Valves - SOV.

(a) Automatic Switch Co.
(b) Skinner Electric Valve Division

14.4.6.19. Control Valves - PV, LV.

(a) Fisher Controls Co.
(b) Masoneilan International
(c) Kieley & Mueller Inc.
(d) Copes-Vucan
(e) Valtek
(f) Jamesbury Corp.

14.5. Instrument, Control and Miscellaneous Device Tubing Requirements.

14.5.1. Tubing, valves and fittings shall conform to the attached Engineering Standards Specification No. E1 (DOE 40P700-28S). Sizes and applicable Engineering Standards are shown on the attached Instrument Detail Drawings.

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14.5.1.1. Piping Materials Specification Sheets:

Eng. Std. No.	Title
SE00.ZBA	"ZBA" Instrumentation - Carbon Steel
SE00.ZBB	"ZBB" Instrumentation - Carbon Steel
SE00.ZCA	"ZCA" Instrumentation - Copper
SE00.ZSC	"ZSC" Instrumentation - Stainless Steel
SE00.ZSD	"ZSD" Instrumentation - Stainless Steel

14.5.1.2 Valve Specification Sheets:

Eng. Std. No.	Eng. Std. No.
V050	V900
V500	V901
V514	V5953
V515	V7889

14.5.2. Each run of tubing in an LIP shall be continuous from the entrance fitting to the first in-line fitting at the instrument, control or miscellaneous device. Routing shall be separate from the electrical conduits and other electrical raceways.

14.5.3. Wherever possible, no tubing run shall be placed in front or on top of another. When necessary, clearance shall be left for easy access and to prevent chafing.

14.5.4. Each run of tubing shall be so fitted that no strain or stress will be placed upon the instrument connections. Clamping and/or supporting of tubing shall not create any stress or strain.

14.5.5. Commercial one- and two-tube tubing clips and 2-piece tube clamps may be used. All tube clips, supports or clamps shall be removed and replaced without cutting or burning. Tube clips, supports and clamps shall be brass or cadmium plated steel.

14.5.6. Tubing shall be square cut using tube cutters. All ends shall be reamed to full tube inside diameter, and burrs shall be completely removed from cut. All bends shall be distinctly formed.

14.5.7. Tubing and pipe of filled thermal systems, filled pressure systems and any special manufacturer's supplied mechanical systems shall enter the LIP at the top and be fastened with a clip at that point. No clip or support shall be within 12 inches of the final connection and the final connection shall be piped or tubed so that it can be disconnected from the instrument without bending the tubing or without removing or slackening the clips or supports. Where LIPs are made in the Contractor's shop, filled thermal

systems, filled pressure systems and special manufacturer supplied mechanical systems shall be coiled and fastened so that no damage will take place during shipment.

14.5.8. All threaded joints shall be made up using "Tite Seal" or "Teflon" tape such as Crawford "Strip Teeze" or SFDI-approved equal.

14.5.9. All stainless steel tube fittings shall have the tube nut made up using antiseize compound where no integral provisions have been provided in the fitting.

14.5.10. All non-filled process, air supply and pneumatic signal tubing shall be terminated at the top of the LIP with bulkhead connectors. Piping shall be terminated at the top of the LIP with pipe couplings.

14.5.11. Each entry or exit of tubing, pipe or systems shall be identified at the bulkhead bracket. This identification can be made with a permanently attached metal tag or stamped directly to the bulk bracket with the instrument tag number to which it connects. In addition, pneumatic signals shall be identified as to input (including terminal) or output and differential pressure instrument primary inputs shall be identified by "H" for (high) and "L" for (low).

14.5.12. Primary sensing tubing and instrument air tubing shall not be run in the same tray.

14.5.13. Tubing runs requiring the use of couplings shall have the tubing bent to lift the coupling from the tray for ease of maintenance.

14.5.14. All tubing and piping shall be adequately supported and protected by trays or steel channel. Tubing trays shall be according to Tubing Raceway, Typical Installations Instrument Detail Drawing DOE No. 40I7002133059 Sheets I4-18 and I4-19.

14.5.15. Tubing runs between buildings shall be run in conduit or duct banks provided for this purpose. Tube clips, supports and clamps may be used; they shall be brass or cadmium plated steel, galvanized steel or extruded aluminum.

14.5.16. Capillary lines for filled thermal systems, filled pressure systems and any other special manufacturer's systems shall be run in trays, separate from primary sensing and pneumatic tubing.

14.5.17. Tubing that requires heat-tracing shall be supplied with integral, self-regulating heat trace, insulation and overall protective jacket similar to Samuel Moore and Company Type 2156 or Type 2166. Manufacturer's standard termination and junction hardware and fittings shall be used. Tubing size, wall and material in these prepackaged systems shall be that specified in the Instrument Detail Drawing for that item.

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14.6. Materials.

14.6.1. The Contractor shall furnish the following material as shown on the attached LIP Drawings and as specified herein:

14.6.1.1. All shapes, plate, pipe, angles, hardware and welding materials including filler rod, required to make the Local Instrument Panels (LIPs) and to mount local instruments, controls and miscellaneous devices.

14.6.1.2. All anchors, shims, supports and grout for installing control devices, miscellaneous floor mounted supports and LIPs.

14.6.1.3. All piping, tubing, fittings, specialties and valves, all supports and fasteners, all pipe thread and compression fitting lubricants, antiseize compounds and sealants, etc., to install instruments, controls and miscellaneous devices and to install piping and tubing from instruments to termination.

14.6.1.4. All materials for surface preparation, priming and finishing of LIP assemblies.

14.6.1.5. All materials for nondestructive and functional testing.

14.6.1.6. All materials for cleaning and protecting the finished LIP assemblies.

14.6.1.7. All materials for temporary protection, including freeze protection, of locally mounted instruments, LIPs, controls and miscellaneous devices during construction.

14.6.1.8. All tube trays, raceways and supports.

14.7. Local Indicating Panels (LIPs) (As Required).

14.7.1. Fabricate all LIP assemblies.

14.7.1.1. All materials shall be as stated under materials for local panels in the General Notes on the attached drawing 4017002133059, Sheet I4-20.

14.7.1.2. LIP's shall be fitted with lifting lugs so positioned as to give an even lift to the rack. Lugs shall be accessible after protection for shipment and removed after onsite setting.

14.7.1.3. LIPs shall be securely fastened to the floor, platform supports or other support structure. LIPs set on concrete floors shall have baseplates grouted.

14.7.1.4. Exposed portions of welded seams in all LIPs and local supports shall have welding slag removed and shall be smooth. All component sections joined by bolted clips and shapes and all panel cutouts and drillings shall be deburred and ground smooth.

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14.7.1.5. All LIP surfaces shall be plumb, straight and true before finishing. All mill scale shall be removed from flat plate.

14.7.1.6. Except as approved by the Construction Manager, all LIPs and local supports shall be cleaned and prime painted to protect exposed metals. All surfaces of the LIPs shall then be covered with two (2) coats of the approved paint.

14.7.2. Mount on the LIPs all instruments, controls and miscellaneous devices.

14.7.2.1. All LIP Instruments shall be mounted as shown on Local Instrument Panel drawings. Interchanging of instruments on the same LIP may take place to effect better piping and/or tubing layout. All instruments shall be level and plumb.

14.7.2.2. All equipment shall be mounted securely in accordance with the methods shown on the manufacturer's certified mounting drawing using, the manufacturer's mounting hardware. Any instrument requiring additional support in the judgement of the Construction Manager shall be provided with the required support.

14.7.2.3. Manufacturer's certified dimension and mounting drawings shall be used to establish cutout dimensions, drillings, center-to-center minimum mounting dimensions and maintenance and removal clearances. No deviation shall be made from the allowable limits in these drawings.

14.7.2.4. The top of all items mounted in cutouts on the LIP shall be aligned so that the uppermost part of the bezels are along a horizontal line. Vertical centerlines shall also be on the same line where items of the same relative size are mounted one above the other. All miscellaneous devices not mounted in cutouts shall be mounted in an orderly manner.

14.7.2.5. Each LIP shall be identified by a nameplate showing the LIP number. Each instrument, control or miscellaneous device shall be identified by a nameplate in accordance with the Instrument Data Sheets. All nameplates shall be securely fastened to the face of the LIP under the instrument.

14.8. Local Instrument Installation.

14.8.1. All equipment not mounted on LIPs, shall be mounted securely in the best location near its primary sensing source or final control device to meet operations and maintenance convenience requirements and to meet all special requirements stated by the manufacturer where these requirements are paramount.

14.8.2. Mounting brackets, methods and material shall be in accordance with methods shown on the manufacturer's Certified Mounting Drawing using, where supplied, the manufacturer's mounting hardware. Any item requiring additional support in the judgement of the Contractor shall be provided with the required support. Minimum clearance and/or removal shall be observed.

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14.8.3. The Contractor shall install all screwed thermowells and welded thermowells which are not supplied in GFE pipe. The Contractor shall be responsible for correct mechanical installation of direct reading thermometers and resistance temperature detectors. Thermowells shall be clear of all foreign materials and corrosion before installation of the temperature sensitive device. 4 4

14.8.4. Displacement and float type level switches and controllers shall be installed in accordance with the Tank Trim Detail Drawing and Level Setting Drawing. The instrument air supply, input and output from pneumatic instruments and controllers shall be installed in accordance with the Instrument Detail Drawings.

14.8.5. Instruments, controls and miscellaneous devices mounted in the weather or in unheated areas shall be provided with protective instrument housing complete with insulation, heater and weathertight seals similar to Winston Manufacturing Corporation, Series 800. In areas where radiant heating from the sun can overheat the enclosure, a shed shall be provided. Temperature within the enclosure shall not fall below 50 F or go above 120 F.

14.9. Quality of Work.

14.9.1. All LIPs shall be structurally sound, free standing and neat in appearance.

14.9.2. Instruments shall be mounted free from stress and vibration.

14.9.3. Instruments shall be readily accessible for maintenance and convenient to operations.

14.9.4. All tubing, piping, fittings, specialties and valves shall:

14.9.4.1. Be installed in neatly arranged runs and bends with no sags or bows in the tubing. Tubing bends shall be made with industrial quality tubing benders.

14.9.4.2. Have valves placed in convenient locations for operation and maintenance.

14.9.4.3. Have valves and fittings arranged in orderly arrays at points of concentration.

14.9.4.4. Be supported in neatly run trays, raceways or supports.

14.9.5. The work shall be performed by qualified workmen in strict accorance with the Contract Drawings and this Specification.

14.9.6. The Contractor shall furnish and/or utilize new materials and equipment only in performance of all work under this Contract.

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14.10. Special Tools and Devices. One (1) complete set of special tools and devices, including metric tools and other hand tools that are not standard in the United States, required for operation and maintenance of the equipment furnished under this Contract shall be furnished with the equipment, in a separate container clearly identified with the name of the equipment. These tools and devices shall be in a new and unused condition on delivery.

14.11. Spare Parts.

14.11.1. Item 4 of Engineering Standard No. FJ60.60T shall include the following:

14.11.1.1. A list of recommended spare parts for Contractor-supplied instruments. Such listing shall include part numbers, descriptions, quantities and unit prices for all spare parts recommended to be carried in stock by the Purchaser for maintenance purposes.

14.11.1.2. The unit prices shall be based on such recommended spare parts being included in these Specifications at the option of the Purchaser either in whole or in part, and delivered with the equipment.

14.12. Additional Documentation.

14.12.1. Manufacturer's name, model number, and all other required data on the spaces indicated on the data sheets attached as supplements hereto. These data sheets shall be submitted together with drawings, diagrams, bills of material complete with prices and descriptive literature required to define equipment to be supplied.

14.12.2. One (1) set of marked Instrument Detail Drawing showing the As-Built corrections and additions. This shall be done as soon as each installation is complete. Later modifications shall be submitted in a similar manner.

14.12.3. A complete set of as-built drawings of LIPs, arrangement drawings, and tubing and wiring diagrams.

14.12.4. Copies of all test reports for the tests specified herein.

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15.0. TESTING REQUIREMENTS, REPORTS AND PROCEDURES 5

This Article covers testing to be performed during the course of construction of the systems and equipment installed under this Contract. Testing performed during production and/or fabrication of the equipment specified by this Contract is also addressed.

15.1. Construction Testing.

15.1.1. Construction testing includes all tests to be performed by the Contractor during the initial assembly and installation of the specified equipment, devices and systems to verify that the installation and adjustment of the equipment, devices and systems has been properly performed and that all equipment as installed is mechanically functional and ready for start-up testing and operation. These tests shall include, but not be limited to, hydrostatic and leak tests, and equipment alignment checks.

15.1.2. These tests shall be considered as part of the mechanical equipment or system installation. The Contractor shall furnish competent supervision, personnel and test equipment and any rental equipment required for testing and adjustment of all equipment erected and/or installed by the Contractor. The Contractor will also provide, install and remove, after testing, all temporary piping required for these tests and return all piping to its design configuration. 5

15.1.3. The Contractor shall perform testing in accordance with the following procedures:

15.1.3.1. Prior to any testing, the Contractor shall furnish to the Construction Manager for his approval a written procedure for those common or generic construction tests to be performed for each system, i.e., hydrostatic, pump alignment, etc., as specified by this Contract. The procedures shall contain blank data sheets to record the results of the test and specific test parameters.

15.1.3.2. Prior to performance of any testing, the Construction Manager will issue to the Contractor a Construction Test Checklist for each system. This will provide the Contractor with a checklist of the generic tests to be performed for each system.

15.1.3.3. All tests shall be accomplished with Construction Manager-approved procedures and only with the approval of the Construction Manager. Deviation from these procedures shall require approval of the Construction Manager. Scheduling of these tests will be the responsibility of the Construction Manager and the Contractor to establish.

15.1.3.4. Deleted. 4,5

15.1.3.5. Filling, flushing and start-up of the TSS shall be in accordance with the "Filling, Flushing and Bed Conditioning Procedure for TSS" included as a part of these specifications. Refer to Paragraph 19.2.3. 5

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15.1.3.6. The Contractor shall record the results of all tests conducted by him on the appropriate data sheets and furnish these to the Construction Manager at the completion of each test for approval. The test results shall meet or exceed the criteria specified, or be approved as acceptable by the Construction Manager. 4,5

15.1.3.6. Upon completion of all construction tests for a system, the Contractor shall furnish to the Construction Manager a package including, but not necessarily limited to, the completed Construction Test Checklist, approved test data sheets, completed special test procedures, and maintenance records for equipment in the system as applicable. 4

15.2. Manufacturing Tests

15.2.1. Manufacturing tests are those tests performed during the production of materials and the production and/or fabrication of equipment specified by this Contract before they are installed as part of the operating plant.

15.2.2. The Contractor shall perform, or require performance of, the manufacturing tests as defined in various articles throughout this Contract.

15.2.3. The Contractor shall submit to the Construction Manager for review and acceptance reports of all manufacturing tests, where required, in accordance with Article 4.0. "Drawing and Data Submittals" and as listed in Engineering Standard FJ60.60 attached. If submittal of a test report for any specified test is not required, the Contractor shall submit written certification that the specified manufacturing test was performed.

15.3 Construction Tagging Procedures. The Contractor shall use the SCE tagging procedure.

15.4 Start-Up Tests. Refer to Article 19.0. 4,5

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16.0. PRIME AND TOUCH-UP PAINTING

This Article covers surface preparation, prime painting and touch-up painting, both shop and field, as applicable to the work installed under this Contract.

16.1. General.

16.1.1. Shop Prime Painting. Except as excluded below from prime painting, all ungalvanized ferrous surfaces shall receive the specified surface preparation and prime painting in the shop before shipment to the field.

16.1.2. Field Painting.

16.1.2.1. Field-fabricated structural and miscellaneous steel, unprimed non-insulated pipe, and field-installed bolting, shall receive the specified surface preparation and be prime painted in the field.

16.1.2.2. Damaged areas of shop primer shall be touched up in the field, using the same primer as used for the shop coat.

16.1.2.3. Abraded or corroded areas of galvanizing shall be touched up using the specified galvanizing repair paint.

16.1.3. Surfaces Not to be Painted. Prime paint shall not be applied to the following surfaces, and any paint coming in contact with the following surfaces shall be promptly removed:

Pipe, valves and fittings which are to be buried or insulated.
Factory-finish painted surfaces.
Threads.
Name and data plates.
Indicator scales and pointers.
Galvanized surfaces.
Surfaces of stainless steel, aluminum, brass, bronze, rubber, neoprene, plastic, fabric or glass.
Machined mating surfaces of piping and equipment.

16.1.4. Painting of Equipment. Shop painting of equipment shall be as indicated elsewhere in this Specification.

16.2. Materials.

16.2.1. Prime Paint. Except as noted below, the prime paint for both shop and field use under this Contract shall be an approved rust-inhibitive primer meeting the following requirements, and shall be a single product and color of the manufacturer.

16.2.1.1. Type: "Universal" alkyd or modified alkyd base, medium length, penetrating rust-inhibitive primer.

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16.2.1.2. Drying time to handle: 2 to 4 hours, minimum.

16.2.1.3. Minimum solids content: 55 percent by volume.

16.2.1.4. Acceptable color: Red, green, gray, blue or white.

16.2.2. Primer for Hot Surfaces. Prime paint for ungalvanized ferrous surfaces which will remain exposed to view in the finished work and which will be subject to operating temperatures of 200 degrees F or higher, shall be a heat-resistant primer which is suitable for service at the maximum operating temperatures to be encountered, and which is suitable for field finish painting by others.

16.2.3. Galvanizing Repair Compound. Galvanizing repair compound shall be Galvanox Type 1 as manufactured by the Subox Division of Carboline Company, or a Construction Manager approved equal zinc-rich galvanizing repair compound, gray in color.

16.2.4. Thinner. Thinner shall be as recommended by the manufacturer of the product to be thinned.

16.2.5. Cleaning Solvents. Solvent for cleaning steel surfaces shall be SOCAL No. 2 or an approved equal solvent which does not leave a greasy film which would interfere with adhesion of the prime paint. Solvent for cleaning galvanized surfaces shall be xylol.

16.3. Shop Painting.

16.3.1. Surface Preparation. Ungalvanized ferrous surfaces not excluded above from prime painting, shall be prepared in accordance with Steel Structures Painting Council Specification SSPC-SP6, "Commercial Blast Cleaning." These surfaces shall then be thoroughly wiped down to remove all traces of grit or other contaminants, and solvent cleaned in accordance with SSPC-SP1 prior to application of the prime coat.

16.3.2. Application. Prior to any deterioration of the prepared surfaces, those surfaces not excluded from painting shall be given one or more coats of primer for a total dry film thickness of not less than 2 mils. Application of the prime paint shall conform to SSPC Specification SSPC-PA1, "Shop, Field and Maintenance Painting" and the printed recommendations of the paint manufacturer. Prime paint shall be stopped back approximately 3 inches from joints to be field welded.

16.3.3. Match Marking. Following shop fabrication, and prime painting if required, all shop fabricated piping and structural steel shall receive painted or stenciled match or piece marks identical to those on the Contractor's shop and erection drawings.

16.4. Field Painting. Immediately upon detection, all damaged areas of shop primer, and galvanized areas that have been abraded, field cut, or damaged by field welding, shall be prepared and touch-up painted. Upon

completion of field welding of connections from which shop priming was stopped back, the areas from which shop primer was omitted shall receive surface preparation and prime painting as specified below. Field-installed structural bolting shall not receive surface preparation and prime painting until tightened, inspected and approved.

16.4.1. Surface Preparation. Ungalvanized surfaces to receive field touch-up prime painting, galvanized surfaces to receive field touch-up with galvanizing repair compound, and field-installed fasteners to be prime painted, shall be prepared in accordance with Steel Structures Painting Council Specification SSPC-SP3, "Power Tool Cleaning."

16.4.2. Application. Application and curing of the prime paint and galvanizing repair compound shall be in strict accordance with the manufacturer's instructions and SSPC Specification SSPC-PA1, "Shop, Field and Maintenance Painting."

16.4.2.1. Touch-up areas on prime painted ungalvanized steel shall be given one (1) coat of the same prime paint as used for the shop coat.

16.4.2.2. Touch-up areas on galvanized surfaces shall be given a minimum of two (2) coats of galvanizing repair compound.

16.4.2.3. Field structural bolting shall be given one or more coats of the same prime paint as used for the adjacent surfaces.

16.5. Touch-Up Painting. The Contractor shall be responsible for touch-up painting of equipment he installs. Touch-up paint for each shop painted surface shall be compatible with and shall, as nearly as possible, match the color, shade and gloss of the factory applied paint when dry. The paint shall be either obtained from the manufacturer of the item or shall be as recommended by the manufacturer. Touch-up paint for abraded or corroded areas of galvanized surfaces shall be as specified. The paint manufacturer's recommendations for storage and use of his product shall be complied with. Painting outdoors shall be performed only during favorable conditions of weather and temperature. Touchup of factory finish painted surfaces shall consist of one coat, unless a second coat is required to more closely match the adjacent finish. Touchup of galvanized surfaces shall consist of two coats.

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17.0 MISCELLANEOUS ITEMS OF WORK

This Article describes specific requirements for miscellaneous items of work required under this contract. The requirements set forth in this Article 17.0 are in addition to those requirements specified in Article 5.0, GENERAL REQUIREMENTS.

17.1 Miscellaneous Structural Steel

17.1.1. General. The Contractor shall detail, furnish, fabricate, deliver and erect the structural and miscellaneous steel for the structures listed or indicated as part of the work of this Contract. Work hereunder shall comply with the applicable requirements of the referenced codes, standards and publications.

17.1.2. Design. The engineering drawings furnished herewith are descriptive of the requirements for the structural and miscellaneous steel to be furnished, but do not attempt to describe all connection design details. Such additional designing and detailing shall be the responsibility of the Contractor, and shall have been submitted for review and received approval before fabrication.

17.1.2.1. Unless otherwise shown on drawings or approved in writing, shop connections shall be welded, and field connections shall be bolted.

17.1.2.2. Connections shall be designed in accordance with the typical details shown on the drawings and the following: AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings" and "Code of Standard Practice," and the San Bernardino County Building Code.

17.1.2.3. Field connections for secondary members, such as stairs, ladders and handrails may be bearing-type connections made with "common" or regular bolts conforming to ASTM A307.

17.1.2.4. Bolted connections on the structural members shall be bearing type connections with threads in shear planes, or friction type connections, all made with ASTM A325 high-strength bolts.

17.1.2.5. Load indicator washers shall be used under the non-turning part for all high-strength bolts.

17.1.2.6. Minimum field connections shall contain not less than two bolts and shall be capable of resisting a 10 kip load.

17.1.2.7. Field welding of connections will be permitted only where indicated on the contract drawings or on shop drawings reviewed by the Construction Manager.

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17.1.2.8. Working points on columns, beams, trusses and braces shall be concentric, where practical. The design of connections shall take any eccentricity into account.

17.1.3. Materials. Materials shall conform to the latest editions of the specified codes and standards, as indicated and as specified herein.

17.1.3.1. Structural Steel. Structural steel shapes, plates and bars shall conform to ASTM A36.

17.1.3.2. Pipe. Steel pipe for handrail shall conform to Engineering Standard DC21.01.1T.

17.1.3.3. High-Strength Bolting. High-strength bolts, nuts and plain washers shall conform to ASTM A325 "Standard Specification for High-Strength bolts for Structural Steel Joints," Including Suitable Nuts and Plain Hardened Washers.

17.1.3.4. Common Bolting: Common bolts, nuts and washers shall conform to ASTM A307, Grade A.

17.1.3.5. Load Indicator Washers. Load Indicator Washers shall be as manufactured by Cooper-Turner Inc, or a Contracting Officer approved equal.

17.1.3.6. Stud Connectors. Weldable steel stud connectors shall be of the automatic-end-weld type. Application shall be in accordance with the manufacturer's printed instructions.

17.1.3.7. Welding Electrodes. Welding electrodes shall be Series E7018 low hydrogen shielded metal arc electrodes conforming to the American Welding Society Specification A5.1 or A5.5.

17.1.3.8. Miscellaneous Items. Miscellaneous items not specifically described, but required for completion of the work shall, as nearly as practicable, be of standard types. The Contractor shall furnish and install the bolting, fasteners, shims, load indicating washers, and other supplies necessary for completion of field erection. In addition, the Contractor shall furnish fit-up bolts, drift pins and welding electrodes required for both temporary and permanent connection of the component parts of the structural steel during field erection.

17.1.3.9. Galvanizing. Items designated as "galvanized," shall be hot-dip zinc coated with coatings conforming to ASTM A123. Galvanizing procedures shall be in accordance with ASTM A143 and A384. Items to be galvanized shall have all cutting, banding and welding completed prior to galvanizing.

17.1.4. Fabrication.

17.1.4.1. Material shall be fabricated and assembled in the shop to the greatest practical extent.

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17.1.4.2. Bolting shall conform to the "Research Council Specification for Structural Joints Using ASTM A325 or A490 Bolts" and to applicable AISC Standards and Specifications.

17.1.4.3. Work shall be performed in accordance with drawings prepared by the Contractor, and shop drawings as approved or reviewed by the Contracting Officer.

17.1.4.4. The Contractor shall be responsible for all errors in detailing and fabrication and for correct fitting and attachment of structural members.

17.1.5. Shop Welding.

17.1.5.1. Welding and Welding Operators. Shop production welding performed under this Contract shall be performed in accordance with AWS D1.1, applicable AISC Standards and Specifications, and the approved shop drawings. This production welding shall be performed only by welding operators who have qualified in accordance with AWS D1.1. Proof of such qualification shall be furnished to the Construction Manager in accordance with Standard FJ60.60 and Article 4.0, DRAWING AND DATA SUBMITTALS.

17.1.5.2. Weld Inspection Personnel. It shall be the responsibility of the Contractor to assure that weld preparation and welds are inspected in the fabricator's shop and found satisfactory before shipment to the field. Inspections shall be at the Contractor's expense. Visual inspection for correct joint preparation and fit-up before release for welding, and visual inspection of completed welds, shall be performed by a qualified welding inspector acceptable to the Construction Manager. Evidence of the qualifications of the proposed inspector shall be furnished to the Construction Manager not less than 4 weeks prior to start of production welding.

17.1.5.3. Care and Use of Low-Hydrogen Electrodes. The Contractor shall ensure that his fabricator provides and uses acceptable electric ovens and complies in all respects with AWS D1.1 in the pretreatment, use and care of the low-hydrogen electrodes used hereunder.

17.1.5.4. Levels of Inspection. All shop welds performed on the structural and miscellaneous steel for this Contract shall, as a minimum, receive inspection in accordance with the following.

17.1.5.4.1. Welds, regardless of size, type and location, shall be visually inspected for proper joint preparation and fit-up before release for welding.

17.1.5.4.2. Completed welds shall be visually inspected for compliance with AWS D1.1 and the approved shop drawings.

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17.1.5.5. Minimum Weld Quality Requirements. Welds shall meet the visual workmanship and freedom from defects requirements of AWS D1.1.

17.1.5.6. Correction of Defects. Unacceptable defects in welds which are disclosed by inspection shall be repaired and proved acceptable by reinspection, using the appropriate inspection method or methods, before shipment to the field.

17.1.6. Painting. Surface preparation, shop prime painting and field touchup of structural and miscellaneous steel shall be performed in accordance with Article 16.0., PRIME AND TOUCH-UP PAINTING.

17.1.7. Shop and Erection Drawings. The Contractor shall submit shop and erection drawings to the Construction Manager for review and comment. Review of such drawings shall not relieve the Contractor of the responsibility for errors which may exist, and the Contractor shall be responsible for all dimensions, detail design, and fabrication of the work. Material shall not be fabricated or delivered to the jobsite before the Construction Manager's review of the shop and erection drawings has been completed and the indicated revisions, if any, have been made.

17.1.7.1. The drawings shall include shop and erection details, including cuts, copes, connections, holes, bolts and welds in structural steel. Welds shall be in accordance with the shop drawings. The drawings shall show size, length and type of each weld.

17.1.7.2. Before commencing detailing, the Contractor shall submit for approval the piece-mark system which he proposes to use. The system shall indicate the location of each piece within the particular structure, either in the piece-mark or with appropriate notation on the detail sheet. The piece mark shall also identify the sheet on which the piece is detailed.

17.1.7.3. Submittals shall in addition, comply with the requirements of Article 4.0., DRAWING AND DATA SUBMITTALS.

17.1.8. Erection.

17.1.8.1. The work shall comply with the AISC "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings," the "Code of Standard Practice for Buildings and Bridges," and the "Manual of Steel Construction," unless otherwise specified or noted on the approved drawings.

17.1.8.2. Use of gas cutting for correction of errors will not be permitted. The methods to be used in the correction of errors will require the prior approval of the Construction Manager.

17.1.8.3. Throughout the period of structural steel erection, members shall be suitably and adequately braced and guyed to resist wind and other loads which may be imposed on the incomplete structure.

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17.1.8.4. Except where welded connections are shown on the approved drawings, all field connections shall be bolted.

17.1.8.5. High-strength bolted connections shall conform to the latest edition of the AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts," the Drawings, and the following:

Hardened plain washers in accordance with ASTM A325 shall be used under the turned element of all high-strength bolts.

Load Indicator Washers shall be used under the non-turning part of all high-strength bolts.

17.1.8.6. Prior to tightening of bolts, all plies of the connection shall be drawn into firm contact. Bolt tightening shall progress from the most rigid part of the connection to its free edges.

17.1.8.7. Tightening of high-strength bolts installed in accordance with the above requirements shall be as follows. The clamping force shall have caused the protrusions on the washers to partially flatten and reduce the gap between the load indicator washer and the hardened surface of the bolt-nut assembly to the prescribed measurement established by the manufacturer of the load indicator washers.

17.1.8.8. "Common bolt" connections shall be tightened to a "snug-tight" condition. "Snug-tight" is defined as the full effort of a man using an ordinary spud wrench. Such connections shall be made with ASTM A307 Grade A bolts as specified and/or shown on the approved drawings.

17.1.8.9. Drift pins may be used to bring parts into alignment, but shall not be used in a manner which will distort or damage the structural steel. Gas cutting shall not be used to enlarge holes. Suitable reaming devices shall be used if enlargement of holes is necessary.

17.1.8.10. Connections or splices shall not be made in the field except where shown on the approved drawings or specifically approved by the Construction Manager.

17.1.8.11. After assembly, the various members forming parts of a completed frame or structure, shall be accurately aligned and adjusted before being permanently fastened. Tolerances shall conform to the AISC "Code of Standard Practice for Steel Buildings and Bridges." As erection progresses, the work shall be fastened to resist all dead load, wind and erection stresses. Bolted connections, both shop and field, shall be inspected for proper tightening.

17.1.8.12. Compression member splices shall be fastened only after abutting surfaces have been brought completely into contact. Bearing surfaces and surfaces that will be in permanent contact shall be cleaned and have burrs removed before assembly.

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17.1.9. Field Welding.

17.1.9.1. Field welding of structural steel shall not be permitted unless shown on the approved drawings, or specifically approved for the particular instance, by the Construction Manager.

17.1.9.2. Prior to use of welders on the work, the Contractor shall submit qualification test reports for each welder for each class of work to be done by that welder, in accordance with the governing codes. Submittal shall be in accordance with Engineering Standard FJ60.60, attached, and Article 4.0, DRAWING AND DATA SUBMITALS.

17.1.9.3. Field welding of structural steel shall be performed only by welders who have qualified in accordance with AWS D1.1.

17.1.9.4. Field welding of structural steel, where permitted, shall be performed in accordance with the requirements shown on the approved drawings and the requirements of AWS D1.1 "Structural Welding Code" and addenda thereto, and the requirements of AISC "Specification for Design, Fabrication and Erection of Structural Steel for Buildings."

17.1.9.5. The Contractor shall provide and use acceptable electric ovens and shall comply in all respects with AWS D1.1 in the pretreatment, use and care of the low-hydrogen electrodes used hereunder.

17.1.10. Field Weld Inspection. Throughout erection of structural and miscellaneous steel, field welds shall be visually inspected for proper joint preparation and fit-up before release for welding, and shall be visually inspected after completion for compliance with the approved drawings and the Codes and Standards referenced above.

17.1.10.1. Field weld inspection shall be performed by and at the expense of the Contractor, utilizing a qualified Contractor-furnished welding inspector acceptable to the Construction Manager. Evidence of the qualifications of the proposed inspector or inspectors shall be furnished to the Construction Manager not less than 4 weeks prior to start of field erection.

17.1.10.2. Unacceptable defects in field welds disclosed by inspection shall be repaired and proved acceptable by reinspection.

17.1.11. Miscellaneous Steel. Miscellaneous steel shall be erected in accordance with the approved drawings and general requirements specified herein.

17.1.11.1. Where grating or floor plate is cut or coped for passage of columns or piping, additional support angles shall be installed beneath the grating or floor plate as required. The gap between the columns and grating or floor plate shall not exceed 1 inch.

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17.2. Perimeter Shield at 15th Level.

17.2.1. General. The Contractor shall detail, furnish, fabricate, deliver, and install the 15th level perimeter shielding on structural steel framing previously installed by others. This work shall include top and corner flashing as detailed on the drawings, and shall comply with the applicable requirements of the referenced codes, standards and publications.

17.2.2. Materials

17.2.2.1. Shielding material shall be steel decking in conformance with the AISI's latest "Specification for the Design of Cold Formed Steel Structural Members." The material shall be ASTM A446 steel sheets, roll formed in 24 inch wide sections with custom cut lengths. The units shall have a depth of 1-1/2 inches and four flutes 6 inch on centers. The units shall be fabricated from 20 guage steel and be provided with an interlocking side lap. The steel shall be hot dipped galvanized in accordance with ASTM-A525, G90.

17.2.2.2. Flashings shall be formed from steel sheets conforming to ASTM-A446 and hot-dipped galvanized in accordance with ASTM-A525, G90.

17.2.2.3. Fasteners shall be #14 stainless steel hex head screws having a length of 3/4 inch.

17.2.3. Erection. The decking units shall be installed to span vertically as shown on the drawings. The units shall be attached to the supporting steel at every flute. Flashing shall be attached with fasteners spaced at a minimum of 12 inch O.C.

17.3. Concrete Work.

17.3.1. General. This Article shall govern all concrete work of this Contract. Concrete work shall be in accordance with ACI 318 and as specified herein.

17.3.1.1. Concrete Supply. The Contractor shall arrange for his own concrete supply, and shall be responsible for his concrete supply meeting specified requirements, including, but not limited to, strength requirements, cement type and content, aggregate size and slump.

17.3.1.2. Sampling and Testing. Sampling and testing as necessary to determine specification compliance of concrete materials, concrete at point of placement, and hardened concrete in-place, will be performed by a Testing Agency retained by the Construction Manager.

17.3.1.3. Design Mixes. The Contractor shall furnish the Construction Manager three (3) copies of his concrete supplier's design mix applicable to the class of concrete to be furnished. Concrete placed in the work of this Contract shall conform to its design mix. Following submittal of design mix, the sources of materials, type of cement, and mix proportions shall not be

changed without the Construction Manager's prior approval. With the design mix, the Contractor shall submit certification from an approved testing laboratory that (1) the aggregate which will be used in the concrete will not create an alkali-aggregate reaction and (2) that the mix will produce the concrete strength specified. Such certification shall be based upon chemical testing, petrographic analysis of aggregate samples, or other methods acceptable to the Construction Manager.

17.3.2. Materials Other Than Concrete

17.3.2.1. Admixtures. Air-Entraining Admixture, when required, shall conform to ASTM C260.

17.3.2.2. Reinforcing. Reinforcing bars shall be new deformed billet steel bars conforming to ASTM A615 Grade 60, except for ties and stirrups which shall conform to ASTM A615 Grade 40 or Grade 60.

17.3.2.3. Reinforcement Accessories. Reinforcement accessories shall be free from flake rust, scale, grease, clay, and other coatings or foreign substances which would reduce the bonding qualities. Materials shall be as follows:

17.3.2.3.1. Tie wire shall be annealed wire, not less than No. 16 gage, of suitable quality for securing reinforcement in place.

17.3.2.3.2. Bar supports shall be standard bright basic wire sufficiently heavy to properly carry the steel they support, or shall be precast concrete blocks. Wire pieces and number of supports shall conform to specifications for placing accessories as published by the Concrete Reinforcing Steel Institute.

17.3.2.4. Forms. Material for form work shall consist of wood, metal or other approved material, free from surface defects which might affect the finished concrete. The type of material is optional with the Contractor unless specific requirements are indicated on the Drawings. Contact forms for exposed surfaces shall be plywood, metal or other approved smooth surface material.

17.3.2.5. Embedded Items. Inserts, anchor bolts, pull anchors, conduit, and other devices for embedment in concrete shall be of standard manufacture, and of approved types as detailed, specified, or otherwise required to satisfactorily engage and anchor the work.

17.3.2.6. Form Oil. Form oil shall be a commercial form oil of satisfactory and proven performance that will prevent adhesion of the concrete to the forms, but will not penetrate, stain or adversely affect concrete surfaces. The form oil shall not impede wetting of surfaces to be damp cured nor impair subsequent surface treatments which depend upon bond or adhesion.

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17.3.2.7. Curing Materials. Curing materials shall meet the following requirements, as applicable:

17.3.2.7.1 Waterproof Paper: ASTM Standard C171, regular or white.

17.3.2.7.2. Mats: Commercial curing mats of cloth or canvas.

17.3.2.7.3. Burlap: Commercial Standard.

17.3.2.7.4. Membrane-Forming Curing Compound: ASTM Standard C309, Type 1 or ID Class B. Wax base or wax-resin base curing compounds will not be permitted.

17.3.2.7.5. Polyethylene Sheeting: ASTM C171.

17.3.2.7.6. Polyethylene-Coated Burlap: ASTM C171.

17.3.3. Concrete Requirements

17.3.3.1. Concrete. Concrete placed hereunder shall be batched, mixed and delivered in accordance with ASTM C94, "Ready-Mixed Concrete", Alternative 2, as further defined below, and with this Specification:

17.3.3.1.1. Aggregate shall conform to ASTM C33. Coarse aggregate shall be No. 67 (3/4 inch to No. 4 sieve).

17.3.3.1.2. Cement shall be an approved brand of Portland cement conforming to ASTM C150 Type II, low alkali. A single brand of cement shall be used throughout the work.

17.3.3.1.3. Water shall conform to the requirements of Paragraph 4.1.3. of ASTM C94.

17.3.3.2. Class and Strength. The following class and strength of concrete will be required in the work:

Class*	Max. Aggregate Size (Inches)	Minimum Allowable Compressive Strength at 28 days (psi)
CS	3/4	3000

*An "A" suffix following the concrete class designation shall indicate air entrainment is required. Such suffix shall, when applicable, be part of the class designation in orders for concrete issued by the Contractor.

17.3.3.3. Air Entrainment. Concrete which will remain exposed to the weather in the finished work shall contain an air entraining admixture which produces concrete containing the following air content at the point of discharge from the transport vehicle:

Maximum Aggregate Size (Inches)	Total Air Content (Percentage by Volume)
3/4	5 to 7

17.3.3.4. Slump. At the point of discharge from the transport vehicle, the concrete shall have a slump of from 2 to 4 inches.

17.3.4. Mixing and Delivery.

17.3.4.1. Truck Mixers. Truck mixers shall conform to the applicable requirements of ASTM C94.

17.3.4.2. Cold Weather Concreting. Concrete mixed and delivered when the mean ambient temperature is 40°F or less shall be mixed and delivered in accordance with the American Concrete Institute Standard ACI 306 "Recommended Practice for Cold Weather Concreting."

17.3.4.3. Hot Weather Concreting. Concrete mixed and delivered when the mean ambient temperature (as defined in ACI 301, Section 8.4.3) would be detrimental to concrete, shall be mixed and delivered in accordance with the American Concrete Institute Standard ACI 305 "Recommended Practice for Hot-Weather Concreting." Concrete temperatures at time of discharge from the truck shall not exceed 90°F.

17.3.4.4. Contractor Responsibility. The Contractor shall bear complete responsibility for the delivery of satisfactory concrete conforming to the requirements of this Specification. The Contractor shall effect such alterations in methods and equipment, and furnish new materials and concrete as may be required, when tests indicate that materials or concrete as delivered, did not meet Specification requirements.

17.3.4.5. Delivery Tickets

17.3.4.5.1. Each load of concrete shall be accompanied by a delivery ticket, in triplicate. After the concrete has been discharged or the truck has been released, one copy of each waybill shall be grouped with other waybills for that pour, and shall be delivered to the Construction Manager within 24 hours.

17.3.4.5.2. Each waybill shall show the information prescribed by Article 15.1 of ASTM C94, and in addition shall show the information listed under Article 15.2 of ASTM C94.

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17.3.4.6. Allowable Time Interval Between Mixing and Placing. Concrete shall be placed in the forms within forty-five (45) minutes after the addition of water to the cement and aggregate when hot weather conditions prevail. At other times, the time limit shall be ninety (90) minutes. Discharge of the concrete shall be completed within the time limits specified above, and then only if the initial set has not been attained in the concrete.

17.3.5. Form Installation

17.3.5.1. General. Forms, complete with appurtenances, shall be constructed to conform to shape, form, line and required grade. The forms shall be maintained sufficiently rigid to prevent deformation under load in order that deflection under the weight of wet concrete will not exceed 1/8-inch.

17.3.5.2. Responsibility. The Contractor shall be responsible for design, adequacy, and safety of formwork, the design of which is subject to the Construction Manager's review. Completed forms, in place, must be inspected by the Construction Manager prior to concrete placement. All formwork design shall conform to ACI 347, "Recommended Practice for Concrete Formwork."

17.3.5.3. Construction. Where indicated, suitable stripping shall be placed in forms to shape edges or surfaces of concrete. Exposed corners shall be chamfered 3/4-inch unless noted otherwise.

17.3.5.4. Surface Treatment. Before any reinforcement is placed, forms shall be oiled.

17.3.5.5. Setting Embedded Items. Prior to placement of concrete and during formwork operations, the Contractor shall locate and set all items to be placed in the forms. Anchor bolts, conduit, pipe sleeves, pull anchors, inserts, and all other items indicated on the Drawings to be set in concrete shall be set in accordance with the Drawings.

17.3.5.6. Inspection. Inspection of formwork, reinforcing and embedded items shall have been completed and approval given before the forms are closed or concrete ordered for placement therein. The Contractor shall, in each case, allow the Construction Manager a minimum of eight (8) working hours notice prior to anticipated start of pour to permit sufficient time for such inspection.

17.3.5.7. Removal of Forms The minimum waiting period before stripping of forms shall be in conformance with Table 5.1.7 of ACI 306, however, the use of this table shall not relieve the Contractor of responsibility for the safety of or damage to the work. Forms left in place for moist curing shall not be loosened for the entire curing period.

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17.3.6. Reinforcing Steel Installation

17.3.6.1. General

17.3.6.1.1. Reinforcing steel shall be detailed, fabricated, and furnished by the Contractor. Reinforcing materials are specified in Paragraph 6.2.2. The Contractor shall furnish certified copies of mill test reports for the reinforcing steel furnished hereunder. Submittals shall conform to Article 4.0, DRAWING AND DATA SUBMITTALS.

17.3.6.1.2. Reinforcing steel delivered to the site shall be stored off the ground. Before placement, reinforcing shall be thoroughly cleaned of loose or flaky rust, mill scale, or coatings of any foreign substance that would reduce or destroy the bond. Bars reduced in section shall not be used. In the event of a substantial work delay, previously placed reinforcing steel left for future bonding shall be inspected and cleaned. Reinforcing steel shall not be bent or straightened in a manner injurious to the steel, and bars with kinks or bends not shown on the Drawings shall not be used.

17.3.6.1.3. The use of heat to bend or straighten reinforcing steel shall not be permitted. Field splices, if required, shall be made with a wire-tied lap of not less than the number of diameters indicated in ACI 318 for the proper class of splice as shown on the Drawings. Field splices not indicated on the Drawings will not be permitted.

17.3.6.1.4. The clear distance between parallel bars shall be not less than the nominal diameter of the bars, 1-1/3 times the maximum size of the coarse aggregate, or 1 inch, whichever is greater.

17.3.6.1.5. Reinforcing steel shall not be welded except where shown on the approved Drawings.

17.3.6.2 Design and Details. Unless otherwise indicated, the design of reinforced concrete structures will conform to ACI 318, and the details of reinforcing steel will conform to ACI 315.

17.3.6.3. Concrete Covering Over Steel Reinforcement. The thickness of the concrete covering over steel reinforcement shall not be less than the diameter of the round bars and in the following specific instances, not less than specified below:

Footings, underside of duct banks and other surfaces where concrete is deposited against the ground:	3 inches between steel and ground

Concrete surfaces which, after removal of forms, are exposed to weather or backfill:

For bars No. 6 and larger:	2 inches
For bars No. 5 and smaller:	1-1/2 inches

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17.3.6.4. Supports. Reinforcing shall be accurately placed and securely tied at intersections and splices with black annealed wire sufficiently to prevent displacement during handling and concreting. Reinforcement shall be securely held in position during the placing of concrete by spacers, chairs, or other approved supports. Supports shall be galvanized when the finished concrete is to be exposed. Wire tie-ends shall point away from the form. Unless otherwise indicated, the number, type and spacing of supports shall conform to ACI 315. Tack welding of reinforcing steel assemblies will not be permitted.

17.3.6.5. Accessories. Accessories such as bar supports, spacers and ties shall be furnished and arranged in accordance with the CRSI "Manual of Standard Practice for Reinforced Concrete Construction."

17.3.7. Preparation for Placing Concrete

17.3.7.1. Water shall be removed from excavations before concrete is deposited. Hardened concrete, debris, and foreign materials shall be removed from the interior of forms, and from inner surfaces of conveying equipment.

17.3.7.2. Reinforcement shall be secured in position, inspected and approved before depositing concrete. Runways shall be provided for wheeled concrete-handling equipment. In addition, the equipment shall not be wheeled over reinforcement, nor shall runways be supported on reinforcement.

17.3.7.3. The subgrade for slabs shall be finished to the exact section of the bottom of the slabs, and shall be maintained in a smooth, compacted condition, in conformity with the required section and grade until the concrete is placed. Where concrete is placed directly on earth, the subgrade shall be clean and thoroughly moistened, but not muddy, at the time the concrete is deposited.

17.3.7.4. Placement of concrete shall not be commenced until reinforcement and items set into the forms have been inspected by the Construction Manager.

17.3.8. Placing Concrete

17.3.8.1. General

17.3.8.1.1. Concrete shall be handled from transport vehicle to place of final deposit in a continuous manner, as rapidly as practicable, and without segregation or loss in ingredients, until the approved unit of operation is completed.

17.3.8.1.2. Concrete that has attained its initial set or otherwise becomes unsuitable for placement, as determined in accordance with ASTM C94, shall not be placed in the work. Placement will not be permitted when the sun, heat, wind or limitations of facilities furnished by the Contractor prevent proper finishing and curing of the concrete.

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17.3.8.1.3. Concrete shall be placed in the forms as nearly as practicable in final position. Forms or reinforcement splashed with concrete shall be cleaned in advance of pouring subsequent lifts. Immediately after placing, concrete shall be compacted by thorough agitation in an approved manner. Tapping or other external vibration of forms shall not be permitted.

17.3.8.1.4. Concrete shall be placed in the forms in a planned sequence to avoid cold joints. Concrete shall not be allowed to drop freely more than 5 feet in unexposed work nor more than 3 feet in exposed work. Where greater drops are required, a tremie or other approved means shall be employed.

17.3.8.2. Cold-Weather Requirements. Concrete shall not be placed when the ambient temperature is 40°F or less, unless special precautions are taken. If necessary to place concrete under conditions of 40°F or less, placement and protection methods shall be in accordance with ACI 306 "Recommended Practice for Cold Weather Concreting." Concrete damaged by freezing shall be removed and replaced by the Contractor.

17.3.8.3. Hot-Weather Requirements. In hot weather, concrete shall be placed in accordance with the recommendations of ACI 305.

17.3.8.4. Placing. Concrete shall be conveyed and placed as rapidly as practicable, either by manual or mechanical means that will prevent segregation or loss of ingredients. Aluminum shall not be used to convey or place concrete. Concrete shall be deposited continuously in horizontal layers, in a manner to prevent displacing reinforcement and accumulation of concrete on the forms or the reinforcement above the level of fresh concrete. Chutes shall be of rounded cross-section to avoid accumulation of concrete in corners. The slopes of chutes shall be steep enough to permit flow without requiring a slump greater than that specified or required for placement (slope usually 1 vertical to 2 or 2-1/2 horizontal). In intermittent operations when free movement of concrete in the chute is not possible, the concrete shall be discharged into approved hoppers. Chutes and hoppers shall be thoroughly cleaned before and after each run. Wash water debris shall be discharged outside of forms.

17.3.8.5. Consolidation. During and immediately after placing, concrete shall be worked to provide thorough consolidation around all reinforcement, conduit and other embedded items, and into corners of forms. Consolidation shall be accomplished by the use of high frequency internal vibrators. The type and operation of vibrators is subject to approval by the Construction Manager. Consolidation procedure shall conform generally to ACI 304 and the following:

17.3.8.6. Extent of Vibration. Vibration shall extend through the entire depth of each new layer and several inches into the preceding layer. Vibration shall be applied to the point of deposit and uniformly throughout the freshly placed concrete.

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17.3.8.7. Duration of Vibration. Vibration shall be performed such as to secure the desired results within 5 to 15 seconds at points 18 to 30 inches apart rather than vibrating for longer periods at wider intervals. To prevent segregation of mix, vibration shall be continued only long enough to accomplish thorough consolidation and complete embedment of the reinforcement and fixtures.

17.3.8.8. Limitations. Vibrators shall not be used as a means of moving concrete inside the forms. This action shall be accomplished by correct initial placement augmented by the use of hand shovels. The Contractor shall provide a sufficent number of vibrators so that consolidation can be accomplished immediately after the concrete has been deposited in the forms.

17.3.9. Bonding Joints or Resuming Placement on Hardened Concrete

17.3.9.1. Concrete on which other concrete is placed shall be either still plastic or thoroughly hardened, but not in a semi-hardened state that may be disturbed or weakened by the added load and the jarring.

17.3.9.2. To provide bond between successive lifts of concrete, the exposed surface of the hardened concrete shall be cleaned and roughened, without loosening the embedded aggregate. Concrete surfaces on which other concrete is to be placed shall be kept wet for the 24 hours previous to the pour.

17.3.9.3. Brooms or air-water jets shall be used after the start of initial setting of the cement. Sandblasting or air-tooling shall be employed after the concrete has hardened. The surface film and laitance or diluted paste shall be removed and a reasonably high percentage of aggregate exposed.

17.3.9.4. The old surface shall be clean, damp and free from standing pools of water when the new concrete is placed.

17.3.9.5. Batches of neat cement or of mortar having about the same proportion of cement to sand as used in the concrete, shall be deposited and well brushed in, just ahead of the new concrete.

17.3.10. Repairing and Patching Surfaces. Concrete surfaces shall be repaired immediately after form removal, in accordance with the following procedure:

17.3.10.1. Holes left by tie rods shall be hammer-packed with stiff, dry-pack mortar of the same materials as, but somewhat leaner than, the concrete.

17.3.10.2. Honeycombed areas shall be removed to a depth at which sound concrete is exposed. Cut-out areas shall be straight at right angles to the surface, and filled with concrete matching that of the structure.

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17.3.10.3. Spalled and pitted areas resulting from concrete sticking to the forms shall be chipped back to obtain a good mechanical bond, undercut at the edges, and repaired with mortar matching the concrete.

17.3.10.4. Before mortar is placed in patches, a grout of cement and water mixed to the consistency of paint shall be brushed into the surfaces to which the new material is to be bonded.

17.3.10.5. On concrete which will be exposed in finished work, approximately 20 percent white cement shall be mixed with the gray cement to offset the tendency of patches to show up darker than the surrounding concrete.

17.3.10.6. Throughout finishing operations and repair of defects, the surface shall not be allowed to become dry (damp cure for 72 hours), nor shall the underlying concrete be damaged.

17.3.10.7. Finished repairs will be inspected. Unsatisfactory repairs shall be redone by and at the expense of the Contractor as directed by the Construction Manager.

17.3.11. Concrete Finishes

17.3.11.1. General. Concrete surfaces shall be given finishes in accordance with the following and as shown on the Drawings.

17.3.11.1.1. Formed concrete surfaces against which backfill will be placed and therefore will be concealed in the finished work, shall have fins and burrs removed and defects repaired. No other finishing will be required.

17.3.11.1.2. Top surfaces of slabs on grade shall be given a broomed finish as specified hereinafter.

17.3.11.1.3. Formed concrete surfaces which will remain exposed to view in the finished work, shall be given smooth finish.

17.3.11.2. Float Finish. After the concrete has been placed, vibrated and roughly leveled, it shall be screeded off to the required elevation. Coarse aggregate shall be pushed below the surface. The use of neat cement to absorb excess surface moisture will not be permitted.

17.3.11.3. Broomed Finish. Where a broomed finish surface is required, floating as specified for Float Finish shall be completed and the surface finished by brooming. The brooms shall be of the push broom or floor brush type. The brooms shall be drawn across the surface from the centerline to each side with not more than one stroke per width of broom, slightly overlapping adjacent strokes. The brooming operation shall be so executed that the corrugations provided in the surface will be uniform in appearance and not more than 1/16 inch in depth. Sufficient time shall be allowed before starting brooming to permit surplus water and laitance to rise to the surface. The brooming operation shall be completed before the concrete is in such condition that it will be torn or unduly roughened, and before initial set has developed.

17.3.11.4. Smooth Finish. Smooth finish for formed concrete surfaces which will remain exposed to view, shall consist of thoroughly wetting and brush-coating the surfaces with cement grout composed of 1 part light colored Portland cement to 2 parts fine aggregate, mixed with water to the consistency of thick paint. Grout shall be cork- or wood-floated to fill all pits, air bubbles, and surface holes. Excess grout shall be scraped off with a trowel and the surface rubbed with burlap to remove any visible grout film. In hot, dry weather, the grout shall be kept damp by means of a fog spray during the setting period. The finish for each area shall be completed in the same day, and the limits of a finished area shall be established at natural breaks in the finished surface.

17.3.12. Protection and Curing. Protection and curing shall be accomplished by preventing loss of moisture, rapid temperature change, mechanical injury, or damage from rain, frost or flowing water. Curing shall be started as soon after placing and finishing as the surface conditions are suitable. Curing of formed surfaces shall be accomplished by moist curing with forms in place for the full curing period, or, if forms are removed prior to the end of the curing period, by any of the following methods or combinations thereof:

17.3.12.1. Minimum Curing Periods. The following shall be the minimum curing periods for all concrete placed hereunder, except as noted in ACI 306:

Curing Temperature	Curing Period
50 to 70°F	7 days
70 to 100°F	5 days

17.3.12.2. Protective Wet Curing. The protective medium for wet curing shall consist of saturated cotton mats or a double layer of burlap, of sufficient size to cover the entire concrete surface and side forms. The mats or burlap shall be kept wet continually during its use. After finishing operations and prior to start of protective wet curing, the concrete surface shall be kept wet with adequate fog spraying equipment. During any change in curing medium, the concrete shall not remain exposed for more than one hour.

17.3.12.3. Moist Curing. Unformed surfaces shall be covered with burlap, cotton or other approved fabric mats kept in contact with the surface, or with sand, and shall be kept continually wet. Where formed surfaces are cured in the forms, the forms shall be kept continually wet. If the forms are removed before the end of the curing period, curing shall be continued as on unformed surfaces, using suitable materials. Burlap shall be in two layers.

17.3.12.4. Waterproof-Paper Curing. Surfaces shall be covered with waterproof paper with 4 inches of overlap at sides and ends and sealed with mastic or pressure-sensitive tape not less than 1-1/2 inches in width. The paper shall be weighted to prevent displacement, and tears or holes occurring during the curing period shall be immediately repaired by patching.

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17.3.12.5. Membrane Curing

17.3.12.5.1. Pressure spray curing compounds shall be of the type previously specified. The compound shall be applied according to the manufacturer's directions and shall be applied immediately after finishing operations are completed and after forms are removed. The quantity shall be sufficient to ensure the formation of a continuous unbroken film. The curing compound shall be applied to the entire area of the exposed surface, and shall be applied in two separate applications, each of which shall be by an even sweeping motion of the nozzle with sufficient overlap to ensure uniform and complete coverage. The second application shall follow five to thirty minutes after the first application and shall be applied to cross and recross the sweep of the first application.

17.3.12.5.2. Curing compound shall not be used or permitted on surfaces where future bonding is indicated. Such surfaces shall be moist cured as previously specified.

17.3.12.5.3. After final application of the compound, surfaces shall be protected from traffic and other damage to the membrane for a period of curing as previously specified.

17.3.12.5.4. The use of any membrane material which will impart a slippery surface to the concrete or alter its natural color shall not be permitted. The compound, however, shall contain a fugitive dye of color strength sufficient to render the film distinctly visible on the concrete surface for a period of at least four hours after application. The compound shall harden within thirty (30) minutes.

17.3.12.5.5. If concrete surfaces to be cured are expected to be exposed to freezing temperatures within five (5) days, membrane curing compound shall not be used, unless enclosing and heating methods approved by the Construction Manager are employed.

17.3.12.6. Polyethylene Sheeting and Polyethylene-Coated Waterproof Paper and Burlap. Surfaces shall be completely covered. Where a single sheet does not cover the entire surface, ends and sides shall be lapped not less than 4 inches and sealed with pressure-sensitive tape.

17.3.13. Protection. The Contractor shall be fully responsible for protecting his finished concrete work from damage, marring of finish, discoloration or other detrimental conditions during curing and his subsequent construction operations.

17.3.13.1. After the curing periods specified, concrete shall not be allowed to heat or cool faster than 5 degrees F per hour, or 20 degrees F per twenty-four hour period, until outside temperatures are reached. Either dry or steam heat will be an acceptable means of maintaining temperature control.

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17.3.13.2. When the air temperature is expected to exceed 90 degrees F within forty-eight hours after placement, concrete surfaces shall be protected from direct sunlight for a minimum period of forty-eight hours. The use of membrane curing compound alone does not satisfy this requirement.

17.4. Environmental Electronics Instrumentation Enclosures. 4

This Section covers and shall be applicable to work of this Contract associated with the Environmental Electronic Instrumentation Enclosures.

17.4.1. General. The buildings shall be the product of a manufacturer regularly engaged in the fabrication and erection of prefabricated metal buildings of the type and size specified and conforming to the Metal Building Manufacturers Association Standards. 4

17.4.2. Description. The buildings shall be self framing type structures. The structures shall be of the sizes shown on the Drawings. 4

17.4.3. Design and Construction. The Contractor shall furnish and erect the metal buildings with all components and accessories, including but not limited to: framing, roof and wall panels, insulation, interior liner panels, doors, trim, flashing, fasteners, gutters and downspouts, splash blocks, calking and similar items necessary to provide a complete weather-tight structure. All materials shall be new, unused, free from defects and shall be the manufacturer's standard stock material unless otherwise specified. The dimensions, orientation, door and framed opening dimensions and other essential details of the building shall be shown on the Drawings and specified herein. Eave height shall be as shown on the Drawings. The building, components and accessories shall be the product of a single manufacturer. 4

17.4.3.1. Design. Design of the buildings shall conform to the latest editions of the American Iron and Steel Institute's "Specification for the Design of Cold-Formed Steel Structural Members" and the "Metal Building Manufacturer's Association Standards." 4

17.4.3.2. Welding. All welding shall conform to the latest edition of the American Welding Society's Standard D1.0, "Code for Welding in Building Construction." 4

17.4.3.3. Design Loads. Design loads shall be as follows: 4

17.4.3.3.1. Wind Load:	Wind Zone 25 (Roof uplift design for 90 mph gusts)	4
17.4.3.3.2. Roof Live Load:	30 psf	4
17.4.3.3.3. Seismic Zone:	Zone 3 per Uniform Building Code	4

17.4.3.4. Deflection. Deflections under the above wind and live loading shall not exceed L/180. 4

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17.4.3.5. Positive Pressure. The assembled liner and ceiling panel systems shall have a field calked vapor seal applied in the side and end joints of the panels. Static air infiltration through panels or panel joints shall be zero under 90 mph winds. The South Weather Station Electronic Enclosure shall be designed and all seams double calked or otherwise secured to ensure that the building can maintain a 15 pounds per square foot positive internal pressure. 4

17.4.4. Shop and Erection Drawings and Data 4

17.4.4.1. Shop and field erection drawings showing complete erection layouts, details and installation instructions, design calculations, and data substantiating compliance with specification requirements, shall be prepared and submitted for review. Submittals shall conform to Article, DRAWING AND DATA SUBMITTALS. Materials shall not be fabricated or delivered to the jobsite before the drawings have been reviewed and returned to the Contractor. Details and layouts shall show the structural framing, and the location, lengths and marking of panels and all closures and accessories. 4

17.4.4.2. Markings shall correspond with the sequence and procedures which will be followed when erecting the panels, fasteners and accessory component parts. The Contractor shall be responsible for all errors of detailing and fabrication and for the correct fit of parts and accessories shown on the shop and field erection drawings. 4

17.4.5. Gages. Gages for steel are U.S. Standard and shall be as specified herein or as indicated on the Drawings. 4

17.4.6. Assembly. The size of prefabricated components, necessary field connections, and fastenings required for erection shall permit easy assembly by means of standard construction equipment or tools. The maximum size of any shop-assembled components of the building shall permit transportation to the jobsite by commercial carrier. Each piece and part of the building shall be clearly and legibly marked to correspond with erection drawings, diagrams and/or manufacturer's instruction manuals. "Painted-on" erection marks, if any, shall be removed by the Contractor following final assembly of the building. 4

17.4.7. Materials 4

17.4.7.1. Common Bolts. Common bolts shall be carbon steel conforming to ASTM A307, electro-galvanized in accordance with ASTM A164. In addition, a chromate conversion treatment shall be applied over the protective zinc coating. 4

17.4.7.2. Screws. Sheet metal screws and self-tapping screws shall be stainless steel conforming to Federal Specification QQ-S-763. Screws shall be provided with neoprene-faced washers, or approved equal, for weatherproofing and sealing all self-tapping screw penetrations. 4

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17.4.7.3. Structural Members 4

17.4.7.3.1. Structural members less than 1/4-inch thick shall be Grade B steel conforming to ASTM A446 with a yield of 37,000 psi. 4

17.4.7.3.2. Structural members, if required, shall be factory prime-coated with a "universal" alkyd or modified alkyd base, medium length, penetrating rust inhibitive primer applied to a dry film thickness of not less than 2 mils. 4

17.4.7.4. Roof Panels. Roof panels shall have interlocking ribs 3 inches minimum and 4 inches maximum in depth, and shall be minimum 20 gage steel. Panels shall be one piece and shall be installed with the ribs upright and parallel to the roof slope. Panels shall be bolted in accordance with manufacturer's recommendations. Roofs shall be furnished complete with flashing, calking, fascia, and other required items. Roof panels that extend beyond wall line on the eave sides of the building shall be adequately supported. Panels shall be zinc coated (galvanized) by the hot-dip process in accordance with ASTM A525, coating designation G90 and shall have manufacturer's stock surface treatment to prevent or conceal the effects of "oil canning." 4

17.4.7.5. Ceiling Panels. Ceiling panels shall be minimum 24 gage steel to present a flat surface and shall be installed as shown on the Drawings. 4

17.4.7.6. Wall Panels. Exterior wall panels for the buildings shall be of the profile shown on the Drawings and shall be minimum 20 gage galvanized steel. There shall be no thru-wall fastening. Wall panels shall be continuous from base to eave without horizontal joints, except over openings. Panels shall be zinc coated (galvanized) by the hot-dip process in accordance with ASTM A525, coating designation G90 and shall have manufacturer's stock surface texture or treatment to prevent or conceal the effects of "oil-canning." Interior liner panels shall be minimum 20 gage galvanized steel panels and shall be installed as shown on the Drawings. 4

17.4.7.7. Building Trim. Flashings, wall caps, gutters, downspouts and fascias shall be galvanized steel conforming to ASTM A446, Grade B, factory-finished to match the building siding. 4

17.4.7.8. Anchoring Devices. Drawings submitted by the Contractor shall show the sizes and locations of all anchor bolts required. 4

17.4.8. Insulation. Insulation shall be provided on the inside of both wall and ceiling panels. Insulation shall be fiberglass semi-rigid board type meeting the requirements of Federal Specification HH-I-558B Form B, Type 1, Class 6. 4

17.4.8.1. Insulation shall be provided at such thickness that when installed the air to air "U" value through the installed insulation and panels, including side joints, does not exceed 0.14 for the walls and 0.08 for the ceiling. 4

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17.4.8.2. The insulation shall bear the Underwriters' Laboratories Inc. Class A Fire Hazard Classification indicating a flame spread rating of 25 or less. 4

17.4.9. Doors and Frames 4

17.4.9.1. General 4

17.4.9.1.1. Doors and frames shall conform to the current issues of U.S. Department of Commerce Standard PS4 and the Steel Door Institute SDI-100, Type III, Style 2. All door sizes, swings and hands shall be as indicated on the Drawings. 4

17.4.9.1.2. Doors and frames shall be zinc-coated (galvanized) by the electrodeposit method to meet the requirements of ASTM A164, coating class GS, phosphatized and coated with a baked-on primer. 4

17.4.9.2. Doors 4

17.4.9.2.1. Doors shall be 1-3/4-inch thick, not less than 16 gage, full flush type, with edge seams tack-welded, filled and ground smooth. Doors shall be reinforced, stiffened, insulated and sound deadened with an impregnated kraft honeycomb core, completely filling the inside of the door, laminated to the inside face of both face panels. 4

17.4.9.2.2. The top and bottom reinforcing channels shall be formed from 14 gage steel spot welded to the stiles to provide horizontal rigidity. The top and bottom of each door shall be closed and made weathertight with a 20 gage steel cap, reinforced with a 16 gage steel channel. 4

17.4.9.2.3. The lock stile edges only of doors shall be beveled 1/8-inch in 2 inches to provide easy unobstructed operation against the door frame stops. All doors shall be provided with 3/16-inch thick steel hinge reinforcements and a 16 gage steel lock box welded into the stile. Hinge and lock reinforcements shall be drilled and tapped to receive the finished hardware. Top rails of doors shall be reinforced for closers. 4

17.4.9.3. Door Frames 4

17.4.9.3.1. Door frames shall be a double-rabbeted type with heavy duty standard jamb depth, formed from 16 gage steel. Frames shall have factory primed finish suitable for field painting. 4

17.4.9.3.2. The mitered corners of the frame components shall be arc welded and welds ground flush and smooth. 4

17.4.9.3.3. The hinge jamb for doors shall be mortised for one and one-half (1-1/2) pairs of hinges. 4

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17.4.9.3.4. Door frames shall have a minimum of four (4) wall anchors per jamb and two (2) per head.

17.4.10 Preparation for Hardware 4

17.4.10.1. All necessary cutouts, reinforcements, drilling and tapping for hardware shall be performed at the factory in accordance with the hardware manufacturer's templates and instructions. The Contractor shall obtain the proper templates and instructions from the hardware supplier in accordance with the hardware to be used for each opening, and shall be responsible for the correct preparation of the doors and frames. 4

17.4.10.2. It is the intent of this Specification, and the following schedule, to provide correct and sufficient hardware to fully equip each door. The Contractor shall verify the correctness of all items listed. If any item is found to be unsuitable for the opening for which it is intended, such item shall be changed, subject to the approval of the Construction Manager. Closers shall have a prime coat finish for field painting to match adjacent door trim. Door closers shall be of the full rack and pinion type. Closers mounted on metal doors and/or jambs shall be furnished templated with proper machine screws. It shall be the responsibility of the hardware supplier to furnish all necessary hardware templates to the metal building manufacturer without delay in order that the metal building manufacturer may properly prepare his product for the builders hardware to be applied thereon. The Contractor shall ensure that building and hardware manufacturers comply with the requirements herein. 4

17.4.11. Builders Hardware 4

17.4.11.1. General. The Contractor shall furnish all builders hardware, complete with screws and other fastenings required for proper installation, in accordance with the drawings, schedules and these Specifications. Where items of builders hardware specified below are specified by brand name and type, such designation is intended to facilitate description and establish the level of quality desired. Such designation is not intended to restrict selection of equivalent products of other manufacturers. The respective equivalent products of other manufacturers will, if proposed, receive full consideration. In such matters of equivalency, the approval of the Construction Manager will be required. 4

17.4.11.2. Hardware Schedule 4

HW1 Exterior Doors, each pair shall have:
3 pr Butts LaWrence BB4101-A-4-1/2x4-1/2 - US 26D
2 Closers LCN 4115-H-CUSH P.C.
1 Lockset Mfgrs Standard Mortise Lock, Entrance Function US26D
1 Threshold Pemko 154A
2 Auto Door Bottoms Pemko 430AS
Weatherstripping Pemko 379AR
1 length Pemko 357 SC Astragal with sufficient pieces of EPDM Neoprene Closed All Tape NP490 to cover the surface of the Astragal next to the doors.
1 Coordinator Von Duprin 1237-US26D

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17.4.12. Erection 4

17.4.12.1. General 4

17.4.12.1.1. The concrete foundation shall have cured for not less than 7 days at the time erection of the building is commenced. 4

17.4.12.1.2. The prefabricated metal building shall be erected in accordance with the approved erection drawings and the metal building manufacturer's instructions. The Contractor shall be responsible for the proper fitting of all panel framing and bracing, the tight interlock of all sheet steel panels, fastenings, and accessory items, as required to make the building complete. Wall panels shall be applied running vertically, and roof panels shall be applied with their length parallel to the roof slope. Materials or accessories having defects that would affect their appearance, use or durability shall not be installed in the work and shall be replaced with new units by and at the expense of the Contractor. Any abraded or damaged panels or components shall be satisfactorily repaired or shall be replaced. 4

17.4.12.1.3. The Contractor shall furnish all wall cut outs, roof and ceiling cut outs and wall penetrations for equipment, ducting, and louvers. Cut outs shall be framed to structurally replace the wall or roof area removed. The Contractor shall furnish and install all hardware, fasteners and calking/sealing materials as required to make such framing weatherproof and air tight around its perimeters. Size and/or dimensions of all cut outs, and framing are shown on the Drawings. The Contractor shall submit shop drawings showing methods and details of cut outs, framing, weatherproofing means of sealing to maintain the required 15 psf positive pressure and related details for the Construction Manager's approval. 4

17.4.12.2. Joint Sealing and Waterproofing. Sealing compound recommended by the building manufacturer for weatherproofing and waterproofing lapped joints shall be installed at joints and laps between panels, flashings, and accessories, as required to make the work weathertight and air tight. Surfaces to be sealed shall be clean and free of foreign matter. 4

17.4.12.3. Accessories. Standard flashings, closures, fillers and similar items necessary to assure that the building is dust-tight, weathertight, and leak-free shall be furnished and installed in accordance with the manufacturer's instructions. 4

17.4.12.4. Doors and Door Hardware. Each door shall be installed complete with all hardware, as specified. Following installation, doors and door hardware shall be adjusted and demonstrated to operate properly. Keys shall be tagged with proper identification and delivered to the Construction Manager. Each item of hardware shall be examined before installation and determined to be complete and free from damage and blemishes. Incomplete, damaged or blemished items shall not be installed and shall be replaced with satisfactory items. Only workmen who are skilled in the installation of 4

builders hardware shall be permitted to perform installation of builders hardware. Upon completion of installation of builders hardware, hardware requiring lubrication shall be lubricated with graphite, and all moving parts checked and adjusted to free and smooth operation. After the building is complete, final adjustment of builders hardware shall be performed by the Contractor to compensate for air movement and other conditions such that all items operate properly under actual conditions of service. Following final adjustment, all special tools required to adjust and maintain the hardware shall be tagged with identification and delivered to the Construction Manager.

17.4.12.5. Field Corrections and Modifications. When, in the course of erecting materials and accessories, minor interferences are found to exist between the materials and existing construction, the Contractor shall make minor cutouts, copes or openings as required to accomplish correct installation. Field errors in installation of materials, closures and accessories shall be corrected by and at the expense of the Contractor. 4

17.4.13. Finishes 4

17.4.13.1. Exterior Surfaces. Exterior surfaces of wall panels which will be exposed to view, including gutters and downspouts, shall be finished as follows: 4

17.4.13.1.1. Surfaces shall be solvent cleaned in accordance with SSPC-SP1, followed by a vinyl chloride interior-exterior metal primer. Coverage shall be not less than 2.0 mils dry film thickness. 4

17.4.13.1.2. The panels shall then be coated with 2 coats of an approved high build vinyl paint to a dry film thickness of not less than 5 mills per coat. 4

17.4.13.1.3. Finish coat shall be an approved vinyl enamel at not less than 1.5 mils dry film thickness. 4

17.4.13.1.4. Exterior surfaces of doors and frames and surfaces exposed to view in addition to the wall panels shall be painted to match the wall panels, using the same type of coating. 4

17.4.13.2. Interior Surface 4

17.4.13.2.1. Surfaces of liner panels shall be solvent cleaned in accordance with SSPC-SP1 and then coated with one coat of an approved galvanized metal primer to a dry film thickness of not less than 1.5 mils. 4

SECTION 4 - IFB
TECHNICAL INFORMATION (CONTD)

17.4.13.2.3. Finish coat shall consist of 2 coats of an approved thermal-setting enamel resulting in a dry film thickness of not less than 1.5 mils per coat. 4

17.4.13.2.4. Interior surfaces of doors and frames shall be finish coated with two coats of an approved alkyd-oil based semi-gloss enamel. 4

17.4.13.3 Colors Finish colors shall be as follows: 4

Exterior wall and roof surfaces - match exactly Glidden color No. 20652. 4
Interior wall and ceiling surfaces - manufacturers standard off-white. 5
Gutters, downspouts, doors and frames - match exactly Glidden color No. 12833.

18.0 RECEIVER MODULE INSULATION, PAINTING AND IDENTIFICATION

18.1 Piping and Receiver Module Insulation

18.1.1. Piping

18.1.1.1. All piping and components above the 15th level (El. 311'-0") including that piping which is a part of the receiver preheater and boiler modules shall be insulated in accordance with this procedure.

18.1.1.2. All materials required by this procedure shall be Contractor-furnished unless otherwise noted.

18.1.1.3. The configuration of piping to be insulated is defined by Rocketdyne drawings listed in Appendix 2.

18.1.1.4. Should a conflict be found to exist between the listed codes and standards and this Specification, the conflict shall be submitted to the Construction Manager for resolution prior to proceeding with the affected work.

18.1.1.5. Prior to fabrication or delivery to the jobsite of the materials to be installed under this section, the Contractor shall submit to the Construction Manager, for review and comment, the drawings and descriptive data called for in this section.

18.1.2. Installation Procedures

18.1.2.1. General

18.1.2.1.1. Piping shall be insulated and jacketed in accordance with procedures of this section and Figures 1 through 3 (Pages TI-152a thru TI-152c) as applicable. 5

18.1.2.1.2. Insulation shall not be applied until all lines have been cleaned and tested.

18.1.2.1.3. Those sections of piping in the preheater and boilers modules which are to be insulated prior to hoisting and installation of the modules will have been cleaned and tested prior to delivery to the site.

18.1.2.1.4. Lines that are to be insulated and insulation thickness requirements are given by the Line Schedule. Insulation schedule "A" is 3 inches and "B" is 2 inches. (Volume II, Tab 9) 3 3

18.1.2.1.5. Instrument connections (including root valves) on insulated process piping shall be insulated.

18.1.2.1.6. Flanges, flanged fittings, lower manifold and valves shall be insulated with removable type insulation for easy maintenance. 4

18.1.2.1.7. The upper and lower manifold areas of both preheaters and boilers shall be insulated in accordance with procedures of this section and Figures 4 through 6 (Pages TI-152d thru TI-152f). 5

18.1.2.1.8. The start system flash tank shall be insulated with 3-inch thick insulation and shall have removable type insulation over the 2-inch inspection openings. 4

18.1.2.1.9. For safety valves, insulation shall be installed in such manner as to provide access for the operation and/or adjustment of safety valves. 4

18.1.2.1.10. All insulation saddles and other components provided for support of insulated pipe shall have open spaces filled with insulation of a type suitable for the point of installation. 4

18.1.2.1.11 In outside locations, hanger protrusions shall be suitably shielded with metal flashing to deflect rain and snow and protect the insulation from moisture, yet permit movement of the hanger rod. 4

18.1.2.1.12. Insulation shall be installed in accordance with the material manufacturer's recommendations, the various equipment suppliers' requirements, and the requirements of this section. 4

18.1.2.1.13. The Contractor shall develop and be responsible for all installation details which may be required to complete the specified work but which are not included in this document. The Contractor shall submit all details in accordance with documentation requirements. All details which are submitted by the Contractor in writing or by drawing or sketch will be reviewed by the Construction Manager for adequacy and must be approved before the Contractor can proceed. Installation details and procedures which are submitted by the Contractor, or any deviations from the specified procedures which may be permitted by the Construction Manager, shall conform to best trade practices and shall produce end results acceptable to the Construction Manager. When completed, the work shall be of uniformly neat and workmanlike appearance, with finished surfaces. 4

18.1.2.1.14. All insulation materials shall be installed as soon as possible after roughing in and in such manner as to provide sufficient clearance for expansion between the insulation materials and support steel, handrails, platforms or any other obstructions. 4

18.1.2.1.15. All insulation materials shall be installed in such manner as to remain free from hot spots, blisters, discoloration and faulty installation or workmanship. 4

18.1.2.1.16. Protective coverings, flashing and finishing cement applied to exterior surfaces of insulation shall be in addition to the specified insulation thickness, and shall not be counted as part of the specified insulation thickness. 4

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TECHNICAL INFORMATION (CONTD)

18.1.2.1.17. The Contractor shall provide equipment for hoisting all materials and supplies to the area of application from the deck of the 15th level. 4

18.1.2.1.18. Insulating Heat-Traced Surfaces. The receiver inlet filter, PF-FW-2-201, will be electrically heat traced for freeze protection and shall be insulated. The furnishing and installation of the electrical heat tracing cables and all electrical appurtenances therefore, will be by others. 4

18.1.2.1.18.1. The heat tracing cable will be routed, positioned, and securely fastened in place by others as applicable. The Contractor shall then complete the heat tracing manufacturer's recommendations. 4

18.1.2.1.18.2. The insulation shall be sized to fit the surface to which it is being applied, fitting snugly against the metal or underlying insulation surface, but shall not pinch or pressure the heating cables. 4

18.1.2.1.18.3. Valves, flanges and fittings of heat traced lines shall be insulated and lagged with the same materials and to the same thickness as the adjoining pipe. 4

18.1.2.1.18.4. Care shall be taken to prevent damage to the heat tracing. The Contractor shall replace any heat tracing that he damages and at his own expense using materials identical to the original and appropriate craft labor. The Contractor shall promptly inform the Construction Manager of any apparent damaged heat tracing. 4

18.1.2.1.19. Completion of Work Prior to Insulating. Before applying any insulation, the Contractor shall determine and verify with the Construction Manager that the particular item has been completely installed and tested, and heat traced if necessary, and is ready for the application of insulation. 4

18.1.2.1.20. Surface Preparation. Before insulation is applied, the surfaces to be insulated shall be thoroughly cleaned of scale, dirt, or other foreign matter by use of wire brushes, scrapers or other devices as necessary to accomplish the work. All surfaces shall be dry when insulated. 4

18.1.2.1.21. All attachments for supporting insulation shall be installed as specified by Figure 2 (Page TI-152b). 4 5

18.1.2.1.22. Welding of attachments to main steam and other piping will be performed by the piping fabricator or Piping and Mechanical Contractor. 4

18.1.2.1.23. Unless specifically called for herein or approved in writing for a specific location by the Construction Manager, field welding of items for attachment or support of insulation will not be permitted. 4

18.1.2.1.24. If field welding of insulation attachments is required, the welding shall be performed in accordance with approved welding procedures and the welding requirements of the applicable code as follows: 4

18.1.2.1.24.1. Section VIII (1977 Edition plus Addenda through Winter, 1979) of the ASME Code for the receiver and other pressure vessels. 4

SECTION 4 - IFB
TECHNICAL INFORMATION (CONTD)

18.1.2.1.24.2. ANSI B31.1 (1977 Edition plus Addenda through Winter, 1978), Power Piping Code for all other welding requirements. 4

18.1.2.1.25. The Contractor shall comply with all applicable manufacturer's recommendations and instructions pertaining to the mixing, storing, applying and using of their products. 4

18.1.2.1.26. Terminal Points of Work. Terminal points of insulating work to be performed by the Contractor will be located substantially where shown on the drawings and/or specified. It shall be the responsibility of the Contractor to ascertain the exact location of any point where his work starts, terminates, or connects to work installed by others, and to make minor adjustments in the length, line or grade of his work, if necessary, for proper and workmanlike connection thereto. Minor deviation in the location of such terminal points from the position shown on the drawings will not be considered cause for additional payment. 4

18.1.2.1.27. The Contractor shall offer for the Construction Manager's approval any changes in design of insulation which will facilitate the work or improve its reliability. Proposals of modification or substitution shall be made in writing and submitted in detail for the Construction Manager's consideration, whose decision shall be considered final. In all cases of approved substitution or modification, full responsibility for satisfactory work shall remain with the Contractor. 4

18.1.2.1.28. During the course of his work, the Contractor may find it necessary or of major advantage to remove and reinstall or replace certain floor grating or other items which have previously been installed by others. Prior to the removal of any such work, the Contractor shall schedule and program the work in a manner acceptable to the Construction Manager. 4

18.1.2.1.29. Permission to remove any installed component or item shall not in any way relieve the Contractor of full responsibility for the safe and proper performance of his work, or for the protection of life and property. Where and as necessary for safety or weather protection, or when requested by the Construction Manager, the Contractor shall provide and maintain acceptable temporary devices such as guard rails, walls, walkways, shores, braces, tarpaulins, flags, lights, etc., until the removed items have been reinstalled or replaced to provide "as was" conditions. 4

18.1.2.1.30. All cost of removing and reinstalling or replacing building or other components to permit or expedite the work of the Contractor shall be at the Contractor's expense. 4

18.1.2.1.31. All surfaces adjacent to the work area shall be protected by the Contractor to prevent damage from the insulating materials or required installation tools. 4

SECTION 4 - IFB
TECHNICAL INFORMATION (CONTD)

18.1.2.1.32. Any fluid or plastic material such as paint, sizing, asphaltic compound, plastic insulation, etc., which is applied, oversprayed, dropped, or otherwise permitted to get on any object or surface other than to which it is being applied, shall be removed at once, and the surfaces upon which it was present shall be cleaned by the Contractor, at his expense, as necessary to remove all traces of soiling. 4

18.1.2.1.33. It shall be the responsibility of the Contractor to protect all insulation from weather from the time the insulation is delivered until it is installed and weatherproofed with permanent finish. 4

18.1.2.1.34. Where nameplates and code stamps will be covered by the insulation, all information contained thereon shall be stamped or engraved on a nonferrous metal plate by the Contractor. This plate shall be permanently installed by the Contractor on the outside of the insulation and directly over, or in the immediate vicinity of the nameplate and/or code stamp on the insulated surface. 4

18.1.2.1.35. Insulation adjacent to bolted flanges shall be cut back sufficiently to permit removal of flange bolts without damage to the insulation, and insulation of flanges shall be extended beyond the cutback areas for a distance not less than the specified pipe insulation thickness. 4

18.1.2.1.36. At all access openings, handholes, equipment flanges, blind flanges, pipe flanges or similar maintenance points, both the insulation and jacketing shall be of a design permitting removal and replacement of suitable formed sections without disturbing adjacent insulation. Flashing shall be installed around the access opening in the insulation and lagged to form a neat and weathertight maintenance opening. Care shall be taken to keep all instruments clear of insulation materials. 4

18.1.2.1.37. Insulating cement shall be mixed in accordance with the manufacturer's directions, and shall be applied by troweling or palming, and shall be reinforced when and as necessary to comply with best trade practices. 4

18.1.2.1.38. Metal jacketing shall be secured with metal screws or pop-rivets, and installed in a manner best suited to provide a weathertight seal and allow for thermal expansion of the pipe or equipment and its insulation. Jacketing and lagging shall not be installed over wet insulation. 4

18.1.2.1.39. In outdoor locations, joints in the metal jacketing shall be lapped not less than 2 inches in a direction to shed water. The longitudinal seam in jacketing on vertical runs of piping shall be on the side away from the prevailing wind direction. Jacketing on horizontal piping and piping other than vertical shall have the longitudinal seam as shown in Figure 1, (Page TI-152a). Seams shall be sealed watertight with aluminastic calking compound. 4 5

18.1.2.1.40. Openings cut in the jacketing to fit around exposed metal components shall provide a rub-fit between the jacketing and exposed metal to minimize moisture penetration at the opening. 4

SECTION 4 - IFB
TECHNICAL INFORMATION (CONTD)

18.1.2.1.41. Where aluminum will come in contact with steel surface, field paint the contact surfaces of the steel with a minimum of one (1) coat of asphalt aluminum paint. Paint shall be applied in accordance with the manufacturer's instructions after the steel has had all oil and grease removed in accordance with Steel Structures Painting Council SSPC-SP1, using the specified solvents and clean cloths, followed by the removal of dirt, loose rust, weld spatter, mill scale and other foreign material by mechanical cleaning in accordance with SSPC-SP2 or SP3. 4

18.1.2.1.42. Insulation cement, paint, coatings, mastics, and/or loose mineral fibers, where dropped on installed aluminum, shall be immediately removed. Such debris, when wet, will cause water staining of the aluminum. 4

18.1.2.1.43. The Contractor shall immediately remove all steel nuts, bolts, scrap clips, weld rod stubs, etc., that workmen lay or drop on aluminum surfaces. Where unpainted structural steel is located above or adjacent to surfaces which are to be aluminum lagged, the Contractor shall notify the Construction Manager of this condition and request that the steel be immediately prime painted to prevent rust staining of the adjacent aluminum lagging. Aluminum which is rust-stained, water stained and/or oxidized will be rejected. 4

18.1.2.1.44. The Contractor shall require that all his crafts take care to prevent damage to installed aluminum. Welders shall not be permitted to throw weld rod stubs down when working overhead. 4

18.1.3. Materials

18.1.3.1. General

18.1.3.1.1. The materials used shall meet the requirements specified herein. Any additional materials which may be required, but which are not described hereinafter, shall be approved by the Construction Manager for the particular use.

18.1.3.1.2. Materials which are specified herein by manufacturer and/or proprietary name, are so specified only for the purpose of establishing the type and standard of quality required, and except as otherwise noted, do not preclude the use of similar products of proven equal or superior thermal and physical qualities which have been approved by the Construction Manager.

18.1.3.1.3. The Construction Manager shall be the sole judge of whether any proposed material or product is acceptable for a proposed use, or is an acceptable substitute for a material or product specified, and his decision in such matters shall be final.

18.1.3.1.4. Where names of manufacturers are listed hereinafter, the order of listing is not indicative of an order of preference.

SECTION 4 - IFB
TECHNICAL INFORMATION (CONTD)

18.1.3.1.5. After materials have been approved by the Construction Manager, substitutions shall not be made without prior written approval of the Construction Manager.

18.1.3.1.6. All materials shall be asbestos-free.

18.1.3.2. Insulation

18.1.3.2.1. Insulation to be ceramic fiber having 40-50% alumina and 50-60% silica with a density of 6 lb/cu ft.

18.1.3.2.2. Insulation for piping shall have an integral aluminum cover bonded to the ceramic fiber insulation. Cover to be bonded to edge stacked insulation.

18.1.3.2.3. Needled ceramic fiber with 40-50% alumina and 50-60% silica with a density of 6 lb/cu ft shall be used to fill large voids under trowelable or moldable insulation.

18.1.3.2.4. Trowelable or moldable insulation shall be ceramic fiber (40-50% alumina, 50-60% silica) base with a colloidal silica organic binder system having a dry density of 30-40 lb/cu ft.

18.1.3.2.5. Material Sources

Blanket Insulation	
Babcock & Wilcox	Kawool 1800B or 2300
Carborundum	Duraback or Durablanket
C.E. Refractories	Cer-Wool 1900 or 2400
Johns-Manville	Cerawool 1600 or Cerablanket 2400
Moldable Insulation	
Carborundum	LDS Moldable
C.E. Refractories	Moldable Jointpax
Bulk Fiber Insulation	
Babcock & Wilcox	K Wool Bulk
Carborundum	Fiberfax Bulk
C.E. Refractories	Cer-Wool 1900 Bulk
Johns-Manville	Cerawool Bulk

SECTION 4 - IFB
TECHNICAL INFORMATION (CONTD)

Colloidal Silica Impregnated Blanket

Babcock & Wilcox	Wet Pack Kawool
Carborundum	Wet Felt
C.E. Refractories	Wet Wrap

18.1.3.2.6. Tie Wire. Unless otherwise specified herein, tie wire is to be No. 14 gage Type 304 stainless steel wire, annealed, manufactured by Armco Steel Co., J.T. Ryerson, or approved equal.

18.1.3.2.7. Sheet metal screws shall be used for fastening lagging. The screws shall be No. 14 by 3/4-inch, Type "AB" thread, phosphate coated carbon steel or Type 410 stainless steel with indented hexagon concave neoprene washer head. Any of the following will be acceptable:

Parker-Kalon	Camcar
H.M. Harper	Armco Steel Corp.
Townsend Co.	

18.1.3.2.8. Calking Compound. Parr Paint and Chemical Co. "Alumilastic" calking compound, or approved equal.

18.1.3.2.9. Bitumastic. Koppers Chemical Co. Bitumastic No. 50, or approved equal.

18.1.3.2.10. Asphalt Aluminum Paint. M.L. Foss Incorporated "Fosco A-101 Gilsonite," or approved equal.

18.1.4. Guarantees

18.1.4.1. The Contractor shall guarantee that the materials furnished, including the installation thereof, conforms to the requirements set forth herein and to the specified codes and standards.

18.1.4.2. 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 Contract.

18.1.5. Cleanup

18.1.5.1. Throughout this Contract, the Contractor shall perform cleanup of his work and storage areas at intervals not exceeding one week.

18.1.5.2. After completion of this Contract, and before final acceptance of the work, the Contractor shall remove all the Contractor's tools, equipment, temporary structures, temporary construction except as noted, surplus materials, trash, empty containers and other evidences of construction from the Contractor's work, parking and storage areas and leave those areas clean to the satisfaction of the Construction Manager.

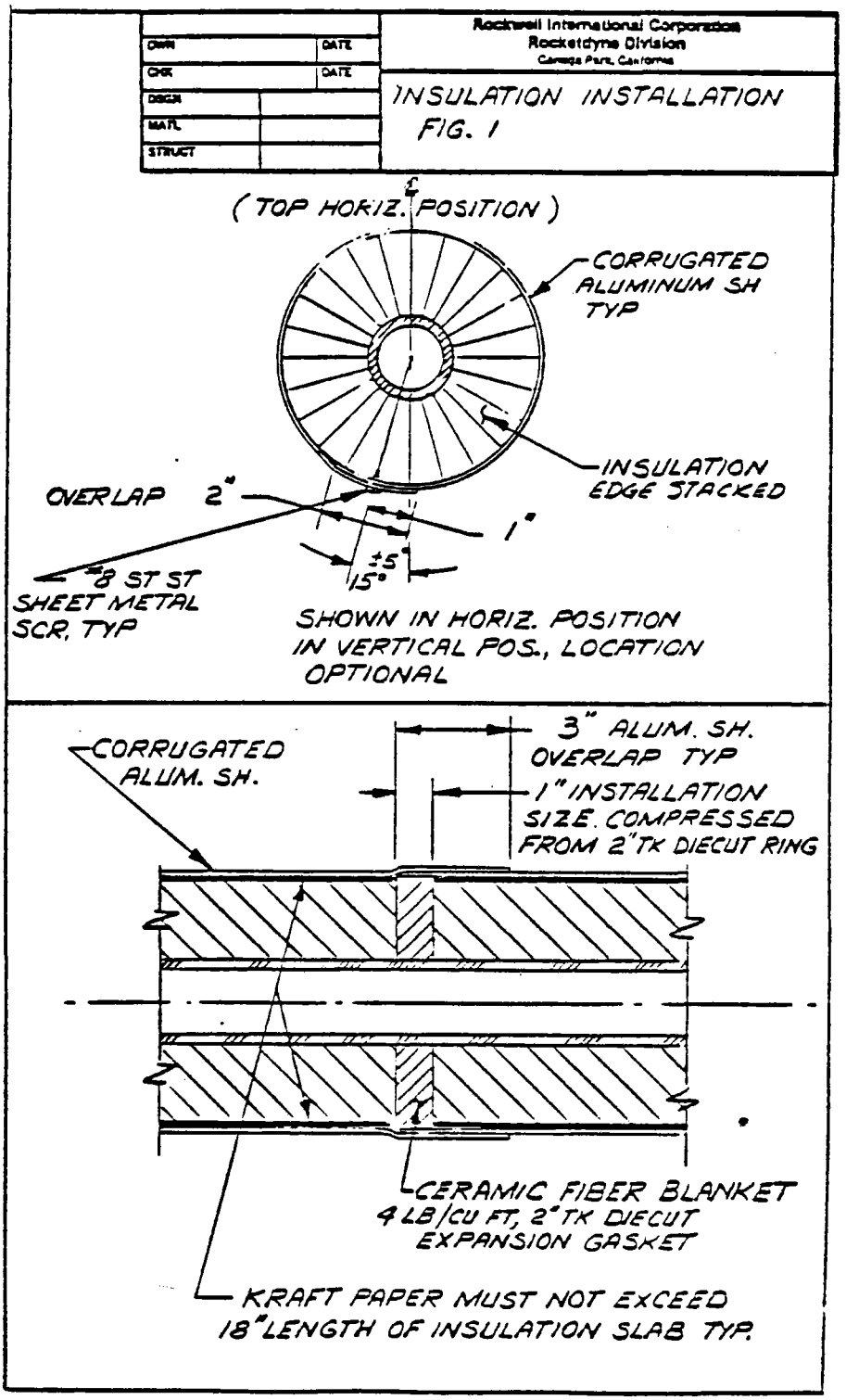


FIGURE 1

TI-152a

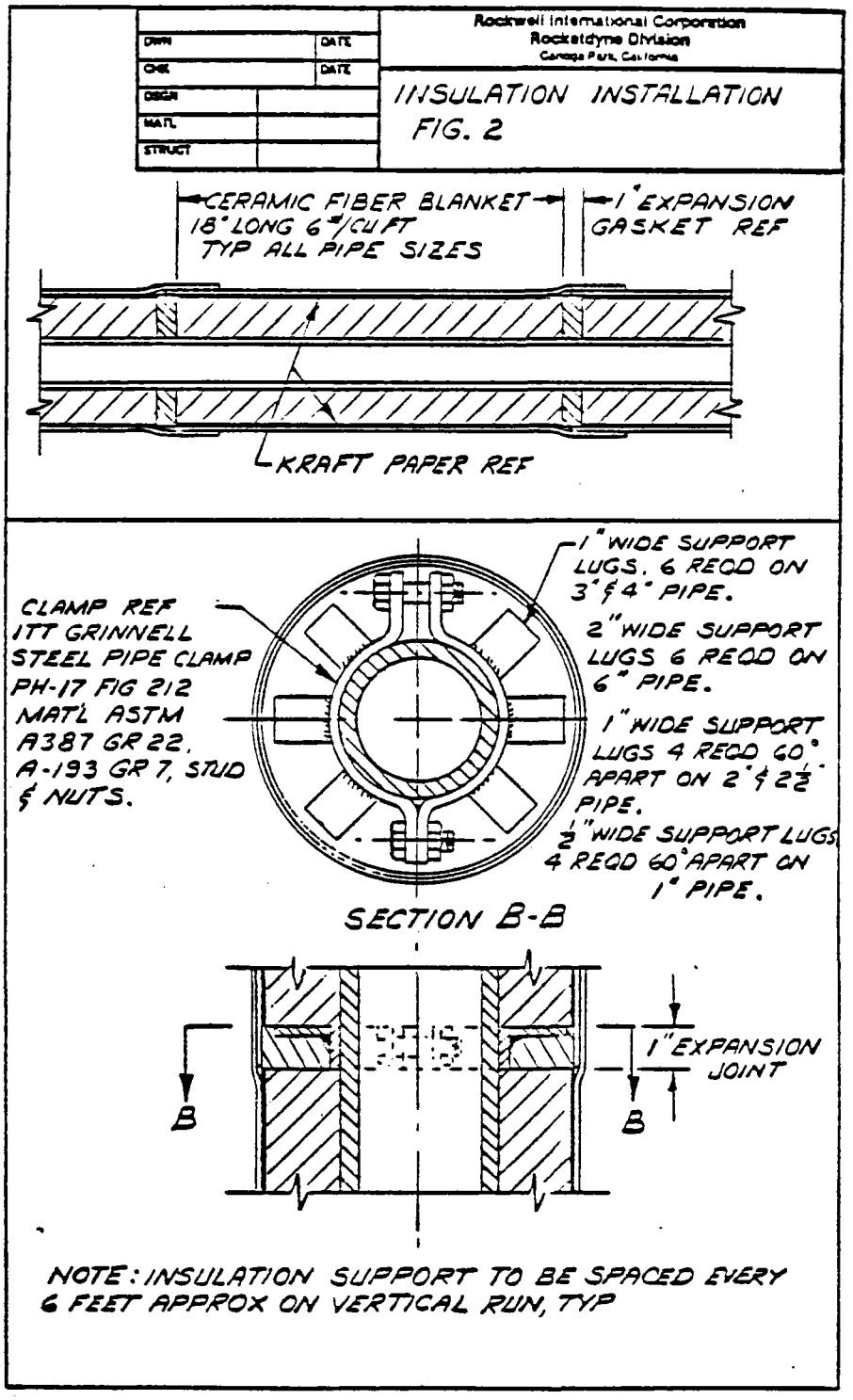

Rockwell International Corporation
Rocketdyne Division
Canoga Park, California
DRWN
DATE
CHK
DATE
DESGN
MATL
STRUCT
INSULATION INSTALLATION
FIG. 2
CERAMIC FIBER BLANKET
18" LONG 6 #/CU FT
TYP ALL PIPE SIZES
1" EXPANSION
GASKET REF
KRAFT PAPER REF
CLAMP REF
ITT GRINNELL
STEEL PIPE CLAMP
PH-17 FIG 212
MAT'L ASTM
A387 GR 22,
A-193 GR 7, STUD
& NUTS.
1" WIDE SUPPORT
LUGS. 6 REQD ON
3" & 4" PIPE.
2" WIDE SUPPORT
LUGS 6 REQD ON
6" PIPE.
1" WIDE SUPPORT
LUGS 4 REQD 60°
APART ON 2" & 2½"
PIPE.
½" WIDE SUPPORT LUGS
4 REQD 60° APART ON
1" PIPE.
SECTION B-B
B
B
1" EXPANSION
JOINT
NOTE: INSULATION SUPPORT TO BE SPACED EVERY
6 FEET APPROX ON VERTICAL RUN, TYP

FIGURE 2

DWN	DATE	
CHK	DATE	
DSGN		
MATL		
STRUCT		

Rockwell International Corporation
Rocketdyne Division
Canoga Park, California

INSULATION INSTALLATION FIG. 3

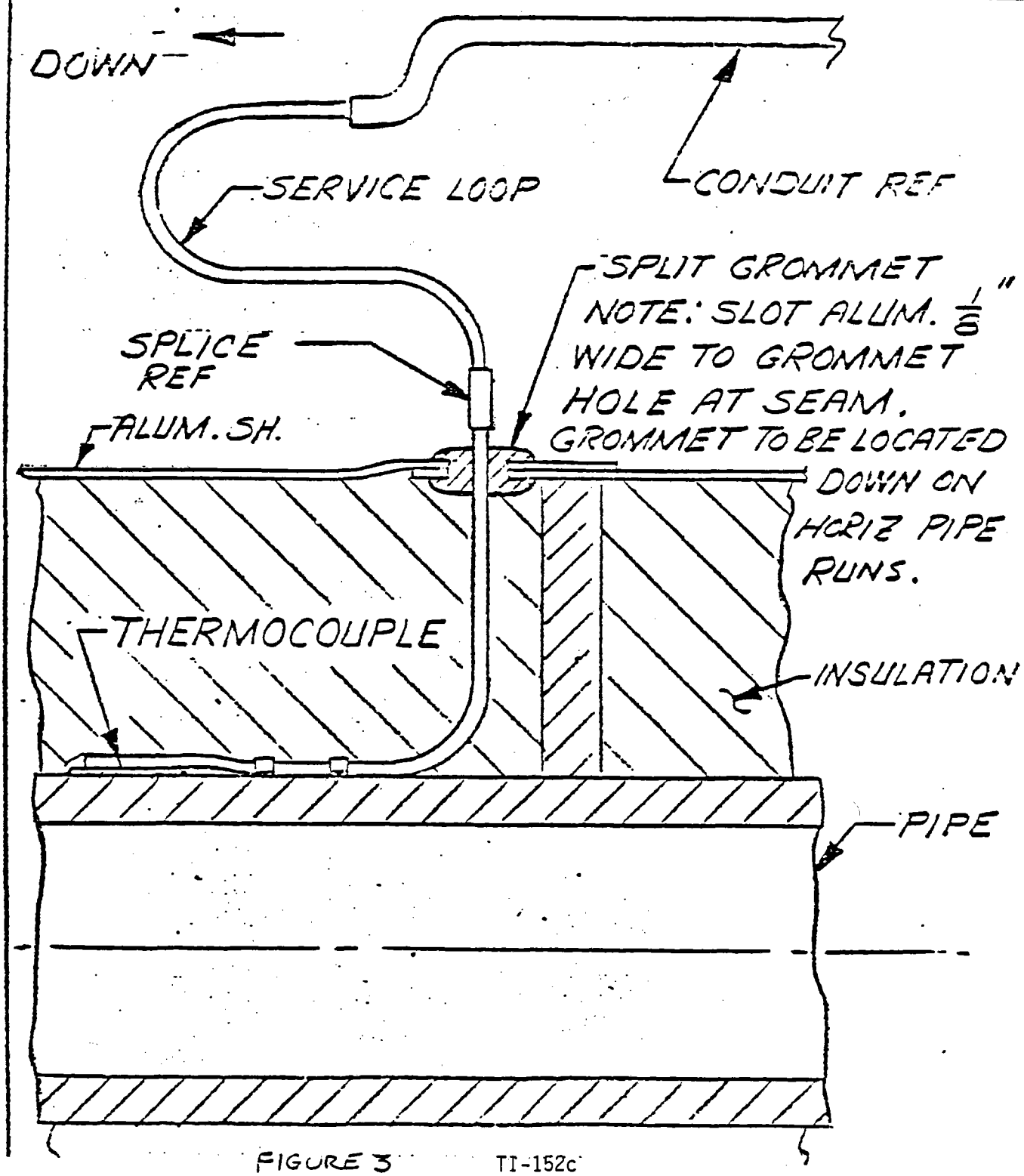


FIGURE 3 TI-152c

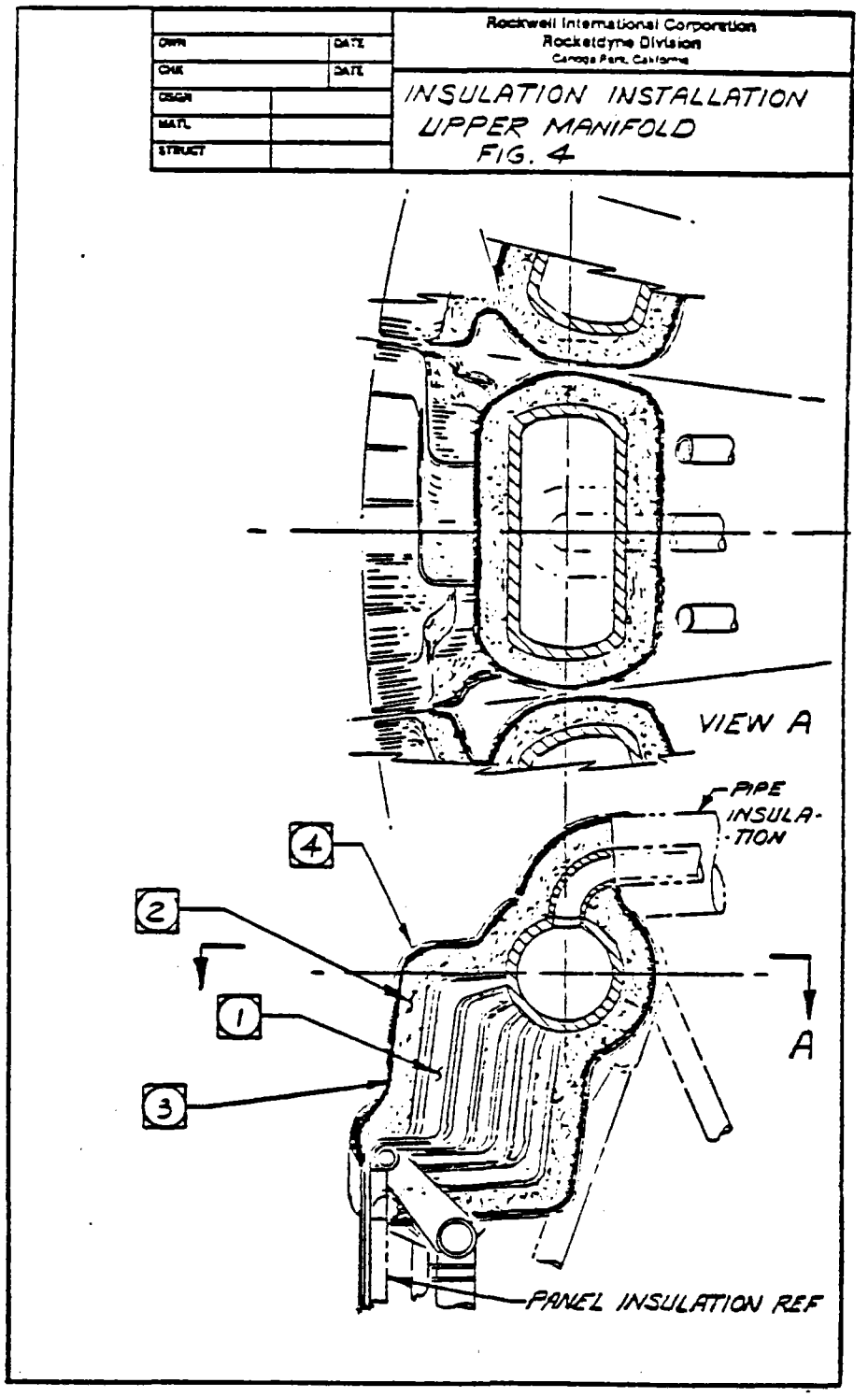
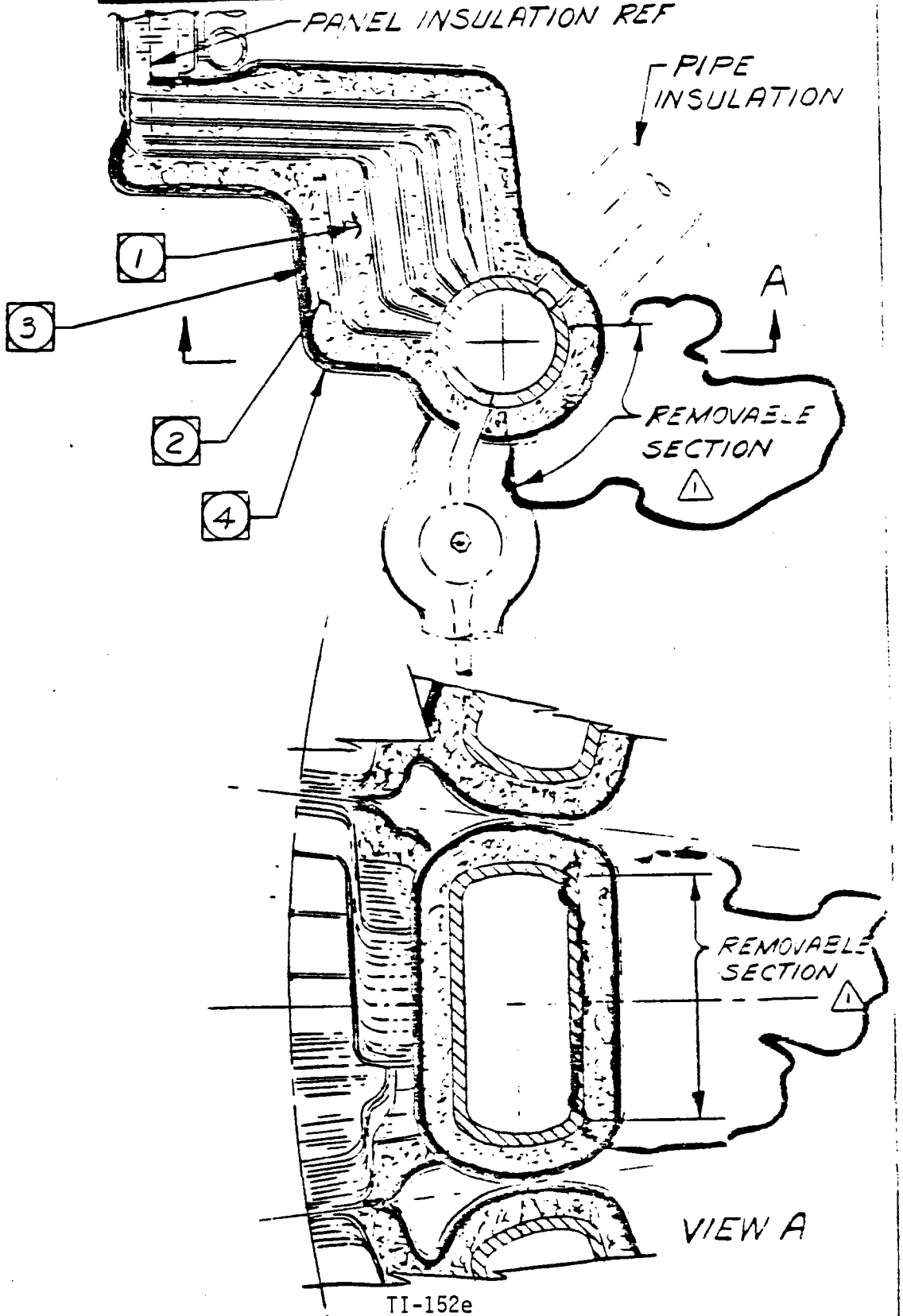

Rockwell International Corporation
Rocketdyne Division
Canoga Park, California
DWN
DATE
CHK
DATE
DSGR
MATL
STRUCT
INSULATION INSTALLATION
UPPER MANIFOLD
FIG. 4
VIEW A
PIPE INSULATION
4
2
1
3
A
PANEL INSULATION REF

FIGURE 4

		Rockwell International Corporation Rocketdyne Division Canoga Park, California
DWN	DATE	
CHK	DATE	INSULATION INSTALLATION LOWER MANIFOLD FIG. 5
DSGN		
MATL		
STRUCT		



TI-152e

FIGURE 5

		Rockwell International Corporation Rocketdyne Division Canoga Park, California
DWN	DATE	
CHK	DATE	
DSGN		INSULATION INSTALLATION FIG. 6
MATL		
STRUCT		

NOTES: UNLESS OTHERWISE SPECIFIED

(1) PACK BETWEEN TUBES WITH BULK CERAMIC FIBER (40-50% ALUMINA & 50-60% SILICATE) @ APPROX 6 LBS/FT^3

(2) WRAP & WIRE CIRCUMFRENCE WITH NEEDLED CERAMIC FIBER BLANKET (40-50% ALUMINA & 50-60% SILICATE) TO A THICKNESS OF 2½" USING 1½" & 1" 8LB/FT^3 BLANKETS.

(3) WRAP & WIRE EXTERIOR WITH ½" (TWO ¼" LAYERS) OF COLLOIDAL SILICA SATURATED CERAMIC FIBER BLANKET (20-24 LBS/FT^3). SEAMS OF FIRST LAYER TO BE COVERED BY SECOND ¼" LAYER.

(4) COVER INSULATION WITH .003" THICK DIE FORMED STAINLESS STEEL FOIL SECURED BY OVERLAPING SECTIONS & INSTALLING SHEET METAL SCREWS & TINNERMAN SPEED NUTS OR STAINLESS STEEL THREADED SCREWS & SHUR-LOK CLIP NUTS.

TI-152f

FIGURE 6

SECTION 4 - IFB
TECHNICAL INFORMATION (CONTD)

18.2 Painting of the Preheater, Boiler Modules and Core-Module Interface. This Article shall govern field surface preparation, field priming, field touchup and field finish painting of the module assemblies and the core-module interface of the core structure, as required under this Contract.

18.2.1. General

18.2.1.1. General Requirements

18.2.1.1.1. The term "Paint" shall include all paints, varnishes, emulsions, enamels, stains, sealers, galvanizing repair compound and other liquid-applied coatings required, regardless of whether used as prime, intermediate or finish coats.

18.2.1.1.2. Paint materials shall meet or exceed the requirements specified herein. Any additional materials which may be required, but which are not described hereinafter, shall be of suitable type and quality, and have been approved by the Construction Manager for the intended use.

18.2.1.1.3. After materials have been approved, no substitutions shall be made without written authorization from the Construction Manager.

18.2.1.1.4. Paints, thinners and related materials shall be delivered to the project site in sealed containers. Containers shall plainly show the brand name, date of manufacture, batch number and name of manufacturer, all of which shall be legible at the time of use. Containers that have such data obliterated shall be rejected and shall be removed from the project site. Pigmented paints shall be furnished in containers not larger than 5 gallons.

18.2.1.1.5. Paint for each use shall be of the type, grade, color and shade specified herein.

18.2.2. Coordination With Other Work

18.2.2.1. All cleaning and painting operations shall be performed in a logical sequence and shall be coordinated with the work of other trades and crafts performing or scheduled to perform work in the areas. Before starting any cleaning or painting operations, it shall be determined that other work on or in the vicinity of the item or surfaces to be painted has been completed and that the item or surface is ready for cleaning and painting.

18.2.2.2. The final field coat of paint shall not be applied to an item or surface until all other trades have completed their work within the space in which the item or surface is located.

18.2.3. Protection of Finishes

18.2.3.1. Factory primed or finish painted surfaces and galvanized surfaces shall at all times be protected from damage and deterioration.

SECTION 4 - IFB
TECHNICAL INFORMATION (CONTD)

18.2.3.2. Immediately upon detection, abraded or corroded areas of shop-primed surfaces shall be cleaned and touched up with the same material as the prime coat.

18.2.3.3. Immediately upon detection, abraded or corroded areas of galvanized surfaces shall be cleaned and touched up with galvanizing repair paint.

18.2.3.4. Immediately upon detection, abraded or corroded areas of factory finish painted surfaces shall be cleaned and touched up with the same material and matching color as the finish paint.

18.2.4. Manufacturer's Instructions

18.2.4.1. Coating materials shall be prepared and applied as required by this Specification and in strict accordance with the recommendations of the manufacturer of the coating product. The Contractor shall furnish the manufacturer's coating preparation and application instructions to the Construction Manager upon request. The Contractor shall request clarification when instructions are lacking or conflict exists.

18.2.4.2. Equipment for the application of each coating material shall comply with the recommendations of the manufacturer of the product. Effective oil and water separators shall be used in all compressed air lines serving spray painting and sandblasting operations to remove detrimental oil and moisture from the air before it is used. Separators shall be placed as close as practicable to the equipment.

18.2.5. Safety Requirements. The following requirements shall apply to all areas where painting is in progress.

18.2.5.1. Smoking, and heating devices having burners or open flame shall not be permitted in enclosed spaces where painting is in progress.

18.2.5.2. Forced ventilation shall be provided where and as required to keep fume concentration at a safe level inside enclosed areas.

18.2.5.3. Spark-producing equipment shall not be used in spaces where fume concentrations could occur until those areas have been thoroughly ventilated.

18.2.5.4. Paint, thinner and solvents shall be stored in a separate structure, that is well ventilated and free from flame or spark producing equipment and excessive heat. Paints, thinners and solvents shall be removed from the work areas and stored safely at the end of each work day.

18.2.5.5. Fire extinguishers of suitable type and capacity shall be kept handy at locations where painting is in progress or flammables are stored.

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18.2.5.6. At the end of each day, cloths, cotton waste and other materials which might constitute a fire hazard shall be destroyed or placed in tightly covered metal containers.

18.2.6. Equipment Protection. The Contractor shall take necessary precautions to prevent the entrance of dust, paint, and debris from mechanical surface preparations and from spray painting into machinery, instruments, control panels, switchgear, heliostats, and other areas subject to damage from these causes. No mechanical cleaning operations or spraying operations shall be commenced in the vicinity of operating motors or electrical apparatus. Equipment not in operation shall be covered and sealed before any cleaning or spraying operations are commenced in the vicinity.

18.2.7. Materials

18.2.7.1. Paints and Coatings

18.2.7.1.1. Identification. Paints and coatings indicated by P-number (P-1, P-2, etc.) in Table 1 (Pages TI-160a and TI-160b), PAINTING SCHEDULE are identified as follows: 5

Designation	Acceptable Products
P-1	Glidden Glid-Guard Double Build Vinyl Finish No. 5514 PPG High Build Vinyl Coating UC 40127 S-W Tank Clad High Build Enamel Series B69
P-2	Not Used
P-3	Not Used
P-4	Not Used
P-5	Not Used
P-6	Glidden Glid-Guard Alkyd Industrial Enamel No. 4500 PPG QD Enamel 54 Series S-W Kem-Lustral Enamel F65 Series
P-7	Glidden Glid-Guard Universal Primer No. 52310 PPG Multi-Prime Universal Primer US40054 S-W Kem Bond Metal Primer E41N15

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18.2.7.1.2. Proposal of Substitution. Prior to substitution for a specified paint, the Contractor shall accomplish the following and shall have received the Construction Manager's written approval of each proposed substitution.

18.2.7.1.2.1. Submit a proposal identifying each paint for which a substitution is proposed, giving its P-number, and listing the proposed substitute paint, identified by the manufacturer's name and catalog designation.

18.2.7.1.2.2. Submit an actual sample of each paint the Contractor proposes for use. Each sample shall consist of the actual paint, in the color, shade and appearance proposed, applied to Morest Co. Form 015 or approved equal penetration-opacity panel. Each panel shall have attached a color chip of the corresponding paint specified herein.

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18.2.7.2. Colors. Finish colors shall be as follows:

Tan - match exactly Glidden Color No. 20652
Brown - match exactly Glidden Color No. 12833
Yellow - OSHA safety yellow
Red - OSHA safety red

18.2.7.3. Thinners. Thinner for use with each product shall be as recommended by the manufacturer of the product being thinned and shall not be added in excess of the amount recommended.

18.2.7.4. Cleaning Solvent. Solvent for cleaning metallic surfaces other than galvanized surfaces, shall be Standard Oil Company SOCAL No. 2, or other suitable low-toxicity solvent which does not leave a residue which would reduce the bond of the paint. Solvent for cleaning galvanized surfaces shall be xylol.

18.2.7.5. Galvanizing Repair Compound. Galvanizing repair compound shall be Galvanox Type 1, as manufactured by the Subox Division of BASF Wyandotte Corporation, Carstadt, New Jersey, or a Construction Manager approved zinc-rich paint, gray in color.

18.2.8. Cleaning and Preparation of Surfaces

18.2.8.1. General

18.2.8.1.1. Surfaces of the module assemblies will have received surface preparation and shop prime painting by others before shipment to the field. Prime painting of field welds and field bolting, and touch-up of abraded or corroded areas of primer after installation or erection shall be performed by the Contractor.

18.2.8.1.2. All hardware, hardware accessories, machined surfaces, nameplates, switchplates, and similar items on or in contact with surfaces to be painted, shall be removed, masked or otherwise protected prior to surface cleaning and application of paint. Removal of items and subsequent reinstallation, shall be done by workmen skilled in the trades involved.

18.2.8.1.3. The Contractor shall not apply any paint until the surface to be painted is in proper condition to receive the paint. Application of the first coat shall be considered as acceptance by the Contractor of full responsibility for the satisfactory quality of the finish work.

18.2.8.1.4. At the time of commencing touch-up and paint application, the surfaces to be painted shall be free from oil, grease, dust, dirt, areas of powder rust, and other foreign substances.

18.2.8.2. Preparation of Unprimed Piping. Ungalvanized pipe and fittings which remain unprimed at the time of this Contract, shall be prepared for painting by being power tool cleaned in accordance with Steel Structures

Painting Council Specification SSPC-SP3, then solvent cleaned in accordance with SSPC-SP1. Prior to deterioration of the cleaned surfaces, they shall be prime painted.

18.2.8.3. Preparation of Prime-Painted Surfaces.

18.2.8.3.1. All damaged or deteriorated areas of existing prime coat shall be repaired, using the following methods and the same primer as the original shop coat. Abraded areas shall be solvent-cleaned in accordance with Steel Structures Painting Council Specification SSPC-SP1. Areas showing rust or corrosion shall first be cleaned to bare metal by power wire brushing in accordance with SSPC-SP3, then solvent-cleaned in accordance with SSPC-SP1. Application of touch-up paint shall be by brush only.

18.2.8.3.2. Joints and seams between abutting structural steel members which are located outdoors or wherever moisture could penetrate the joints and cause corrosion, shall be sealed with an approved, permanently resilient calking compound before finish painting.

18.2.8.3.3. Surfaces to be finish painted shall have all traces of oil, grease, dust and other detrimental substances removed by solvent cleaning in accordance with SSPC-SP1 and shall be clean at the time of paint application.

18.2.8.4. Repair of Galvanized Surfaces. Galvanized surfaces having breaks in the zinc coating shall be solvent-cleaned in accordance with SSPC-SP1 and touched up with the specified galvanizing repair compound.

18.2.9. Paint and Coating Application.

18.2.9.1. Surfaces Not to be Painted. Paint shall not be applied to following surfaces, and any paint contamination of these surfaces shall be promptly and completely removed.

18.2.9.1.1. Galvanized surfaces, except for galvanizing repair touch-up.

18.2.9.1.2. Surfaces of corrosion-resistant steel, stainless steel, aluminum, copper, bronze, brass, lead, and other non-ferrous metals, except as otherwise specified.

18.2.9.1.3. Name and data plates of equipment.

18.2.9.1.4. Flange faces, and mating, machined or polished surfaces of equipment.

18.2.9.1.5. Builders hardware, other than items which have been prime-painted only.

18.2.9.1.6. Insulated and metal jacketed piping, tanks, solar panels and panel insulation metal covering.

18.2.9.1.7. Factory finish painted surfaces, except for touch-up.

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18.2.9.2. Workmanship.

18.2.9.2.1. The finish coating shall be free from pinholes, bubbles, runs, drops, ridges, waves, laps, unnecessary brush marks, and variations in color, texture and gloss. Coats shall be applied in a manner that will produce a uniform film thickness. Special attention shall be given to ensure that all surfaces, including edges, corners, welds and bolts receive a coating thickness equal to that of adjacent surfaces. Care shall be exercised during spraying operations to hold the nozzle sufficiently close to surfaces being painted to avoid excessive evaporation of the volatile constituents and loss of material into the air, or the bridging over of crevices and corners. Spray equipment shall be equipped with mechanical agitators, pressure gages and pressure regulators. Nozzles shall be of proper size. Equipment, floors and adjacent surfaces shall be satisfactorily protected by dropcloths or other precautionary measures.

18.2.9.2.2. Mechanical mixers capable of thoroughly mixing the pigment and vehicle together shall be used to mix paint prior to use. Pressure pots shall be equipped with mechanical mixers to keep the pigment in suspension. Small quantities of paint may be mixed manually if necessary. All mixing shall be done in accordance with practices set forth in SSPC Vol. 1, Chapter 4, "Practical Aspects, Use and Application of Paints," or with the manufacturer's recommendations. Catalysts or thinners shall be added and the material used or discarded in strict accordance with the manufacturer's instructions. If the paint or coating becomes thick in cold weather, it shall be heated in the container by use of paint heaters and not thinned by addition of solvents.

18.2.10. Paint Properties, Mixing and Thinning.

18.2.10.1. Paint, when applied, shall provide a satisfactory coat and a smooth, even surface. Excessively glossy undercoats shall be lightly sanded to provide a surface suitable for the proper application and adhesion of subsequent coats. Paints shall be thoroughly stirred, strained and kept at a uniform consistency during application.

18.2.10.2. Paste pigments, added at the time of use, shall be placed in a separate container and mixed by adding small increments of the required vehicle or base paint and by thoroughly stirring until a viscous, smooth, homogeneous, lump-free paste is obtained. The remainder of the vehicle or base paint shall then be added by boxing and stirring.

18.2.10.3. Powdered pigments, added at the time of use, shall be mixed by adding the powder in small increments to approximately one-third of the required base paint or vehicle, with thorough mixing to obtain a smooth paste. The remainder of the vehicle or base paint shall then be thoroughly stirred in.

18.2.10.4. Paints shall be stored as recommended by the manufacturer. At time of application, paint shall show no signs of hard settling, excessive

skinning, livering or other deterioration. Paints of different manufacturers shall not be mixed together. Where necessary to suit conditions of surfaces, temperature, weather and method of application, paint may be thinned immediately prior to application. Paint shall be thinned only when necessary for good application properties, and then only with the recommended thinner in amounts not exceeding that recommended by the paint manufacturer.

18.2.11. Atmospheric Conditions. Under no circumstances shall any paint be applied during rain, misty, or snowy weather or to surfaces upon which there is frost, ice, or moisture condensation, without suitable preparation and proper protection. During cold weather the paint may be heated, if necessary, to aid in application. During hot weather, paint shall not be applied to surfaces whose temperature exceeds the maximum application temperature recommended by the paint manufacturer. Surfaces shall be dry and properly prepared when painted. Outdoor spray painting shall not be performed when the wind velocity exceeds 10 mph.

18.2 12. Time Between Surface Preparation and Application of Coating. Surfaces which have been cleaned, pretreated or otherwise prepared shall be painted as soon as practicable after such preparation has been completed, but in any event, prior to deterioration of the prepared surfaces.

18.2.13. Method of Paint and Coating Application. Prime and touch-up paint, to the extent required, and galvanized metal primer, to the extent required, shall be applied by brush only. Subsequent intermediate and finish coats may be applied by brush, spray or roller, unless otherwise specified.

18.2 14. Coating Progress. Where painting on any type of surface has commenced, the complete application, including priming, secondary and finishing coats shall be completed as soon as practicable, without prolonged delays. There shall be a time lapse between successive coats sufficient to permit proper drying.

18.2.15. Tinting Successive Coats. Where successive coats of paint of the same color are specified, the Contractor shall tint the first coat of paint to produce enough contrast to enable visual determination of complete coverage by the second coat. Tinting materials shall be compatible with the paint and shall not be detrimental to its service life.

18.2.16. Protection of Painted Surfaces. Where conditions make it advisable, or where directed, the Contractor shall provide and install temporary protection for painted surfaces. Such protection shall be preserved in place until the coat has properly dried and removal of the protection is acceptable. Items which have been painted shall not be handled, worked on, or otherwise disturbed until the coat is completely dry and set.

18.2.17. Coating Inspection and Test. Visual inspection of surfaces field-painted under this Contract will be performed by the Construction Manager. Testing to determine total dry film thickness on surfaces field-painted under this Contract shall be performed by the Contractor. Such testing shall, where requested, be performed under the surveillance of the Construction Manager.

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18.2.18. Coating Thickness Inspection. Total dry film thickness on metallic surfaces shall be determined by means of a properly calibrated "Mikrotester" furnished by the Contractor. Procedure for use of the Mikrotester in determining paint film thickness shall be in accordance with the printed instructions of the manufacturer of the instrument. Where coating inspection requires that the paint film be scraped back for "zeroing" the meter, the broken film shall be promptly repaired by the Contractor.

18.2.19. Correction of Defects and Deficiencies. All deficiencies and defects revealed by the above inspection and test methods shall be promptly repaired or corrected by the Contractor, using the applicable type, grade, color and shade of finish coat material as that in which the deficiency existed.

18.2.20. Maintenance of Paint Coatings. At all times prior to final acceptance of the work, coats shall be unscarred and completely integral at the time of application of succeeding coats. Immediately upon detection, abraded or corroded areas of painted surfaces shall be cleaned and touched up with the same paint and matching color.

18.2.21. Painting Schedule. The surfaces listed in Table 1 (Pages TI-160a and TI-160b), PAINTING SCHEDULE, shall receive the surface preparation, paint and color as indicated. Total dry film thickness shall be not less than .0085 inch. 5

18.2.22. Piping Identification Labeling. Labeling as required for compliance with OSHA regulations and for proper identification of the various piping is specified in Section 18.3, PIPING IDENTIFICATION.

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PAINTING SCHEDULE

SURFACE OF ITEM	EXISTING FINISH	SURFACE PREPARATION	FIELD FINISH PAINTING PRIME COAT	SECOND COAT	FINISH COAT	COLOR	MIN. TOT. DRY FILM THICKNESS
A. STRUCTURAL STEEL							
a. Receiver Tower	Shop Primer	SSPC-SP1	P-7		P-1	brown	8.5
b. Pipe Rack Structure	Shop Primer	SSPC-SP1	P-7		P-1	brown	8.5
c. TSU Skids	Shop Primer	SSPC-SP1	P-7		P-1	brown	8.5
d. Pipe Supports in trenchs & embedded items	Shop Primer	SSPC-SP1	P-7		P-1	brown	8.5
e. Raw Water Storage Tank	Shop Primer	SSPC-SP1	P-7		P-1	tan	8.5
f. Caloria Makeup Tank	Shop Primer	SSPC-SP1	P-7		P-1	tan	8.5
g. All Ladders	Shop Primer	SSPC-SP1	P-7		P-1	OSHA Safety Yellow	8.5
h. All handrail, including kick-plates	Shop Primer	SSPC-SP1	P-7		P-1	OSHA Safety Yellow	8.5
i. Wind and Weather Towers	Shop Primer	SSPC-SP1	P-7		P-1	brown	8.5
j. Pyranometer Towers	Shop Primer	SSPC-SP1	P-7		P-1	brown	8.5

TABLE I
PAINTING SCHEDULE

SURFACE OF ITEM	EXISTING FINISH	SURFACE PREPARATION	FIELD FINISH PAINTING PRIME COAT	SECOND COAT	FINISH COAT	COLOR	MIN. TOT. DRY FILM THICKNESS
B. BUILDINGS							
a. Structural Steel							
(1) Interior	Shop Primer	Touch-up		P-6	P-6	brown	6.0
(2) Exterior	Shop Primer	SSPC-SP1	P-7		P-1	brown	8.5
b. Doors and Door Frames							
(1) Interior	Shop Primer	Touch-up		P-6	P-6	brown	6.0
(2) Exterior	Shop Primer	SSPC-SP1	P-7		P-1	brown	8.5
C. PIPING							
a. Uninsulated Piping	Mill Finish	SSPC-SP3	P-7		P-1	Aluminum	
b. Fire System Piping	Mill Finish	SSPC-SP3	P-7		P-1	OSHA Safety Red	
c. Ungalvanized Hangers and Misc. Steel Supports	Shop Primer	Finish same as piping being supported					
d. Galvanized Components	Galvanized	(Touch-up repair only)	Do Not Paint				

18.3 Receiver Piping Identification

This Article covers identification labeling of piping in the preheater and boiler modules.

18.3.1 General

18.3.1.1. All carbon and alloy steel piping, other than instrument tubing, shall be identified in accordance with the applicable provisions of ANSI Standard A13.1, as specified herein, and indicated in Table II - "Pipe Identification Schedule," (Page TI-162). Pipe service label wording shall conform to the schedule. 4 5

18.3.1.2. Installation shall be in accordance with the manufacturer's recommendations and the requirements specified herein. The piping identification shall be readily visible from working areas, platforms, walkways and normal access to the piping.

18.3.1.3. Labels shall be applied to clean surfaces which have received their final painting or finish. Metal surfaces shall be cleaned with a suitable solvent prior to applying the label.

18.3.1.4. Labels, directional arrows and pipe bands shall be installed at the following locations, with additional labels installed to meet the intent, as may be directed by the Construction Manager:

18.3.1.4.1. At both sides of floors and core-module interface.

18.3.1.4.2. At eye level on vertical runs between floors.

18.3.1.4.3. At all tees, laterals and crosses except where several fittings are in close proximity, in which case only one fitting need be labeled. One (1) label and three (3) arrows shall be installed at each tee and/or lateral, and one (1) label and four (4) arrows shall be installed at each cross.

18.3.1.4.4. At each valve except where several valves are in close proximity, in which case only one valve need be labeled if of the same size, or the largest valve labeled if of different sizes.

18.3.1.4.5. The arrow label indicating the direction of flow shall have the same background color and the same height as the label indicating pipe content. Pipe banding tapes shall be applied entirely around the pipe at the end of each marker.

18.3.1.4.6. Each pipe marking shall consist of the following, and shall be arranged as shown in Figure 1 (Page TI-162): 5

18.3.1.4.6.1. Pipe legend and line number marker (A).

18.3.1.4.6.2. Directional arrow (B).

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18.3.1.4.6.3. Pipe bands - two (2) (C).

18.3.2.0. Pipe Identification Markers. Pipe identification markers shall be vinyl cloth or thin film pipe markers as manufactured by the W.H. Brady Company, 2223 W. Camden Rd., P.O. Box 2131, Milwaukee, Wisconsin 53201, or Construction Manager approved equal.

18.3.2.1. Pipe Legend. The pipe legend shall be B-350 thin film with card-mounted black letters and numbers, Style 4, 6 or 8 for piping with OD 3 inches and smaller. Coat with clear epoxy. Pipe legends shall carry the service designations.

18.3.2.2. Line Number. Style, material and color shall be the same as for the pipe legend. The numbers used shall be as called for on the Line Schedule Drawings.

18.3.2.3. Directional Arrow. Directional arrows shall be of the same material as the pipe legend. Directional arrows, Brady Style 468S or 468D shall be used for piping with OD 3 inch and smaller. Background color shall be the same as for the service.

18.3.2.4. Pipe Banding. The pipe banding tape shall be equal to Brady B-500 pipe banding tape, 2-1/4 inch vinyl cloth. The pipe banding tape shall be the same color as the background color for the service.

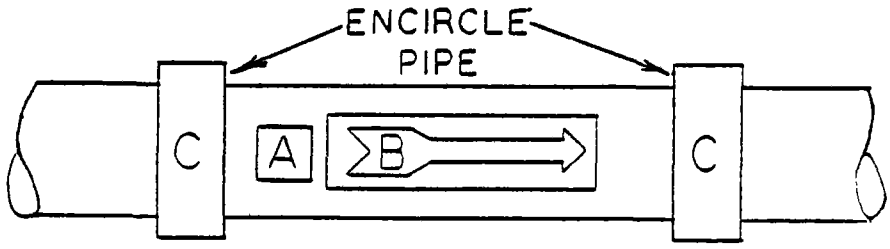
TABLE II

PIPE IDENTIFICATION SCHEDULE

SERVICE	PIPE LEGEND	BACKGROUND COLOR	LETTERING COLOR
Steam	Steam (High Press.)	Yellow	Black
Drain System	System Drain	Yellow/Green	Black
Vent	Vent (Type Service)	Yellow	Black
Water Treated	Hot Treated Water (High Press.)	Yellow	Black

FIGURE 1

PIPE IDENTIFICATION MARKERS



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18.3.3. Marking Incoloy 800 Materials. 4

18.3.3.1. Hand Marking. Hand marking materials which are permitted for marking Incoloy 800 materials shall be Markal Ball Marker - white. 4

18.3.3.2. Stenciling Inks. Stenciling inks which are permitted for marking Incoloy 800 materials shall be Pannier 127-1/2 - blue or Matthews M-257A - blue. 4

18.3.3.3. Temperature Indicating Crayons. Incoloy 800 materials are subject to contamination by temperature crayons containing low melting point metals (more than 50 ppm by weight). Temperature crayons shall not contain any halogen compounds or sulfur, sulfides or organically found sulfur compounds exceeding 1000 ppm. 4

18.4 Receiver Core Shielding

18.4.1. General. The Contractor shall detail, procure, fabricate, and install the shielding shown in drawings 40M2005131968 and 40M2005131969 on the structural steel framework previously installed by others. The work shall comply with the applicable requirements of the referenced codes, standards, and publications.

18.4.2. Materials. The insulation material shall be 2" thick CER-WOOL 1900 blanket (Combustion Engineering Refractories Inc.) or equivalent. The outer sheeting shall be 16 gauge CRES and the inner sheeting carbon steel. Both sheets shall be continuous in the vertical direction except for the break at the removable section 2'6" below the top of the shields. Angles used for attachment to the existing structure shall be carbon steel. Bolts for attaching the shields to the angles shall be 3 x 5/8 inch CRES with self-locking all-metal nuts. 2 x 5/8 carbon steel bolts shall be used to fasten the shield angles to the existing C6 beam.

18.4.3. Erection. The shielding shall be installed to span as shown in the drawings. Bolts securing the shielding to the angles shall be spaced at 18" or less and be installed within 6" of corners of shields. Shields shall be installed such that no gap exists between adjacent shields. An overlap of up to 1/4 inch between adjacent metal sheets (both interior and exterior) is permissible.

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(Line Schedule)

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19.0. PREOPERATIONAL CLEANING AND TESTING REQUIREMENTS, REPORTS AND PROCEDURES. 5

19.1. Description of Work. 5

19.1.1. This Article covers the cleaning and testing to be performed after completion of the construction testing of the systems and equipment installed under this contract. A rental boiler and chemical cleaning specification is also addressed. 5

19.1.2. The tagging of equipment in and out of service for construction purposes, or for any reason, will be done only in accordance with SCE established plant tagging procedures. 5

19.1.2.1. After the Control Room becomes operational for any piece of equipment, any system, or any portion of a system, the Contractor's personnel shall not enter the control room unless they have been issued a pass by the Start-Up Engineer with the consent of the Construction Manager. 5

19.1.3. Start-Up. The Contractor shall prepare all equipment and systems for operation at time required to meet the Detail Start-Up Test schedule and as required to meet the overall project schedule for the start-up and commercial operation of the complete power plant. 5

19.1.4. The Contractor shall prepare all equipment and systems installed by him for initial operation including, but not limited to, the following: 5

19.1.4.1. The Contractor will provide the Construction Manager a manufacturer's recommended list of lubricants and recommended lubrication schedule for all items of equipment installed by the Contractor at least 90 days prior to initial lubrication activities in accordance with Paragraph 10.9, "Lubrication." 5 6

19.1.4.2. The Contractor shall furnish and install all special lubricants necessary for flushing or break-in, etc., as recommended by the equipment manufacturers. The Contractor shall flush all bearings and lubrication systems shortly before final lubrication prior to start-up. Construction Manager shall be notified before starting of flushing and at final lubrication so he may have a witness present. 5

19.1.4.3. Inspection and checking to determine if ready for operation, including jacking over, cleaning, flushing, testing, preheating and preadjustment. 5

19.1.4.4. Final alignment checks including observations by the Start-Up Manager and Construction Manager. 5 6

19.1.4.5. Alignment checks to include opening connections if required to ensure there are no abnormal strains on equipment. 5

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19.1.4.6. Motor rotation checks shall be verified before connecting couplings, under supervision of Start-Up Engineer and Construction Manager personnel. 5,6

19.1.4.7. Inspection of sleeve bearings for adequate contact. Include scraping bearing for at least 80 percent contact and demonstrating contact area to Contruction Manager and Start-Up Engineer before final assembly of bearing caps. 5

19.1.4.8. DELETED. 5,6

19.1.4.9. After run-in and acceptance of alignment affix major equipment in place using standard tapered dowels with jack-out nuts at head end to facilitate removal. 5

19.1.4.10. Provide the Construction Manager with a written record of the alignment of each piece of equipment including coupling alignment readings, vertical offset, number of shims under each foot, date dowelled, etc. 5

19.1.4.11. Provide the Start-Up Engineer, through the Construction Manager, a written record of all electrical tests required and performed under this Contract. 5,6

19.1.4.12. Provide, to the Construction Manager, temporary piping which may be required for operation during partial system operating conditions, and any construction labor required because of these temporary hookups. This would include all temporary pressure relief valves, pressure indicators, valves, spacers, temporary strainers and other items of equipment as noted on the Drawing referenced in Paragraph 19.2.2. and as specified on the specification sheets for Relief Valve PSV-B0A, Pressure Indicators PI-B0B, PI-B0C, PI-B0D and PI-B0E, and Temporary Strainer List P26-5. The relief valve specified must be resized by the Contractor if the Contractor increases the capacity of the temporary rental boiler over what is specified in Paragraph 19.4 of this Specification. 5,6

19.1.5. When, in the Contractor's opinion, his equipment, system or a portion of a system is completed and ready for initial operation, the Contractor shall notify the Start-Up Engineer in writing. 5

19.1.6. The Start-Up Engineer and Construction Manager will inspect that portion of the system to ensure that all required pre-start-up work has been completed. If the condition of the equipment is not acceptable, the Start-Up Engineer will furnish to the Contractor a punch list for system completion and correcting which must be completed before start-up and testing. 5

19.1.7. After completing the punch list items, the Contractor will again notify the Start-Up Engineer of readiness and the foregoing inspection procedure will be repeated. 5

19.1.8. As soon as the Start-Up Engineer and Construction Manager are satisfied that a portion of a system has been properly prepared for initial 5

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operation, the Start-Up Engineer through the Construction Manager, will give the Contractor written notice that it is accepted for start-up and a mutually agreeable time will be set to start-up such system. 6

19.1.9. When a system or a portion of a system is accepted for operation by SCE, it will be so tagged in accordance with the project standard tagging system as outlined in the Start-Up and Test Program Manual. 5

19.1.10. The Contractor shall strictly enforce his own, the Construction Manager's and SCE safety measures for the protection of equipment and personnel. The SCE tagging procedure shall be strictly complied with. 5

19.1.11. After initial acceptance, SCE will assure all operational and maintenance duties and all Contractor's personnel are specifically prohibited from starting or stopping any equipment in the system, opening or closing any valve in the system, operating any switches, breakers or controls in the system, or performing any other operational and maintenance duties whatsoever, unless directed by the Start-Up Engineer through the Construction Manager. 5 6

19.1.12. After acceptance for operation, the Contractor shall continue to provide all craft support, specialized personnel and attendance required to perform the work specified in this Contract. 5 6

19.1.13. DELETED. 6

19.1.14. The Contractor shall provide to the Construction Manager, all craft support, specialized personnel and support labor during the start-up and initial operation of systems as deemed necessary by the Construction Manager. 5,6 6

19.1.15. After the system, or a portion of the system, has been started, the Contractor shall continue to provide to the Construction Manager, all specialized personnel and support labor required to correct defective Contractor supplied material and workmanship and to perform the operational checkout, troubleshooting, adjustments and repairs until system operation performance is acceptable. 5 6 6

19.1.16. During initial operations of equipment (Government Furnished Equipment and Contractor-Furnished Equipment) installed under this Contract, the Contractor shall furnish personnel to make checks and corrections as directed by the Construction Manager. The Contractor's responsibility shall include, but is not limited to, the following: 5,6 6

19.1.16.1. Check for excessive vibratrion, overheating and unusual noises. 5

19.1.16.2. Check for piping leaks, proper hanger action, clearances and proper functioning of gages. 5

19.1.16.3. Check for pressure drop across pump strainers, clean strainers and install new gaskets when directed by the Construction Manager. 5 6

19.1.16.4. DELETED 5,6

19.1.16.5. Check adjustments of all safety switches and mechanical actuated devices. 5,6

19.1.16.6. Check adjustment to idler and pulley alignment and belt training. 5,6

19.1.16.7. DELETED 5,6

19.1.16.8. Flange retightening and equipment re-alignment after initial hot operation. 5,6

19.1.16.9. Gasket replacement to correct leaks which occur during initial operation. 5

19.1.16.10. Valve repacking and pump seal repacking and run-in to correct leaks which occur during initial operation. 5

19.1.16.11. Assist instrument and control service personnel with instrument calibration (Reference Paragraph 19.7). 5,6

19.1.16.12. Assist manufacturer's service personnel with operating checks as required until system operation and performance is acceptable. 5

19.1.16.13. The Contractor shall directly and/or through his manufacturer's representatives instruct SCE personnel until they are fully informed as to the proper operation and maintenance of the Contractor Furnished equipment or systems. 5 6

19.1.16.14. The tagging of equipment in and out of service for any of the above operations, for construction purposes, or for any reason, will be done only by SCE in accordance with their established plant tagging procedures. 5

19.1.17. Performance Tests. The Contractor shall provide maintenance support personnel for the Government-Furnished Equipment and Contractor-Furnished Equipment installed under this contract for the preoperational test period. This test period is defined on the preoperational test schedule which can be obtained from the Construction Manager. 5,6

19.1.17.1. DELETED 5,6

19.1.17.2. DELETED. 5,6

19.2. Preoperational Cleaning 5

19.2.1. Preoperational cleaning consists of velocity flushes, chemical flushes, rinses and steam blows. 5

19.2.2. The preoperational cleaning shall be performed in accordance with preoperational test procedure number 980 and as defined in Drawing No. 40P7005133151 Sheets P3-12A, P3-12B and P3-12C. 5

19.2.3. The Contractor shall provide, and remove after cleaning all equipment identified as Contractor-Furnished Equipment and all temporary piping. After completion of cleaning, all permanent piping and equipment are to be returned to their design configuration. Temporary piping in the RS and TSS areas are defined by the Temporary Flush and Steam Blow Interface Data Sheets and Drawings No. 40P7002133104, 40P7005133195, 40P7005133197 and SK1E M809. Appendices A and B contain information for the RS temporary piping and for the RS and Ramapo flowmeters. (Refer to Page A-1 and B-1.) Appendix C contains detailed procedures for the steam and water side of the TSS. (Refer to page C-1.) Appendix D contains the temporary flush and steam blow interface data. (Refer to Page D-1.) 5,6

19.2.3.1. The Contractor shall record the results of the cleaning operations on the appropriate data sheets and furnish these to the Construction Manager at the completion of each cleaning operation. The results shall meet or exceed the criteria specified. 5 6 6

19.3. Preoperational Testing 5

19.3.1. Preoperational testing consists of those operational tests of equipment and systems installed in whole or in part under this Contract. 5

19.3.2. These tests shall be performed in accordance with the following preoperational test procedures: 5

Description	Number
Receiver System	000
Beam Characterization System	150
Thermal Storage Oil System	205
Thermal Steam System	250
Main/Admission Steam	405
Nitrogen System	905
Water Supply Systems	910
Plant Drains and Sumps	940
Flushing and Steam Blows	980

19.3.3. Filling, flushing, and bed conditioning procedure for the Thermal Storage Oil System: 5 6

a) Maintain a vent opening to atmosphere of appropriate size for the ullage space in the TSU to allow free communication with the atmosphere. Excessive positive and negative pressures must be avoided at all times. 5,6

b) Close hand valves to equipment and isolate TSU from remaining portion of system. 5

c) Install temporary oil level sight gage from lower to upper manifold on the TSU. Transparent plastic tubing that is compatible with petroleum products may be used. 5

d) Prior to transferring oil from the tank car to the TSU, a 5 gallon sample shall be withdrawn and stored for future reference, and the oil shall be verified as Caloria HT43 by laboratory tests. Bill of lading will be checked to verify contents and car number. 5

e) Fill TSU only to TBD level. Record oil level as a function of volume. Recording may be in 10,000 to 20,000 gallon increments, i.e., tank car units. Flow rate during filling shall be no greater than 500 gpm. A record shall be kept of each tank car serial number and time of transfer to TSU. 5

f) After filling the TSU, all TSS lines and equipment shall be filled by opening appropriate valves and bleeding and venting where necessary. This can be done by gravity flow from the TSU or by boosting with oil circulation pumps. When circulating the oil at room temperature, flow rates and pressures shall remain below 500 gpm and 50 psig respectively. TSU oil level should be recorded before and after filling to establish the volume in the remaining portions of the system. 5

g) After filling complete TSS top off TSU to TBD oil level. Remove temporary sight gage and verify operation of permanent sight gage. 5

h) Reactivate TSU relief valves and activate GN_2 ullage gas supply system. TSU and UMU should be in operating trim at this point. 5

i) Purge air from ullage space in TSU with GN_2 from UMU through 1 inch purge line connected to upper manifold. Monitor oxygen content of discharge gages during purging. 5

j) Close upper manifold and auxiliary manifold valves at TSU. Open lower manifold valve. 5

k) Circulate oil through all portions of the system and heat to 300°F. Circulate up to maximum velocity through the various parts of the system and clean out filters as needed to assure removal of 5

construction debris. Do not circulate through TSU. Allow oil to cool at 100°F before opening lines to clean out filters. Caution must be observed to avoid trapping cooling oil in a closed portion of the system. This can lead to collapse of certain equipment items.

l) Remove temporary filters and drive water from bed by circulating oil through charging circuit and TSU. Heat oil to 300°F during this operation and control heat input to avoid overpressurizing the TSU. Remove condensed water from UMU. 5

m) Heat bed (TSU) to a maximum of 450°F or less dependent upon the capabilities of the temporary boiler. 5

19.4. Rental Boiler 5

19.4.1. The Contractor shall furnish, deliver to the site, unload and install a temporary rental boiler with all temporary piping connections. The Contractor shall provide a foundation of adequate size and load-bearing capacity for the rental boiler. The Contractor shall provide labor and supervision to operate this boiler at the site. Following its use, the Contractor shall remove the boiler from the site. The boiler foundation shall be removed and disposed of per the direction of the Construction Manager. 5

19.4.2. The boiler shall be rated, as a minimum, for a capacity of 75,000 pounds per hour of saturated steam at 400 psig, and have a design pressure of 600 psig. A superheated steam boiler is not acceptable. The boiler shall be provided with all necessary equipment to allow the use of No. 2 fuel oil as a fuel. 5

19.4.3. The boiler must, as a minimum, be furnished with the following accessories: 5

a) Feedwater, Steam and Fuel Oil Controls 5

b) Fuel Oil Pump and Motor 5

c) Fuel Oil Tank 5

d) Feedwater Pump and Motor compatible with boiler design 5

e) Feedwater Tank 5

f) Chemical Feed Pumps and Motors 5

g) Chemical Feed Tanks 5

h) Smoke Stack 5

i) FD Fan and Motor 5

j) Pressure Safety Valves 5

k) Motor Breakers for all supplied motors 5

l) A supply of all required chemicals for the duration of the boiler site operation 5

m) No. 2 Fuel Oil 5

19.4.4. The following items pertaining to the operation of the rental boiler will be supplied by others: 5

a) Electrical craft labor and supervision for the electrical installation and electrical removal of the temporary rental boiler and accessories. 5

b) Temporary electrical supply wiring, cables, fittings and raceway. 5

c) Softened Water 5

d) 480 V/3 Phase/60 Hz Electrical Power 5

e) 120 V/1 Phase/60 Hz Electrical Power 5

19.5. Chemical Cleaning 5

19.5.1. The Contractor shall furnish all items of equipment, supplies, equipment operators, analyst and supervision to flush, chemically clean, rinse, passivate and lay up those areas of the Solar One Facility as defined in Drawing No. 40P7005133151, Sheets P3-12A, B and C, and as stated in this Specification. 5

19.5.2. The following system cleaning operations are to be performed which apply to the water/steam lines and equipment only. Chemicals are not to be put into the oil side of the TSS. 5,6

a) Velocity Flush Receiver System 5

b) Velocity Flush TSS Charging System 5

c) Velocity Flush TSS Extraction System 5

d) Alkaline (Degreasing) Flush Condensate System 5

e) Alkaline (Degreasing) Flush Receiver System 5

f) Alkaline (Degreasing) Flush TSS Charging System 5

g) Alkaline (Degreasing) Flush TSS Extraction System 5

h) Rinse of Condensate System 5

i) Rinse of Receiver System 5

j) Rinse of TSS Charging System 5

SECTION 4 - IFB
TECHNICAL INFORMATION (CONTD)

k) Rinse of TSS Extraction System 5

l) Chemical (Scale and Rust Removing) Flush Condensate System 5

m) Chemical (Scale and Rust Removing) Flush Receiver System 5

n) Chemical (Scale and Rust Removing) Flush TSS Charging System 5

o) Chemical (Scale and Rust Removing) Flush TSS Extraction System 5

p) Passivation Flush Condensate System 5

q) Passivation Flush Receiver System 5

r) Passivation Flush TSS Charging System 5

s) Passivation Flush TSS Extraction System 5

Depending on the duration (if any) of the lay-up period, the following may be needed: 5

t) Passivation Fill Condensate System 5

u) Passivation Fill Receiver System 5

v) Passivation Fill TSS Charging System 5

w) Passivation Fill TSS Extraction System 5

19.5.3. The velocity flushes are to be performed using raw water. Pipe line velocities shall be kept as close as possible to maximum flow conditions, with the circulating pump discharge pressure regulated to a maximum of 250 psig and maximum flows of 2000 gpm through the 8 inch section of piping. Each system is to be flushed separately with the flushing water to be hauled to and disposed of in the Coolwater Station Evaporation Pond. Following the velocity flushes, the deaerator, the condenser and all piping "Dead Ends" shall be inspected and manually cleaned prior to continuing with further cleaning operations. 5

19.5.4. The alkaline (Degreasing) flushes are to be performed using a solution of 0.5 percent sodium hydroxide, 1 percent trisodium phosphate and 0.1 percent by volume Pen-5 surfactant dissolved in demineralized water. This solution shall be maintained between 150 and 180°F and circulated for a minimum of 6 hours per system. The condenser level shall be kept above the condenser tubes and monitored with a temporary level tube during the operation. A vapor barrier shall be installed in the condenser above the water level to protect the turbine internals. The velocity of this flush should be maintained as was the velocity flush in Paragraph 19.5.3. and the solution hauled to and disposed of in the Coolwater Station Evaporation Pond. 5

SECTION 4 - IFB
TECHNICAL INFORMATION (CONTD)

19.5.5. The systems that were alkaline flushed in Paragraph 19.5.4. shall be rinsed with successive volumes of demineralized water until the conductivity of the circulating rinse water is not greater than 50 micromhos above that of the make-up demineralized water. Velocities and the condenser level shall be the same as specified in Paragraphs 19.5.3. and 19.5.4. Disposal of the rinse water shall be into the polishing demineralizer sump. 5

19.5.6. The systems that were alkaline flushed in Paragraph 19.5.4. and rinsed in Paragraph 19.5.5. shall be chemically cleaned with a scale and rust removing acid solution of 2 percent hydroxyacetic acid, 1 percent formic acid, 0.1 percent Haliburton OSI-1 or Rodine 31A acid inhibitor and a small amount of NF-1 antifoaming agent. Circulation rates must be controlled to keep the largest pipeline velocities between 1.5 and 3.0 feet per second with pumps capable of 470 gallons per minute, maximum required capacity. Circulation shall be maintained at a temperature between 150 and 180°F until the iron in solution and acid strength stabilize (normally about 4-6 hours). Condenser level and disposal site shall be the same as specified in Paragraph 19.5.4. 5 6

19.5.7. The systems that were chemically cleaned with acid in Paragraph 19.5.6. shall be rinsed with successive volumes of demineralized water until the conductivity of the circulating rinse water is not greater than 50 micromhos above that of the make-up demineralized water. Velocities and condenser level shall be the same as specified in Paragraphs 19.5.3. and 19.5.4. Disposal of the rinse water shall be into the polishing demineralizer sump. 5

19.5.8. The systems that were chemically acid cleaned in Paragraph 19.5.6. and rinsed in Paragraph 19.5.7. shall be given a neutralizing/passivating flush using a solution of 200 ppm hydrazine in demineralized water with ammonia added to adjust the pH to 10. Condenser level and velocity shall be the same as specified in Paragraphs 19.5.3. and 19.5.4. Disposal of the solution shall be into the polishing demineralizer sump. 5

19.5.9. If the chemically cleaned plant must be laid-up for longer than one month, its cleaned systems shall be filled with a passivating solution of 200 ppm hydrazine in demineralized water with ammonia added to adjust the pH to 10. This shall not be drained and the condenser level shall be the same as specified in Paragraph 19.5.4. 5

19.5.10. The Contractor is required to furnish the following: 5

a) Pump or pumps capable of delivering an adequate flow rate for the velocity flushes. 5

b) Pump or pumps capable of delivering at least 1.5 but not more than 3.0 feet per second through an 8 inch schedule 40 pipe. 5

c) Transports to haul spent chemicals and rinses to the Coolwater Station Evaporation Pond. 5

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TECHNICAL INFORMATION (CONTD)

d) Storage tanks for holding chemicals, spent solutions and rinses for use if system volume is too large to handle with transports. 5

e) Analytical Equipment. 5

f) A heat exchanger for heating the circulation solutions. 5

g) All required checmicals. 5

19.5.11. The following items will be furnished by others: 5

a) Raw water. 5

b) Demineralized water. 5

c) Access to and use of the evaporation pond at the Coolwater Station. 5

d) Temporary electrical power, both 480V/3 phase/60 Hz and 120V/1 phase/60 Hz. 5

e) Access to the Polishing Demineralizer Sump. 5

19.6. Preoperational Craft Labor 5

19.6.1. The Contractor shall furnish all nonelectrical craft labor and supervision necessary for craft labor assistance during the period defined by the Solar One Preoperational Test Schedule to include but not limited to the following activities: 5

a) Installation of temporary piping for cleaning and steam blowing. 5

b) Velocity flush condensate system. 5

c) Velocity flush receiver system. 5

d) Velocity flush TSS charging system. 5

e) Velocity flush TSS extraction system. 5

f) Alkaline (degreasing) flush condensate system. 5

g) Alkaline (degreasing) flush receiver system. 5

h) Alkaline (degreasing) flush TSS charging system. 5

i) Alkaline (degreasing) flush TSS extraction system. 5

j) Rinse of condensate system. 5

k) Rinse of receiver system. 5

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TECHNICAL INFORMATION (CONTD)

l) Rinse of TSS charging system. 5

m) Rinse of TSS extraction system. 5

n) Chemical (scale and rust removing) flush condensate system. 5

o) Chemical (scale and rust removing) flush receiver system. 5

p) Chemical (scale and rust removing) flush TSS charging system. 5

q) Chemical (scale and rust removing) flush TSS extraction system. 5

r) Passivation flush condensate system. 5

s) Passivation flush receiver system. 5

t) Passivation flush TSS charging system. 5

u) Passivation flush TSS extraction system. 5

v) Restoration of the feedwater and condensate system following cleaning operations. 5

w) Restoration of the receiver system following cleaning operations. 5

x) Restoration of the TSS charging and extraction systems following cleaning operations. 5

y) Preoperational testing of all equipment and systems as defined by the preoperational tests listed in Paragraph 19.3.2. 5

19.6.2. Depending on the duration (if any) of the lay-up period, the following may be needed: 5

a. Passivation fill condensate system. 5

b. Passivation fill receiver system. 5

c. Passivation fill TSS charging system. 5

d. Passivation fill TSS extraction system. 5

19.6.3. This craft support must be available until completion of the cleaning and preoperational testing activities, and the operation, use and removal of the rental boiler from the site. 5

19.7. Calibration Assistance 5

19.7.1. When requested by the Construction Manager, the Contractor shall provide craft to assist the Start-Up Engineer and the manufacturer's representatives to perform the following services: 5

19.7.1.1. Bench calibration consisting of removal of an instrument from its mounting, disconnecting the sensing and/or pneumatic tubing and/or electrical connections, and calibration of and reinstalling the instrument. 5 6

19.7.1.2. Field calibration consisting of disconnecting tubing and/or electrical connection, setting up at the local position, calibration and reconnecting the instrument. 5

19.7.1.3. System testing consisting of preoperational calibration and testing of controllers and control systems requiring disconnecting of control tubing and wiring, insertion of dummy signals, system response testing, control valve characterization, control setting, etc., and reconnecting of tubing and wiring. 5

19.7.1.4. Start-up checkout consisting of operational testings of controllers and control systems to optimize control settings and characteristics, and adapting instruments and controls to their plant operational environment. 5

19.7.1.5. The test operator shall record all results of above noted tests along with instrument tag numbers. If the order calls for customer inspection, the Construction Manager shall be informed before final testing to allow for customer witnessing of all tests in this procedure. 5

19.7.1.6. Contractor shall functionally check all locally mounted instruments supplied with the rental boiler, support equipment or any temporary piping supplied by the Contractor. 5

19.7.2. In general, test instruments required under this section shall be provided by the Contractor. Some of the instruments required will be dead weight testers, multimeters, test gages, oscilloscope, potentiometers, water and mercury manometers, power supplies, nitrogen bottles and regulators, etc. For special instruments furnished GFE, see Appendix TBD. 5

SECTION 4 - IFB
TECHNICAL INFORMATION (CONTD)

20.0 CLEAN-UP 5,6

After completion of the work of this Contract, and before final acceptance of the work will be given, the Contractor shall remove all the Contractor's containers and other evidence of construction from his work, parking and storage areas and leave those areas clean to the satisfaction of the Construction Manager.

LINE NO.	LINE SIZE	DESCRIPTION		OPERATING CONDITIONS			INSUL SCHED	DESIGN CONDITIONS		TEST PSIG	REFERENCE DRAWINGS		BY CONTRACTOR	REMARKS
		FROM	TO	FLOW	PSIG	°F		PSIG	°F		PIPING SYSTEM	DIAG		
AS-301-KBA	1½"	AOV-3218	6"-MS-4-KBA				6	1400	650	2100	M37	103	GFE(1)	
AS-302-KBA	1½"	AOV-3318	6"-MS-4-KBA				6	1400	650	2100	M37	103	GFE(1)	
AS-303-FBA	1½"	6"-ST-5-FBA	6"-ST-5-KBA				5	400	590	600	M55	105	GFE(1)	
AS-304-FBA	1½"	6"-ST-5-FBA	6"-ST-5-KBA				5	400	590	600	M55	105	GFE(1)	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV	DATE			
		DRAWN	RES	11-2-79
		CHECKED	[illegible]	4-25-80
		APPROVED	[illegible]	6/23/80
		APPROVED		

Stearns-Roger
INCORPORATED

LINE SCHEDULE
AUX. STEAM [illegible]

JOB NO. C-21700
DWG. NO. 9033/4
SHEET NO. F-2

2

FORM 16.01 REV 1-1-75

* LINE NO.	* LINE SIZE	* DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	* REFERENCE DRAWINGS PIPING SYSTEM	DIAG	* BY CONTRACTOR	REMARKS
BD-301-FB[illegible]	1"	E-305	AOV-3708				4	412	445	618	M[illegible]	195	GFE (1)	
BD-302-FB[illegible]	1"	E-306	AOV-3808				4	412	445	618	M[illegible]	195	GFE (1)	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	RPG	11-2-79
		CHECKED	RCL	6-25-80
		APPROVED	[illegible]	6/25/80
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE
R BLOWDOWN (B[illegible]

ORDER NO. C-21700
CAT. NO. 9033/4
SHEET NO. [illegible]-2

FORM 16.01 REV. [illegible]

2

• LINE NO.	• LINE SIZE	• DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	• REFERENCE DRAWINGS PIPING SYSTEM 40M2005731-	DIAG.	• BY CONTRACTOR	REMARKS
CO-201 QEX/KBX	3" 4"	3-CO-222-QEX	V-201				B	1775	1010	2662	929/934/943	767	GFE	
CO-202-KEX	2"	V-201	2-CO-1-FBA				B	660	486	990	929	767	CP9	
CO-203-MBX	3, 1½, 1, ¾	PANEL DRAINS VALVES	3-CO-6-BBA				B	200	400	300	946/935	763 TO 766	GFE/CP9	
CO-204-RNX	1"	MS-204	2"-CO-205-RNX				B	1775	1010	2662	929	764	GFE(1)/CP9	
CO-205-RNX	1, 2"	MS-205	3-CO-222-QEX				B	1775	1010	2662	929	764 767	GFE(1)/CP9	
CO-206-RNX	1"	MS-206	2"-CO-205-RNX				B	1775	1010	2662	929	764	GFE(1)/CP9	
CO-207-RNX	1"	MS-207	2"-CO-208-RNX				B	1775	1010	2662	929	764	GFE(1)/CP9	
CO-208-RNX	1, 2"	MS-208	3-CO-222-QEX				B	1775	1010	2662	929	764 767	GFE(1)/CP9	
CO-209-RNX	1"	MS-209	2"-CO-208-RNX				B	1775	1010	2662	929	764	GFE(1)/CP9	
CO-210-RNX	1"	MS-210	2"-CO-211-RNX				B	1775	1010	2662	929	765	GFE(1)/CP9	
CO-211-RNX	1, 2"	MS-211	3-CO-222-QEX				B	1775	1010	2662	929	765 767	GFE(1)/CP9	
CO-212-RNX	1"	MS-212	2"-CO-211-RNX				B	1775	1010	2662	929	765	GFE(1)/CP9	
CO-213-RNX	1"	MS-213	2"-CO-214-RNX				B	1775	1010	2662	929	765	GFE(1)/CP9	
CO-214-RNX	1, 2	MS-214	3-CO-222-QEX				B	1775	1010	2662	929	[illegible]	GFE(1)/CP9	
CO-215-RNX	1"	MS-215	2"-CO-214-RNX				B	1775	1010	2662	929	766	GFE(1)/CP9	
CO-216-RNX	1"	MS-216	2"-CO-217-RNX				B	1775	1010	2662	929	766	GFE(1)/CP9	
CO-217-RNX	1, 2"	MS-217	3-CO-222-QEX				B	1775	1010	2662	929	766 767	GFE(1)/CP9	
CO-218-RNX	1"	MS-218	2"-CO-217-RNX				B	1775	1010	2662	929	766	GFE(1)/CP9	
CO-219-RNX	1"	MS-219	2"-CO-220-RNX				B	1775	1010	2662	929	766	GFE(1)/CP9	
CO-220-RNX	1, 2"	MS-220	3-CO-222-QEX				B	1775	1010	2662	929	766 767	GFE(1)/CP9	
CO-221-RNX	1"	MS-221	2"-CO-220-RNX				B	1775	1010	2662	929	766	GFE(1)/CP9	
CO-222-QEX	3"	2-CO-205, 208, 211, 214, 217, 220-RNX	3-CO-201-QEX				B	1775	1010	2662	924/929	767	GFE	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	[illegible]	[illegible]
		CHECKED	[illegible]	6-25-90
		APPROVED	[illegible]	6/21/[illegible]
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE
R CONDENSATE (CO)

ORDER NO. C-21700
PAGE NO. 2033/[illegible]
SHEET NO. F1-2

2

FORM 16.02 REV. [illegible]

LINE NO.	LINE SIZE	DESCRIPTION FROM	DESCRIPTION TO	OPERATING CONDITIONS FLOW	OPERATING CONDITIONS PSIG	OPERATING CONDITIONS °F	INSUL SCHED	DESIGN CONDITIONS PSIG	DESIGN CONDITIONS °F	TEST PSIG	REFERENCE DRAWINGS PIPING SYSTEM	REFERENCE DRAWINGS DIAG	BY CONTRACTOR	REMARKS
CO-301-KBA	4"	E-311	V-305				4	1350	435	2025	M35	193	GFE (1)	
CO-302-KBA	4"	E-312	V-306				4	1350	435	2025	M35	193	GFE (1)	
CO-303-BBA	4"	V-CO-303-305	V-304				6	165	535	247	M35	193	GFE (1)	
CO-304-BBA	4"	V-CO-304-306	V-304				6	165	535	247	M35	193	GFE (1)	
		DELETED												
CO-306-KBA	6"	E-301	SURGE TANK (V-309)				4	1350	435	2025	M35	193	GFE (1)	
CO-307-KBA	6"	SURGE TANK (V-309)	E-311				4	1350	435	2025	M35	193	GFE (1)	
CO-308-KBA	6"	E-302	SURGE TANK (V-310)				4	1350	435	2025	M35	193	GFE (1)	
CO-309-KBA	6"	SURGE TANK (V-310)	E-312				4	1350	435	2025	M35	193	GFE (1)	
CO-310-FBA	1½"	P307	V-304				4	165	535	247	M35	193	CP9	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	HRS	11-2-79
		CHECKED	DG	6-25-80
		APPROVED	PK	6/27/80
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE
R CONDENSATE (CO)

ORDER NO. C-21700
DWG. NO. 902371
SHEET 1-2

FORM 16.02 REV.

* LINE NO.	* LINE SIZE	* DESCRIPTION		OPERATING CONDITIONS			INSUL SCHED	DESIGN CONDITIONS		TEST PSIG	* REFERENCE DRAWINGS		* BY CONTRACTOR	REMARKS
		FROM	TO	FLOW	PSIG	°F		PSIG	°F		PIPING SYSTEM	DIAG		
FW-200-MBX	4"	FW-2	FW-201, FW-202, FW-203				B	2000	440	3000	945	[illegible]	GFE	
FW-201-MBX	2½"	FW-200	RP-201				B	2000	440	3000	945	[illegible]	GFE	
FW-202-MBX	2½"	FW-200	RP-202				B	2000	440	3000	945	[illegible]	GFE	
FW-203-MBX	2½"	FW-200	RP-203				B	2000	440	3000	945	[illegible]	GFE	
FW-204-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-204				B	2000	440	3000	931	763 764	CPG	
FW-205-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-205				B	2000	440	3000	931	763 764	CPG	
FW-206-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-206				B	2000	440	3000	931	763 764	CPG	
FW-207-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-207				B	2000	440	3000	931	763 764	CPG	
FW-208-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-208				B	2000	440	3000	931	763 764	CPG	
FW-209-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-209				B	2000	440	3000	931	763 764	CPG	
FW-210-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-210				B	2000	440	3000	931	763 765	CPG	
FW-211-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-211				B	2000	440	3000	931	763 765	CPG	
FW-212-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-212				B	2000	440	3000	931	763 765	CPG	
FW-213-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-213				B	2000	440	3000	931	763 765	CPG	
FW-214-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-214				B	2000	440	3000	931	763 765	CPG	
FW-215-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-215				B	2000	440	3000	931	763 765	CPG	
FW-216-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-216				B	2000	440	3000	931	763 766	CPG	
FW-217-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-217				B	2000	440	3000	931	763 766	CPG	
FW-218-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-218				B	2000	440	3000	931	763 766	CPG	
FW-219-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-219				B	2000	440	3000	931	763 766	CPG	
FW-220-MBX	1"	3-FW-228-MBX	BOILER PANEL RB 220				B	2000	440	3000	931	763 766	CPG	
FW-221-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-221				B	2000	440	3000	931	763 766	CPG	
FW-222-RBX	3"	RP-201	FW-231				B	2000	440	3000	658	763	GFE(1)	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV	DATE			
		DRAWN	PV	11-27-79
		CHECKED	DG	6-25-80
		APPROVED	BL	6/26/80
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE

R FEEDWATER (FW)

C 21100

PG 5 OF 10

2

LINE NO.	LINE SIZE	DESCRIPTION FROM	DESCRIPTION TO	OPERATING CONDITIONS FLOW	OPERATING CONDITIONS PSIG	OPERATING CONDITIONS °F	INSUL SCHED	DESIGN CONDITIONS PSIG	DESIGN CONDITIONS °F	TEST PSIG	REFERENCE DRAWINGS PIPING SYSTEM	REFERENCE DRAWINGS DIAG.	BY CONTRACTOR	REMARKS
FW-223-RNX	3"	RP-202	FW-232				B	2000	440	3000	658	763	GFE(1)	
FW-224-RNX	3"	RP-203	FW-233				B	2000	440	3000	658	[illegible]	GFE(1)	
FW-225-RNX	3"	RP-222	FW-234				B	2000	440	3000	658	763	GFE(1)	
FW-226-RNX	3"	RP-223	FW-235				B	2000	440	3000	658	763	GFE(1)	
FW-227-RNX	3"	RP-224	FW-236				B	2000	440	3000	658	763	GFE(1)	
FW-228-MBX	1", 1"	2½-FW-234,235,236-MBX	1-FW-204 THRU 221-MBX				B	2000	440	3000	944	761	GFE	
FW-229-MBX	1"	4-FW-200-MBX	V-201				B	2000	440	3000	954 / 934	763 761	CP9	
		DELETED												
FW-231-MBX	2½"	FW-222	RP-222				B	2000	440	3000	944	763	GFE	
FW-232-MBX	2½"	FW-223	RP-223				B	2000	440	3000	944	763	GFE	
FW-233-MBX	2½"	FW-224	RP-224				B	2000	440	3000	944	763	GFE	
FW-234-MBX	2½"	FW-225	FW-228				B	2000	440	3000	944	763	GFE	
FW-235-MBX	2½"	FW-226	FW-228				B	2000	440	3000	944	763	GFE	
FW-236-MBX	2½"	FW-227	FW-228				B	2000	440	3000	944	763	GFE	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	[illegible]	11-12-79
		CHECKED	PGL	6-25-80
		APPROVED	[illegible]	6/27/80
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE
R FEEDWATER (FW)

ORDER NO. C-21760
DWG. NO. 9233/4
SHEET NO. 2 [illegible] 2

2

 FORM 16.02 REV. [illegible]

LINE NO.	LINE SIZE	DESCRIPTION FROM	DESCRIPTION TO	OPERATING CONDITIONS FLOW	OPERATING CONDITIONS PSIG	OPERATING CONDITIONS °F	INSUL SCHED	DESIGN CONDITIONS PSIG	DESIGN CONDITIONS °F	TEST PSIG	REFERENCE DRAWINGS PIPING SYSTEM	REFERENCE DRAWINGS DIAG	BY CONTRACTOR	REMARKS
FW-301-FBA	2½"	E-303	E-305				6	475	460	713	[illegible]	5	CP9	
FW-302-FBA	2½"	E-304	E-306				6	475	460	713	[illegible]	[illegible] 5	CP9	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	L.B.[illegible]	2-[illegible]
		CHECKED	DG	6-15-80
		APPROVED	[illegible]	6/21/80
		APPROVED		

Stearns-Roger
INCORPORATED

LINE SCHEDULE
F[illegible] WATER (FW)

ORDER NO. C 21700
[illegible] 9033 [illegible]
[illegible] 1 [illegible]

2

FORM 16.92 REV [illegible]

* LINE NO.	* LINE SIZE	* DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	REFERENCE DRAWINGS PIPING SYSTEM	DIAG	BY CONTRACTOR	REMARKS
MS-201-QEX	6", 2", 1"	4-MS-205, 208, 211, 214,	6-MS-2-QEB, RMNCK-1				A	1775	1010	2662	928 & 937 &	767	GFE/CP9	
		217, 220-QBX	½-VT-209-QEB, 3-VT-210-QEB,								939 & 943			
			4-ST-202-QEX											
MS-204-RNX	2", 3"	RB-204	MS-205				A	1775	1010	2662	928 & 659	764	GFE(1)/CP9	
MS-205-RNX QEX	2", 3", 4", 6"	RB-205	6-MS-201-QEB				A	1775	1010	2662	928 & 659	764 767	GFE(1)/CP9/	GFE
MS-206-RNX	2", 3"	RB-206	MS-205				A	1775	1010	2662	928 & 659	764	GFE(1)/CP9	
MS-207-RNX	2", 3"	RB-207	MS-208				A	1775	1010	2662	928 & 659	764	GFE(1)/CP9	
MS-208-RNX QEX	2", 3", 4", 6"	RB-208	6-MS-201-QEB				A	1775	1010	2662	928 & 659	764 767	GFE(1)/CP9/	GFE
MS-209-RNX	2", 3"	RB-209	MS-208				A	1775	1010	2662	928 & 659	764	GFE(1)/CP9	
MS-210-RNX	2", 3"	RB-210	MS-211				A	1775	1010	2662	928 & 659	765	GFE(1)/CP9	
MS-211-RNX QEX	2", 3", 4", 6"	RB-211	6-MS-201-QEB				A	1775	1010	2662	928 & 659	765 767	GFE(1)/CP9/	GFE
MS-212-RNX	2", 3"	RB-212	MS-211				A	1775	1010	2662	928 & 659	765	GFE(1)/CP9	
MS-213-RNX	2", 3"	RB-213	MS-214				A	1775	1010	2662	928 & 659	765	GFE(1)/CP9	
MS-214-RNX QEX	2", 3", 4", 6"	RB-214	6-MS-201-QEB				A	1775	1010	2662	928 & 659	765 767	GFE(1)/CP9/	GFE
MS-215-RNX	2", 3"	RB-215	MS-214				A	1775	1010	2662	928 & 659	76[illegible]	GFE(1)/CP9	
MS-216-RNX	2", 3"	RB-216	MS-217				A	1775	1010	2662	928 & 659	7[illegible]	GFE(1)/CP9	
MS-217-RNX QEX	2", 3", 4", 6"	RB-217	6-MS-201-QEB				A	1775	1010	2662	928 & 659	766 767	GFE(1)/CP9/	GFE
MS-218-RNX	2", 3"	RB-218	MS-217				A	1775	1010	2662	928 & 659	766	GFE(1)/CP9	
MS-219-RNX	2", 3"	RB-219	MS-220				A	1775	1010	2662	928 & 659	766	GFE(1)/CP9	
MS-220-RNX QEX	2", 3", 4", 6"	RB-220	6-MS-201-QEB				A	1775	1010	2662	928 & 659	766 767	GFE(1)/CP9/	GFE
MS-221-RNX	2", 3"	RB-221	MS-220				A	1775	1010	2662	928 & 659	766	GFE(1)/CP9	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SND/MODULE

REV.	DATE		
		DRAWN	I.V. 4-11-80
		CHECKED	DG 4-25-80
		APPROVED	[illegible] 6-12-80
		APPROVED	

Stearns-Roger INCORPORATED

LINE SCHEDULE

R MAIN STEAM (M[illegible])

PG [illegible] OF 1[illegible]

C 21700

907 3/4

[illegible] 2

FORM 14.01 REV [illegible]

2

LINE NO.	LINE SIZE	DESCRIPTION		OPERATING CONDITIONS			INSUL SCHED	DESIGN CONDITIONS		TEST PSIG	REFERENCE DRAWINGS		BY CONTRACTOR	REMARKS
		FROM	TO	FLOW	PSIG	°F		PSIG	°F		PIPING SYSTEM	DRAG		
MS-301-KBA	3/4"	6" - MS - 4 - KBA	V-309				6	1400	650	2100	MSS	193	GFE (1)	
MS-302-KBA	3/4"	6" - MS - 4 - KBA	V-318				6	1400	650	2100	MSS	193	GFE (1)	
MS-303-KBA	3/4"	3/4" - MS-301 - KBA	TH3VV-1 (VENT)				6	1400	650	2100	MSS	193	GFE (1)	
MS-304-KBA	3/4"	3/4" - MS-302 - KBA	TH3VV-2 (VENT)				6	1400	650	2100	MSS	M1	GFE (1)	

GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

Stearns-Roger
INCORPORATED

LINE SCHEDULE
MAIN STEAM (MS)

LINE NO.*	LINE SIZE*	DESCRIPTION* FROM	DESCRIPTION* TO	OPERATING CONDITIONS FLOW	OPERATING CONDITIONS PSIG	OPERATING CONDITIONS °F	INSUL SCHED	DESIGN CONDITIONS PSIG	DESIGN CONDITIONS °F	TEST PSIG	REFERENCE DRAWINGS* PIPING SYSTEM	REFERENCE DRAWINGS* DIAG	BY CONTRA TOR*	REMARKS
N-200-KBA	1"	N-1 @ RNMV	RMNIS & PCV 2013				N/A	600	113	900	918 & 955	[illegible]	CPM	
N-201 QEX	1"	RMNIS	RMNCK				N/A	1775	1010	2662	955	[illegible]	CPM	
N-202 KBA / MBX	1"	IPCV-2013	1/2-VT-207-MBX				N/A	600 / 2000	773 / 440	900 / 3000	950	[illegible]	CPM	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFC(1) INDICATES LINES PROVIDED WITHIN GFC SKID/MODULE

REV.	DATE			
		DRAWN	[illegible]	[illegible]
		CHECKED	DGL	6.25.81
		APPROVED	[illegible]	6/21/80
		APPROVED		

Stearns-Roger
INCORPORATED

LINE SCHEDULE
P NITROGEN (N)

*LINE NO.	*LINE SIZE	*DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	*REFERENCE DRAWINGS PIPING SYSTEM	DIAG	*BY CONTRACTOR	REMARKS
ST-202-QEX	4", 1"	6-MS-201-QEX	AOV-2911 & FO-ST-203-201				A	1775	1010	2662	939/940	767	GFE/CP9	
ST-203-[illegible]	4", 1"	AOV 2911 & FO-ST-203-201	V-201				A	600	1010	900	940	767	GFE/CP9	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV	DATE			
		DRAWN	[illegible]	12-27-[illegible]
		CHECKED	[illegible]	[illegible]
		APPROVED	[illegible]	[illegible]
		APPROVED		

Stearns-Roger
INCORPORATED

LINE SCHEDULE
[illegible] STEAM ([illegible])

ORDER NO. C-21700
DWG. NO. [illegible]
SHEET [illegible] 2

[illegible]

FORM [illegible]

2

LINE NO.	LINE SIZE	DESCRIPTION FROM	DESCRIPTION TO	OPERATING CONDITIONS FLOW	OPERATING CONDITIONS PSIG	OPERATING CONDITIONS °F	INSUL SCHED	DESIGN CONDITIONS PSIG	DESIGN CONDITIONS °F	TEST PSIG	REFERENCE DRAWINGS PIPING SYSTEM	REFERENCE DRAWINGS DIAG.	BY CONTRACTOR	REMARKS
ST-301-KBA	1"	E-301	FO-ST-301-301				6	1400	650	2100	M55	193	GFE (1)	
ST-302-KBA	1"	E-302	FO-ST-302-302				6	1400	650	2100	M55	193	GFE (1)	
ST-303-FBA	6"	E-305	E-307				6	475	600	713	M55	195	GFE (1)	
ST-304-FBA	6"	E-306	E-308				6	475	600	713	M55	195	GFE (1)	
ST 305-KBA	1"	E-302	FO-ST-305-303				6	1400	650	2100	M 55	193	GFE (1)	
ST 306-KBA	1"	E-301	FO-ST-306-304				6	1400	650	2100	M55	193	GFE (1)	
ST 307-FBA	6"	PSV-3719	ATMOSPHERE				N/A	50	600	N/A	M55	195	GFE (1)	
ST-308-FBA	6"	PSV-3819	ATMOSPHERE				N/A	50	600	N/A	M55	195	GFE (1)	
ST-309-FBA	8"	E-305	PSV-3719				N/A	450	600	675	M55	195	GFE (1)	
ST-310-FBA	4"	PSV-3115	ATMOSPHERE				N/A	50	372	N/A	M30	193	GFE (1)	
ST-311-FBA	8"	E-306	PSV-3819				N/A	450	600	675	M65	195	GFE (1)	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE		
		DRAWN	JJN 6-20-80
		CHECKED	6-25-80
		APPROVED	6-27-80
		APPROVED	

Stearns-Roger INCORPORATED

LINE SCHEDULE
R STEAM (ST)

C-21[illegible]

2

LINE NO.	LINE SIZE	DESCRIPTION FROM	DESCRIPTION TO	OPERATING CONDITIONS FLOW	OPERATING CONDITIONS PSIG	OPERATING CONDITIONS °F	INSUL SCHED	DESIGN CONDITIONS PSIG	DESIGN CONDITIONS °F	TEST PSIG	REFERENCE DRAWINGS PIPING SYSTEM	REFERENCE DRAWINGS [illegible]	BY CONTRACTOR	[illegible]
TO-301-BBA	[illegible]	8" - TO - 4 - BBA	8" - TO - 5 - BBA				4	150	425	225	[illegible]	[illegible]	GFE (1)	
TO-302-BBA	8	AOV - 3906	AOV - 3905				5	150	[illegible]	225	[illegible]	[illegible]	GFE (1)	
TO-303-BBA	[illegible]	E - 307	8" - TO - 25 - BBA				4	150	425	225	[illegible]	[illegible]	GFE (1)	
TO-304-BBA	[illegible]	E - 308	8" - TO - 26 - BBA				4	150	425	225	[illegible]	[illegible]	GFE (1)	
TO-305-BBA	[illegible]	E - 305	E - 303				6	150	640	225	40M300S132113	[illegible]	CF9	
TO-306-BBA	[illegible]	E - 306	E - 304				6	150	640	225	40M300S132113	[illegible]	CF9	
TO-307-BBA	[illegible]	P - 305	8-TO-302-BBA				4	150	425	225	M.[illegible]	[illegible]	GFE (1)	
TO-308-BBA	3"	E - 301	PSV - 3222				N/A	150	580	225	M35	192	GFE (1)	
TO-309-BBA	3"	E - 302	PSV - 3322				N/A	150	580	225	M35	192	GFE (1)	
TO-310-BBA	4"	PSV - 3222	8" - TO - 31 - BBA				N/A	150	580	N/A	M35	192	GFE (1)	
TO-311-BBA	4"	PSV - 3322	8" - TO - 30 - BBA				N/A	150	580	N/A	M35	192	GFE (1)	
TO-312-BBA	6"	E - 301	THFRD - 1				N/A	150	580	225	M35	192	GFE (1)	
TO-313-BBA	6"	E - 302	THFRD - 2				N/A	150	580	225	M35	192	GFE (1)	
TO-314-BBA	4"	E-303	TPFRD-1				N/A	150	600	225	M50	194	GFE (1)	
TO-315-BBA	4"	E-304	TPFRD-2				N/A	150	600	225	M50	194	GFE (1)	
TO-316-BBA	4"	E - 307	TSFRD-1				N/A	150	125	225	M50	194	GFE (1)	
TO-317-BBA	4"	E - 308	TSFRD-2				N/A	150	125	225	M50	194	GFE (1)	
TO-318-BBA	3"	E - 303	PSV - 3506				N/A	150	600	225	M50	194	GFE (1)	
TO-319-BBA	3"	E - 304	PSV - 3606				N/A	150	600	225	M50	194	GFE (1)	
TO-320-BBA	4"	PSV - 3506	6" - TO - 34 - BBA				N/A	150	600	N/A	M50	194	GFE (1)	
TO-321-BBA	4"	PSV - 3606	6" - TO - 35 - BBA				N/A	150	600	N/A	M50	194	GFE (1)	
TO-322-BBA	3"	E - 307	PSV - 3720				N/A	150	600	225	M50	194	GFE (1)	
TO-323-BBA	3"	E - 308	PSV - 3820				N/A	150	600	225	M50	194	GFE (1)	
TO-324-BBA	4"	PSV - 3720	6-TO-32-BBA				N/A	150	600	N/A	M50	194	GFE (1)	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

NO.	DATE			
		DRAWN	[illegible]	6-26-[illegible]
		CHECKED		
		APPROVED	[illegible]	6-[illegible]
		APPROVED		

Stearns-Roger
INCORPORATED

LINE SCHEDULE

LINE NO.	LINE SIZE	DESCRIPTION		OPERATING CONDITIONS			INSUL SCHED	DESIGN CONDITIONS		TEST PSIG	REFERENCE DRAWINGS		BY CONTRACTOR	REMARKS
		FROM	TO	FLOW	PSIG	°F		PSIG	°F		PIPING SYSTEM	DRAW.		
TO-125-BBA	4"	PSV-3220	6-TO-35-BBA				N/A	150	644	N/A	MSS	194	GFE(1)	

GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

		DRAWN	[illegible]	6-20-80	Stearns-Roger INCORPORATED	JOB NO. C 2170
		CHECKED		6-25-80	LINE SCHEDULE	SHEET 9
		APPROVED		6-27-80	THERMAL OIL (TO)	SHEETS 1 OF 2
NO.	DATE	ENGINEER				

2

* LINE NO	* LINE SIZE	* DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	PIPE CODE	DESIGN CONDITIONS PSIG	°F	TEST PSIG	* REFERENCE DWGS. PIPING SYSTEM	P&ID	* [illegible]	[illegible]
[illegible]	[illegible]	[illegible]	PV2906 & FO-VT-201-201				B	600	1010	900	943		[illegible]/CP9	
[illegible] MBX	[illegible]	3-FW [illegible]-RNX	½-[illegible]-MBX				B	600	1010	900	926		[illegible]	
VT-[illegible]-MBX	[illegible]	3-FW [illegible]-RNX	½-VT-207-MBX				B	600	1010	900	926		[illegible]	
VT-[illegible]-MBX	[illegible]	3-FW 222-RNX	½-VT-207-MBX				B	600	1010	900	926		[illegible]	
VT-205-MBX	[illegible]	3-FW 227-RNX	½-VT-207-MBX				B	600	1010	900	926	[illegible]	CP9	
VT-[illegible]-MBX	[illegible]	3-FW 226-RNX	½-VT-207-MBX				B	600	1010	900	926	[illegible]	CP9	
[illegible]	[illegible]	3-FW 225-RNX	AOV-2001 (RPW/V)				B	600	1010	900	926	[illegible]	CP9	
[illegible]	[illegible]	AOV 2001 & 2903, AOV 2902	ATMOSPHERE				B	600	1010	N/A	937 / 938	[illegible]	[illegible]/CP9	
[illegible]	[illegible]	6"-[illegible] 201-QEX	AOV-2903 [illegible]				B	1725	1010	2662	927	[illegible]	CP9	
		DELETED												
		DELETED												
		DELETED												
VT-[illegible]-SCN 20	12"	PSV-2909	ATMOSPHERE				N/A	100	1010	N/A	925 & 937	[illegible]	CP9	
VT-[illegible]-SCN 20	12"	PSV-2910	ATMOSPHERE				N/A	100	1010	N/A	925 & 937	[illegible]	CP9	
VT-[illegible]-BBA	6"	PSV-2912	ATMOSPHERE				N/A	100	1010	N/A	935 & 940		CP9	
[illegible]-BBA	6"	PSV-2021	ATMOSPHERE				N/A	100	600	N/A	925	[illegible]	CP9	
[illegible]-BBA	6"	PSV-2022	ATMOSPHERE				N/A	100	600	N/A	925	[illegible]	CP9	
[illegible]-BBA	6"	PSV-20[illegible]	ATMOSPHERE				N/A	100	600	N/A	925	[illegible]	CP9	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.

DG 6-25-80

[illegible] 6-23-[illegible]

Stearns-Roger
INCORPORATED

LINE SCHEDULE

* LINE NO.	* LINE SIZE	* DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL. SCHED.	DESIGN CONDITIONS PSIG	°F	TEST PSIG	* REFERENCE DRAWINGS PIPING SYSTEM	DIAG.	* BY CONTRACTOR	REMARKS
[illegible] 301 FBA	1"	V-305	FO-VT-301-301				5	1425	590	2140	[illegible]	[illegible]	GFE (1)	
[illegible] 302 FBA	1"	V 306	FO-VT-302-302				5	1425	590	2140	[illegible]	[illegible]	GFE (1)	
[illegible] 303 FBA	[illegible]	FO-VT-301-301	1-ST-1-FBA				6	[illegible]	650	450	M35	[illegible]	GFE (1)	
[illegible] FBA	[illegible]	FO-VT-302-302	1-ST-1-FBA				6	[illegible]	650	450	M35	[illegible]	GFE (1)	
[illegible] FBA	1"	V-309	1-VT-301-KBA				5	1425	590	2140	M35	193	GFE (1)	
[illegible] FBA	1"	V-310	1-VT-302-KBA				5	1425	590	2140	M35	193	GFE (1)	
[illegible] FBA	4"	PSV 3221	ATMOSPHERE				N/A	50	590	N/A	M35	193	GFE (1)	
[illegible] FBA	4"	PSV 3321	ATMOSPHERE				N/A	50	590	N/A	M35	193	GFE (1)	

*Information furnished by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

Stearns-Roger INCORPORATED

LINE SCHEDULE

APPENDIX A
RECEIVER TEMPORARY PIPING

Temporary piping in the receiver area will be field routed by the Contractor without formal drawings. Rocketdyne will provide daily on-site engineering support to assure that the routing does not result in excessive loading of the temporary or permanent pipe and components.

The following drawings have been provided to indicate the probable routing and components required. They are primarily intended to provide information to the Contractor for bidding estimates.

200925-B

200926-A through 200932-A

200933-B

200934-A

200940-A

200944-A

200945-B

200658-A through 200660-A

In addition to these drawings and P & ID P3-12A, interface data sheets are included to define the Contractor's responsibilities in providing and assembling interface components. The following relief valves are not to be installed prior to the cleaning operation:

PSV 2021

PSV 2022

PSV 2023

PSV 2912

APPENDIX B

TARGET FLOWMETERS

A. FLANGED PIPE - PROCEDURE USED DURING FLUSHING

The following procedure would be followed by the Contractor for the disassembly and reassembly of the Ramapo Instrument Co. target flowmeter prior to, the following, the system piping flush.

1. Flowmeter Disassembly

Before piping flush, the target flowmeters must be prepared as follows:

Removal of Sensing Element Assembly

a. The Flow Sensor or Target must be removed from the lever rod inside the line housing before the Sensing Element can be removed. Do not attempt to remove the Sensing Element without first removing the Target.

b. The Target is fastened to the rod by means of a socket head set screw only on very small units or by a socket head cap screw and locking nut on larger units.

c. If a locking nut is evident on the downstream side of the Target, loosen it with a nut driver. Select an Allen wrench to fit the socket head screw and back out the screw until the Target falls free from the lever rod. The edges on the disc of the Target should be protected from nicks, scratches, or other damage.

d. Unscrew the Retaining Nut and remove the Sensing Element from the line housing. (Reference Drawing 32902-A Page C-2 and C-3).

e. Identify and retain the flowmeter target and case by corresponding instrument tag number (i.e., FE-2301). (Store these parts in a clean, dry container).

f. Install a (GFE) seal plug complete with steel retaining nut into the flowmeter housing adapter. An "O" ring seal must be used in the housing adapter for the flushing operations. This "O" ring provides the seal between the seal plug and flowmeter housing during flushing operations. The original seal may be used if it is in good condition.

g. Install the target flowmeter housing into the piping between the mating flanges using CFE seals.

2. Flowmeter Reassembly

After piping flushing is completed, the flowmeters are reassembled for normal service in the following manner:

a. Unbolt flowmeter from mating flanges and remove from piping.

b. Check to ensure that an "O" ring is in position inside the threaded mounting adapter.

c. Thread the screw part way into the Target so that it does not protrude into the hole for the lever rod.

d. Holding the Target assembly by means of an Allen wrench inserted into the socket head screw, position the target inside the line housing from the downstream side so that the lever rod hole is in line with the hole through which the Sensing Element is inserted.

e. Assemble the Sensing Element into the line housing through the threaded adapter so that the lever rod goes into the Target Assembly being held in position inside the line housing.

The Sensing Element must be oriented so that the alignment steps are engaged. The alignment steps are located where the Sensing Element engages the adapter on the line housing in the area normally hidden by the Retaining Nut. (Ref. Drawing 32902-A Page C-3)

f. Adjust the Target on the lever rod so that the machined end of the socket head screw will nest into the hole in the end of the lever rod. Tighten the screw and tighten the locking nut if one is provided. The Target disc must be on the downstream side of the lever rod.

g. Tighten the Retaining Nut which secures the Sensing Element into the line housing.

h. Install the flowmeter into the piping between its mating flanges. Be sure the flow direction arrow stamped on the flowmeter housing points in the direction of fluid flow in the piping system.

i. Connect the electrical wiring between the flowmeter junction box and the flow transmitter per the Rocketdyne electrical schematic drawings and the Ramapo instruction manual.

B. INSERTION PROBE - ADDITION TO SYSTEM PIPE FLUSHING PROCEDURE

This procedure should be followed by the Contractor for the removal of insertion probe-type, target flowmeter internals prior to system piping flush.

1. Unbolt the following insertion-type target flowmeters from their respective mating flanges and replace with equivalent ANSI class blind flanges in the piping system:

Flowmeter Tag No.	Flange Size Nominal	Flange Rating ANSI
FE-3102	4"	2500#
FE-3205	4"	1500#
FE-3305	4"	1500#
FE-3715	4"	300#
FE-3815	4"	300#

2. Store the insertion probe target flowmeters in a clean, dry, undisturbed area until after system flush. Caution: Flowmeter insertion probe is very delicate; do not rest flowmeter on target rod or target.

3. After system flush, mount target flowmeter and flange gasket into pipe mating flange and orient flowmeter so that the flow direction arrow stamped on flowmeter body points in the direction of fluid flow. (Refer to attached Ramapo Dwg. No. 32200 (Page C-4) for orientation of target flowmeter on pipe mating flange.)

4. Connect the electrical wiring between the flowmeter junction box and associated flow transmitter per the Rocketdyne electrical schematics and the Ramapo instruction manual.

APPENDIX C

DETAILED PROCEDURES FOR STEAM BLOW, CHEMICAL FLUSH AND VELOCITY FLUSH FOR THE STEAM/WATER SIDE OF THE TSS

This section provides directions as to connections and procedures for velocity flushing, chemical cleaning and steam blow for the TSS water and steam lines.

1. Velocity flush and steam blow should be directed around major equipment items as shown on Drawing 40P7005133151, Sheets 1, 2 & 3.

DS-301	E-308
E-301	E-309
E-302	E-310
E-303	E-311
E-304	E-312
E-305	V-304
E-306	V-305
E-307	V-306

2. Chemical flush and subsequent purging of chemicals with clean water should be conducted through all lines and equipment.

3. Internals of valves and flowmeters involved should be removed prior to steam blow and velocity flush and the access port should be covered with an appropriate cover. Valve and flowmeter internals need not be replaced during chemical flush. Appendix B contains information on cover plates and detailed procedures for the flowmeters. (Reference Page A-1)

4. Flowmeters of 2-1/2 inch size should be disassembled and internals removed prior to initial installation. The internals of components that are removed shall be properly identified and stored. The 2-1/2 inch flowmeter bodies will have to be removed for reinstallation of the internals.

5. Flowmeters of 6 inch size may be installed completely assembled. When moving internals, they should be identified and properly stored.

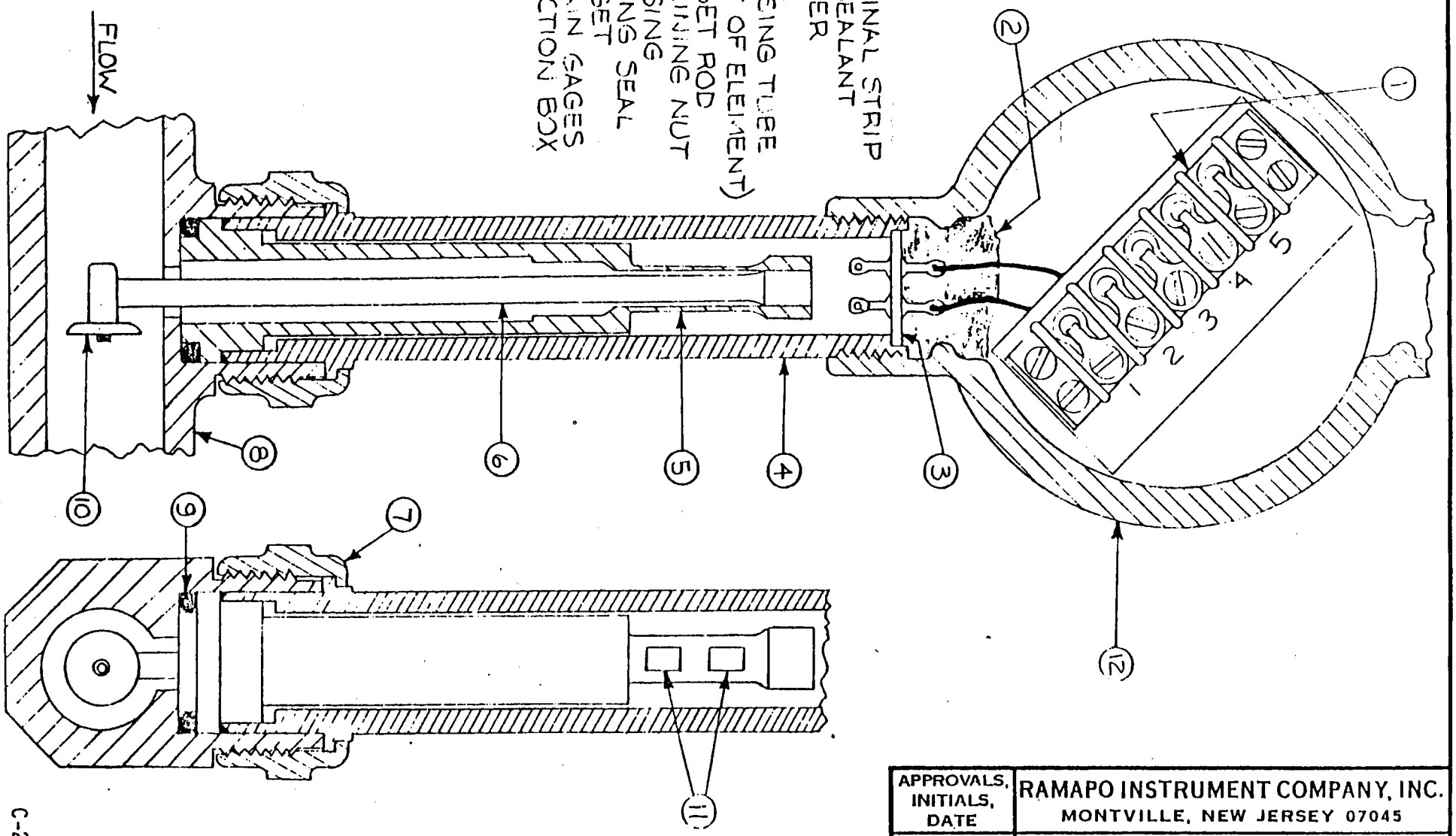
6. Prior to replacing internals, inspect body and valve seats for possible damage. Use new seals (GFE).

FORM RIC-P-1094

K&E 10 8195 ... ITEM 23904

LTR	REVISION RECORD	DATE	DR.	CK	APP

1. TERMINAL STRIP
2. RTV SEALANT
3. HEADER
4. CASE
5. SENSING TUBE (PART OF ELEMENT)
6. TAPSET ROD
7. RETAINING NUT
8. HOUSING
9. O-RING SEAL
10. TARGET
11. STRAIN GAGES
12. JUNCTION BOX



C-2

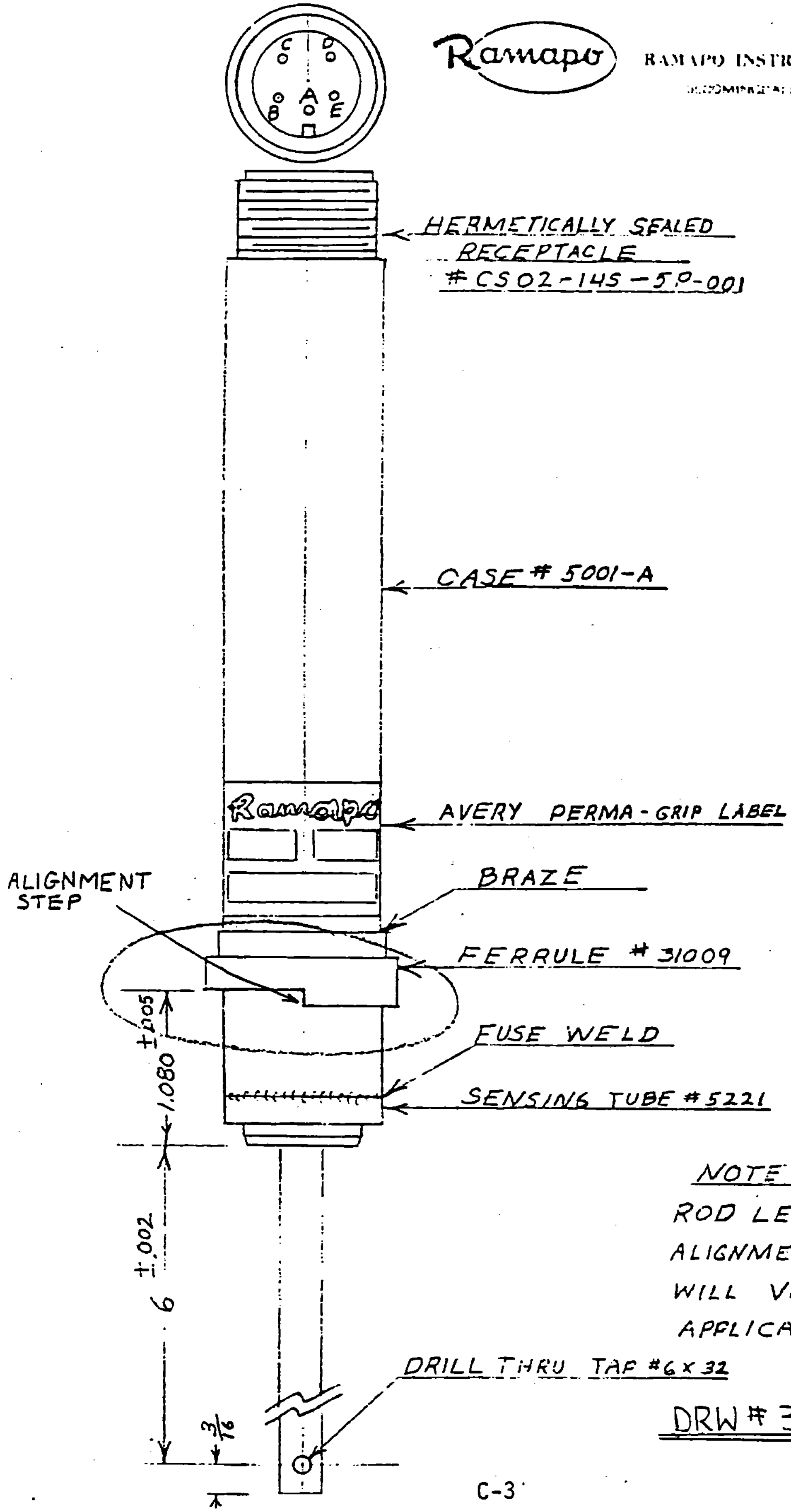
APPROVALS, INITIALS, DATE	RAMAPO INSTRUMENT COMPANY, INC. MONTVILLE, NEW JERSEY 07045			
DRN. BY TD 10-17-78	TITLE CROSS SECTION, MARK V			
CK. BY SMK				
APP. SMK 11-21-78	A	SCALE (X)	CATEGORY B3-P4 P5	DRAWING NUMBER 32902
APP.				

UNLESS OTHERWISE STATED: ... TOLERANCES: FRACTIONAL ± (X) 2 PLACE ± (X) 3 PLACE ± (X)

BY A.M.S. DATE 4/14/71 SUBJECT SENSING ELEMENT SHEET NO. 1 OF 1
CHKD. BY ____ DATE ____ PART NO. 31488 JOB NO. ____

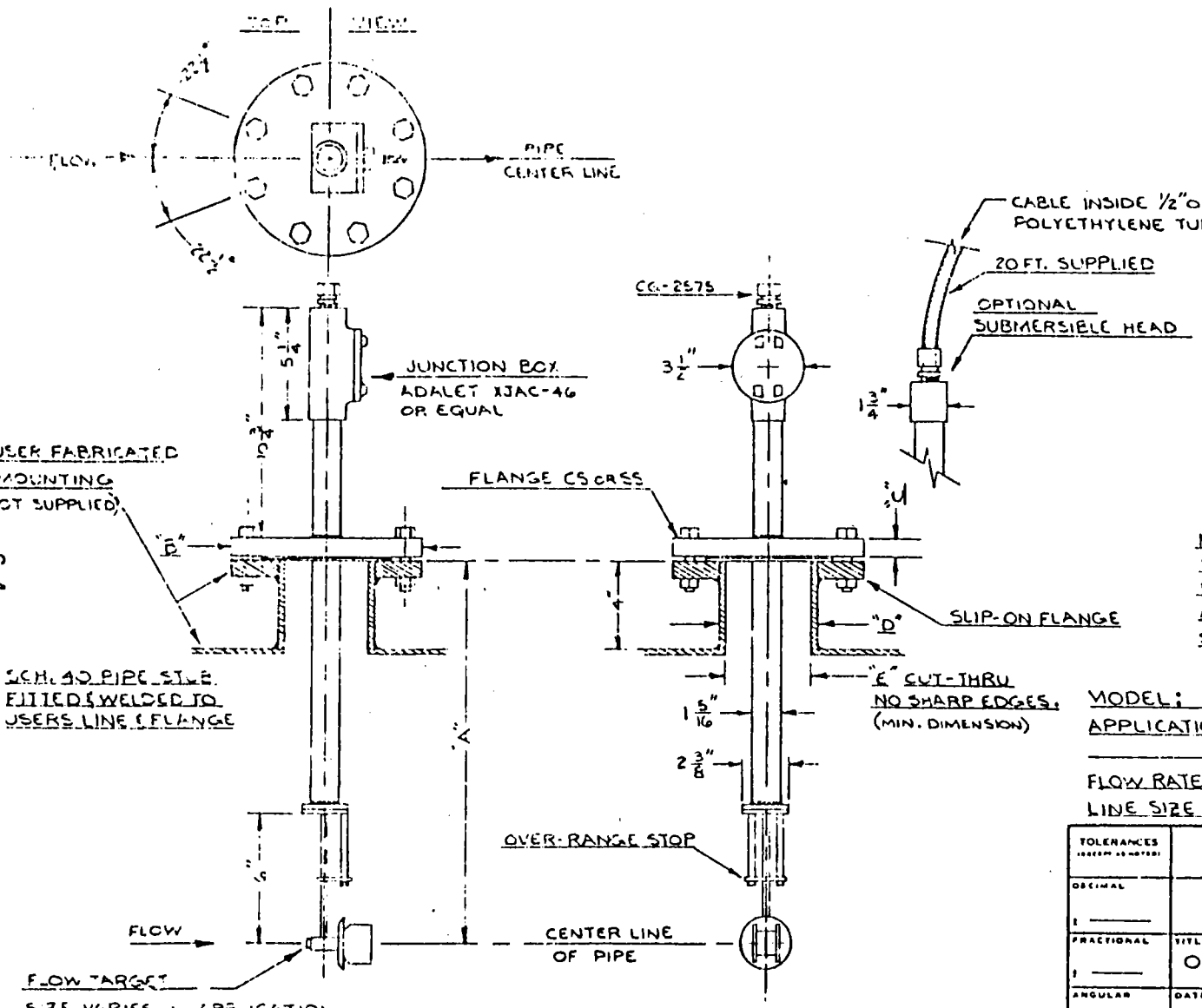
6

RAMAPO INSTRUMENT COMPANY, INC.
NEW JERSEY



NOTE:
ROD LENGTH AND ALIGNMENT PIN HOLE WILL VARY WITH APPLICATION.

DRW # 32902-A



FLANGE SIZE NOMINAL	FLANGE RATING ANSI	DIMENSION "B"	"C"	"D"	"E"
4"	150#	9"	15/16"	4½"	4"
6"	150#	11"	1"	6⅝"	6"
8"	150#	13½"	1⅛"	8⅝"	8"

MATERIALS:
SEAL: TEFLON, VITON, OR BUNA-N
FLANGE:
ALL OTHER WETTED PARTS TO BE STAINLESS STEEL.

MODEL:
APPLICATION:
FLOW RATE:
LINE SIZE: DIM. "A"

TOLERANCES (UNLESS AS NOTED)	RAMAPO INSTRUMENT COMPANY, INC. MONTVILLE NEW JERSEY, USA		
DECIMAL ±		SCALE 1:5	DRAWN BY LPD; APPROVED BY
FRACTIONAL ±	TITLE OUTLINE MARK V FLOWMETER PROBE		
ANGULAR ± 2°	DATE 4-24-74	DRAWING NUMBER 32200	

APPENDIX D

TEMPORARY FLUSH AND STEAM BLOW INTERFACE DATA

A. Receiver Subsystem

P & ID (P3-12A REV. 0) ZONE

D-1

TEMPORARY LINE NO.

2" - SP-49-BBA

PERMANENT LINE/COMPONENT NO. (DRAWINGS)

3" - VT-208-QEX (40M2005131937, 40M2005131938, 3-VT-208-2, 200940-A, 200943-A, 200945-B)

TEMPORARY INTERFACE COMPONENTS

3 x 2 Sched. 40 reducer per BBA Spec. (CFE)

INSTRUCTION TO CONTRACTOR

Precleaning
Cut spool 3-VT-208-2 at 336 ft elevation
Install reducer and temporary piping (Dissimilar Weld)

Post cleaning
Remove reducer and temporary piping
Replace 3-VT-208-2 (radiograph and insulate)

APPENDIX D (CONTD)

P & ID (P3-12A REVE. 0) ZONE

H-2, 3, 8

TEMPORARY LINE NO.

None

PERMANENT LINE/COMPONENT NO. (DRAWINGS)

201 2-1/2" - FW-202 - MBX 203	204 1" - FW - thru- MBX 221

(200932-A, 200945-B)

TEMPORARY INTERFACE COMPONENTS

Threaded caps (GFE)

INSTRUCTION TO CONTRACTOR

Precleaning
- Remove flowmeter internals* prior to installation
- Identify flowmeter internals and corresponding bodies
- Store internals in clean, dry, protected area
- Install caps (GFE) on bodies using old seals
- Install flowmeter bodies (flanged) in lines

Post cleaning
- Remove flowmeter bodies from lines
- Reinstall flowmeter internals* in corresponding bodies with new (GFE) seals
- Install assembled flowmeters in proper lines with new (GFE) seals

*Do not scratch, deform, or otherwise damage internals or flow passages in bodies. Follow procedure in Appendix B. (Reference Page A-1)

APPENDIX D (CONTD)

P & ID (P3-12A REV. 0) ZONE

C-2, 3, 4, 5, 6, 7

TEMPORARY LINE NO.

2" - SP-3-BBA	2" - SP-19-BBA
2" - SP-4-BBA	2" - SP-20-BBA
2" - SP-5-BBA	2" - SP-21-BBA

PERMANENT LINE/COMPONENT NO. (DRAWINGS) 222
223
224
1 " inspection ports in 3" crosses on lines 3" - FW -225-MBX
(40M2005131658, (40M2005131660, 200658-A, 226
200660-A, 200925-B) 227

TEMPORARY INTERFACE COMPONENTS

AN816-16 fittings (CFE) (12 each)
1" x 36" metal flex suitable for BBA service hoses (CFE) (6 each)
2" x 1" BBA reducers (CFE) (6 each)

INSTRUCTIONS TO CONTRACTOR

Precleaning

Remove six 1" plugs from 3" crosses on top of preheater modules
Store plugs in clean, dry environment
Install temporary fittings and piping

Post cleaning

Remove temporary fittings and piping
Reinstall 1" plugs

APPENDIX D (CONTD)

P & ID (P3-12A REV. 0) ZONE

K-2

TEMPORARY LINE NO.

4" - SP-1-BBA

PERMANENT LINE/COMPONENT NO. (DRAWINGS)

V-FW-200-201 (200934-A, 200945-B)

TEMPORARY INTERFACE COMPONENTS

Flanged 4" Sched. 40 pipe stub (GFE)

Bonnet gasket (GFE)

4" Metal Expansion Jt. (for BBA Service) with 3 convolutions and control rods (CFE)

INSTRUCTIONS TO CONTRACTOR

Precleaning
Remove bonnet and plug from valve
Install flanged pipe stub with GFE gasket and valve body bolts
Weld temporary pipe and expansion joint (CFE) to pipe stub

Post cleaning
Remove temporary pipe and interface fitting
Replace valve body (new GFE gasket)

APPENDIX D (CONTD)

P & ID (P3-12A REV. 0) ZONE

J-3

TEMPORARY LINE NO.

2" - SP-59-BBA

PERMANENT LINE/COMPONENT NO. (DRAWINGS)

V-FW-200-202 (200945-B)

TEMPORARY INTERFACE COMPONENTS

Threaded 4" Sched. 40 pipe stub (GFE)

INSTRUCTIONS TO CONTRACTOR

Precleaning
Cut seal weld on valve and remove plug, stem, and packing
Screw GFE pipe stub into valve
Weld temporary pipe to stub

Post cleaning
Remove temporary pipe and stub
Install valve plug, seal, and packing (GFE)
Seal weld valve

APPENDIX D (CONTD)

P & ID (P3-12A REV. 0) ZONE

E-4, 5

TEMPORARY LINE NO.

2" SP-6-BBA
2" SP-7-BBA
2" SP-8-BBA

PERMANENT LINE/COMPONENT NO. (DRAWINGS)

2-1/2" - FW - 231/232/233 - MBX (200927-A, 200944-A)

TEMPORARY INTERFACE COMPONENTS

2 x 2-1/2 BBA reducers (3 each)

2" metal expansion joints (for BBA Service)
with 3 convolutions and control rods (3 ea.) (CFE)

INSTRUCTIONS TO CONTRACTOR

Precleaning
Do not install relief valves PSV-2021, 2022, 2023 (RPWRV-1, 2, 3)
Weld temporary piping to reducers

Post cleaning
Remove temporary piping
Install relief valves

APPENDIX D (CONTD)

P & ID (P3-12A REV. 0) ZONE

J-10 (type. 18 places)

TEMPORARY LINE NO.

1" - SP - 31 thru 48 - BBA

PERMANENT LINE/COMPONENT NO. (DRAWINGS)

1" Sched. 80 tee (40M2005131659, 200659-A, 200933-B)

TEMPORARY INTERFACE COMPONENTS

1" couplings BW/THD NPT (CFE) (18 ea)
AN816 - 16 fittings (CFE) (36 ea)
1" x 36" metal flex hoses suitable for BBA service (CFE) (18 ea)
1" Schedule 80 - MBX CAPS (CFE) (18 each)

INSTRUCTIONS TO CONTRACTOR

Precleaning
- Cut caps from tees
- Weld temporary pipe (coupling, fitting, flex, fitting, pipe)

Post cleaning
- Remove temporary pipe
- Weld new caps on tees

APPENDIX D (CONTD)

P & ID (P3-12A REV. 0) ZONE

J-11

TEMPORARY LINE NO.

4" SP-9-BBA

PERMANENT LINE/COMPONENT NO. (DRAWINGS)

V-201 (200945-B)

TEMPORARY INTERFACE COMPONENTS

Strainer TF-SP-9-3, BBA (CFE)
4" weld neck flange, BBA (CFE)
4" metal expansion joint (for BBA service) with 3 convolutions and control rods (CFE)

INSTRUCTIONS TO CONTRACTOR

Precleaning
Do not install relief valve PSV-2912
Weld temporary flange to tank nozzle intended for valve
Install strainer

Post cleaning
Remove temporary flange and strainer
Install relief valve and line 6" - VT-215-BBA

APPENDIX D (CONTD)

P & ID (P3-12A REV. 0) ZONE

General

TEMPORARY LINE NO.

PERMANENT LINE/COMPONENT NO. (DRAWINGS)

*1) Valves with notes 4 or 18 indicated on P & ID (P3-12A)

2) Orifices with note 3 indicated on P & ID (P3-12A)

**3) Valves with note 39 indicated on P & ID (P3-12A)

TEMPORARY INTERFACE COMPONENTS

1) Covers (GFE)

2) Spacers (GFE)

INSTRUCTIONS TO CONTRACTOR

*Identify and store valve internals and orifices in protected environment. Spacers may have to be drilled from blanks.

**Valve seats to be removed, identified and stored in a protective environment for chemical and velocity flushes. (Note: Boiler panels 204, 205 207 & 208 require Contractor to remove valve seats. Boiler panels 206 and 209 through 221 will be delivered with the seat rings already removed for flushing.)

Upon completion of flushes valve seats to be installed.

B. Thermal Storage Subsystem

P & ID (P3-12C REV. 0) ZONE

E-6 (SA 301)

TEMPORARY LINE NO.

6" - SP-26-FBA

PERMANENT LINE/COMPONENT NO.

6" -MS-3-QEB

TEMPORARY INTERFACE COMPONENTS

Existing 6" temporary low pressure stub-in at interface 11.

INSTRUCTIONS TO CONTRACTOR

Clean out V-304 and DS-301 after chemical flush.

Temporary pipe section with stub-in to be replaced with QEB specification steel pipe (GFE) for permanent connection after steam blow.

APPENDIX D (CONTD)

P & ID (P3-12C REV. 0) ZONE

F-12 (SA 301)

TEMPORARY LINE NO.

6" - SP-30-BBA

PERMANENT LINE/COMPONENT NO.

4" -CO-4-KBA

TEMPORARY INTERFACE COMPONENTS

4" KBA weld neck flange (CFE)
6 x 4 BBA reducer (CFE)

INSTRUCTIONS TO CONTRACTOR

Remove blind flange and connect temporary line for velocity flush and steam blow.

APPENDIX D (CONTD)

P & ID (P3-12C REV. 0) ZONE

L-9 (SA 305)

TEMPORARY LINE NO.

6" - SP-18-FBA (SA 305)

PERMANENT LINE/COMPONENT NO.

V-FW-10-301 (TPWSK-1)

TEMPORARY INTERFACE COMPONENTS

Adapter (GFE) to fit V-FW-10-301

INSTRUCTIONS TO CONTRACTOR

Replace valve bonnet and plug with adapter prior to velocity flush.
Restore valve bonnet and plug after chemical flush.

APPENDIX D (CONTD)

P & ID (P3-12C REV. 0) ZONE

L-12 (SA 306)

TEMPORARY LINE NO.

4" - SP-23-FBA

PERMANENT LINE/COMPONENT NO.

V-FW-10-302 (TPWSK-1)

TEMPORARY INTERFACE COMPONENTS

Adapter (GFE) to fit V-FW-10-302

INSTRUCTIONS TO CONTRACTOR

Replace valve bonnet and plug with adapter prior to velocity flush.
Restore valve bonnet and plug after chemical flush.

APPENDIX D (CONTD)

P & ID (P3-12C REV. 0) ZONE

J-12 (SA 308)

TEMPORARY LINE NO.

6" - SP-22-FBA

6" - SP-58-FBA (bypass, Rocketdyne Dwg. SKIE-M809)

PERMANENT LINE/COMPONENT NO.

6" -ST-5-FBA

6" -ST-304-FBA

TEMPORARY INTERFACE COMPONENTS

6" FBA weld neck flanges (CFE) (3 each)

6" FBA blind flanges (GFE - installed)

INSTRUCTIONS TO CONTRACTOR

Install temporary bypass around E-308 and blind flange side of spectacle flanges on 10" ST-5-FBA, 10"-ST-303-FBA and 8" -ST-303-FBA during velocity flush and steam blow. Remove bypass and cover and install open side of three (3) spectacle flanges during chemical flush.

APPENDIX D (CONTD)

P & ID (P3-12C REV. 0) ZONE

J-9 (SA 307)

TEMPORARY LINE NO.

6" - SP-17-FBA

6" - SP-62-FBA (bypass, Rocketdyne Dwg. SKIE-M809)

PERMANENT LINE/COMPONENT NO.

6" -ST-5-FBA

6" -ST-303-FBA (SA 307)

TEMPORARY INTERFACE COMPONENTS

6" FBA weld neck flanges (CFE) (3 each)

6" FBA blind flanges (GFE - installed)

INSTRUCTIONS TO CONTRACTOR

Install temporary bypass around E-307 and blind flange side of spectacle flanges on 10"-ST-5-FBA, 10"-ST-304-FBA and 8" -ST-304-FBA during velocity flush and steam blow. Remove bypass and cover tee connections and install open side of three (3) spectacle flanges during chemical flush.

APPENDIX D (CONTD)

P & ID (P3-12C REV. 0) ZONE

F-9 (SA 302)

TEMPORARY LINE NO.

6" - SP-29-BBA

PERMANENT LINE/COMPONENT NO.

4" -CO-3-KBA

TEMPORARY INTERFACE COMPONENTS

4" KBA Weld neck flange (CFE)

6 x 4 BBA reducer (CFE)

INSTRUCTIONS TO CONTRACTOR

Remove blind flange and connect temporary line for velocity flush and steam blow.

APPENDIX D (CONTD)

P & ID (P3-12C REV. 0) ZONE

C-13 (SA 303)

TEMPORARY LINE NO.

6" - SP-16-FBA

PERMANENT LINE/COMPONENT NO.

6" -MS-4-KBA

TEMPORARY INTERFACE COMPONENTS

6" BBA weld neck flange (CFE)

INSTRUCTIONS TO CONTRACTOR

Remove pipe section adjacent to E-302 in line 6" -MS-4-KBA during velocity flush and steam blow. Replace for chemical flush. Install 6" -SP-16-FBA for velocity flush and steam blow.
Cut and disconnect 3/4" -MS-302-KBA and 3/4" vent line for velocity flush and steam blow. Provide temporary connections for chemical flush.
Reconnect (weld) after steam blow.

APPENDIX D (CONTD)

P & ID (P3-12C REV. 0) ZONE

C-11 (SA 302)

TEMPORARY LINE NO.

6" - SP-15-FBA

PERMANENT LINE/COMPONENT NO.

6" -MS-4-KBA

TEMPORARY INTERFACE COMPONENTS

6" BBA weld neck flange (CFE)

INSTRUCTIONS TO CONTRACTOR

Remove pipe section adjacent to E-301 in line 6" -MS-4-KBA during velocity flush and steam blow. Replace for chemical flush. Install 6" -SP-15-FBA for velocity flush and steam blow.
Cut and disconnect 3/4" -MS-301-KBA and 3/4" vent line for velocity flush and steam blow. Provide temporary connections for chemical flush.
Reconnect (weld) after steam blow.

TECHNICAL SPECIFICATIONS
FOR
CONSTRUCTION PACKAGE NO. 9
PIPING AND MECHANICAL EQUIPMENT
SECTION 4 - IFB
SECTION TI - TECHNICAL INFORMATION
TABLE OF CONTENTS VOL. II

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X				

APPROVALS
Des. Sec.
Sect. Supv.
Div.

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JF16.02.02

SPECIFICATION FOR NEMA FRAME INDUCTION MOTORS

ISSUED 7/6/76
REVISED 10/12/79

TABLE OF CONTENTS

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X				

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SPECIFICATION FOR NEMA FRAME INDUCTION MOTORS

PAGE 1 of 8

ISSUED 7/6/76
REVISED 10/12/79

1. SCOPE

CAUTION Due to ambient temperature and/or service altitude, this Specification may require nonstandard motors.

A. Motors required for the equipment specified in the Equipment Specification, to which this Specification is a supplement, shall be furnished in accordance with this Specification and Motor Data Sheets No. JF16.02.02-1 attached as a supplement to the Equipment Specification.

B. This Specification covers polyphase and single-phase, squirrel-cage induction motors having frame size 449T and smaller.

C. Single-phase motors shall be capacitor-start induction motors, except where otherwise approved for special application.

2. STANDARDS AND TESTS

The motors furnished shall be designed, manufactured and routinely tested in accordance with the latest applicable NEMA, IEEE, and ANSI Standards. In addition, the motors shall comply with any applicable standards and tests specified in the Equipment Specification.

3. SERVICE CONDITIONS

All motors shall operate successfully at their design load horsepower at the ambient temperature and altitude specified in the Equipment Specification. Motors shall be designed and constructed to withstand the seismic forces specified in the Equipment Specification.

4. RATINGS

A. Horsepower

The continuous nameplate rating shall be greater than or equal to the maximum brake horsepower required by the driven equipment when that equipment is operating at the design load conditions specified in the Equipment Specification. Service factor shall not be used to meet this requirement.

B. Service Factor

Motors shall have service factors in accordance with NEMA Standard MG1-12.47.

C. Torque and WK^2

a. All motors shall have characteristics suitable for the torque and WK^2 characteristics of the driven equipment when the driven equipment is operating as specified in the Equipment Specification or Motor Data Sheets No. JF16.02.02-1.

b. Unless specified otherwise or if other design is required by the driven equipment load characteristics, motors shall have a torque characteristic similar to either NEMA Design B or NEMA Design C. Other torque characteristics for special application shall be approved by the Buyer.

D. Temperature Rise

a. Motor temperature rise for any class of insulation shall not exceed that specified in NEMA Standards for Class B insulation. In addition, the hot-spot temperature (service ambient plus rise at nameplate horsepower plus hot-spot allowance) shall not exceed 130 C for Class B, 155 C for Class F or 180 C for Class H insulation.

b. If the service conditions as specified in the Equipment Specification are not standard in accordance with NEMA MG-1 (40 C ambient temperature and not over 3300 feet elevation) the temperature rise of motors having Class B insulation shall be adjusted in accordance with NEMA MG-1 so that the total hot-spot temperature will not exceed 130 C at rated horsepower, except as specified in Paragraph 4.D.c. below.

c. If the motor nameplate horsepower exceeds the driven equipment brake horsepower requirement by the percentage specified in the Equipment Specification, no adjustment will be required and a standard motor will be accepted.

NEMA MG-1 parts apply as follows:

(1) Fractional Horsepower Motors - MG1-12.41
(2) Integral Horsepower Motors - MG1-12.42

E. Voltage and Frequency

a. Motors shall be rated for the voltage and frequency specified in the Motor Data Sheets No. JF16.02.02-1. Permissible voltage and frequency variations shall be in accordance with NEMA MG-1.

b. When specified in the Equipment Specification, motors shall be capable of producing satisfactory operation of the driven equipment during short duration (up to one minute) dips to 75 percent of rated voltage.

F. Starting

a. All motors shall be designed for full voltage starting. Full voltage starting equipment will be furnished by others, unless specified otherwise in the Equipment Specification or the Motor Data Sheets No. JF16.02.02-1. If the driven equipment is designed to use reduced voltage starting, or if variable speed and/or torque control is required, the driven equipment manufacturer shall furnish suitable starting and control equipment in accordance with this Specification and the Equipment Specification.

b. Motor starters and control equipment, if supplied, shall be suitable for the type of service. All starting equipment shall be fully described in the Bidder's Proposal, complete with manufacturer's catalog data and descriptive bulletins.

c. Motor starting current shall not exceed 6.5 times rated full load current. Motors shall be capable of withstanding the number of starts imposed by the driven equipment without appreciable loss of service life.

d. Motors shall be capable of starting and accelerating their driven equipment to full speed at a starting voltage as required by the Motor Data Sheets No. JF16.02.02-1. The temperature rise during a restart following continuous full-load operation shall not produce injurious heating.

5. DESIGN AND CONSTRUCTION

A. General

a. The Seller shall complete items as required in the Motor Data Sheets No. JF16.02.02-1. The data shall be subject to the Engineer's approval.

b. Each motor furnished shall be a complete assembly. Installation of the motor shall require only setting in place and coupling to the driven equipment.

c. When motors are factory assembled and coupled to the driven equipment, installation of each unit assembly shall require only setting in place.

B. Enclosures

The types of enclosures required for the motors to be furnished are specified in the Motor Data Sheets No. JF16.02.02-1.

C. Insulation

a. The insulation of all motors shall meet or exceed the requirements established by NEMA for Class B insulation. The insulation shall be suitable for power plant service conditions.

b. Motors with weatherproof enclosures or motors for outdoor application shall have sealed or encapsulated insulation systems produced by a vacuum pressure impregnation process.

D. Bearings

a. General

(1) All motors with antifriction bearings shall be furnished with grease fittings for bearing lubrication and drain plugs for draining excess grease, except as specified in Paragraph 5.D.a.(2) below.

(2) Fractional horsepower motors may be furnished with prelubricated sealed ball bearings or oil lubricated sleeve bearings if greaseable ball bearings are not available.

(3) Motors for outdoor installation shall be furnished with special bearing seals to prevent leakage of lubricant or entrance of foreign matter along the shaft or through the bearings.

(4) All motors with antifriction bearings shall have the AFBMA antifriction rating and number stamped on the motor nameplate.

b. Horizontal Motors

(1) All horizontal motors shall be furnished with either antifriction or sleeve bearings in accordance with the manufacturer's standard practice for the particular frame size and application.

(2) Antifriction bearings shall be in accordance with ANSI 83.15-1972 for ball bearings or ANSI 83.16-1972 for roller bearings.

(3) Antifriction bearings in direct-coupled motors shall have a minimum L-10 rating life of 60,000 hours and a median life (L-50) of 300,000 hours as rated by AFBMA system.

(4) Antifriction bearings in belt or chain drive motors will be evaluated based on AFBMA L-10 rating life stated in the Motor Data Sheets No. JF16.02.02-1.

(5) If available, split-sleeve bearings shall be furnished in lieu of antifriction bearings. Sleeve bearings shall be split, oil ring-lubricated, with split end bells. Motors with oil ring-lubricated bearings shall have a glass-sight oil-level gage for instant visual checking of oil level marked to indicate normal oil level. If available, motors with oil ring-lubricated bearings shall have a transparent window for oil ring inspection.

c. Vertical Motors

(1) All vertical motors shall be furnished with antifriction thrust bearings which meet the requirements of ANSI 83.15-1972 for ball bearings or ANSI 83.16-1972 for roller bearings. Bearings shall be of a grade that will provide a minimum L-10 rating life of 35,000 hours and a median life (L-50) of 175,000 hours as rated by AFBMA system.

(2) Thrust bearings and/or guide bearings in vertical motors may be oil lubricated, if required. Sight-glass oil gages marked to indicate normal oil level shall be furnished.

E. V[illegible]ation

T[illegible] motors shall operate without exceeding the applicable vibration a[illegible]owances provided by NEMA Standard MG1-12.05.

F. Terminal Boxes

a. All motor lead terminal boxes, except as specified in Paragraph 5.F.d. below, shall have, as a minimum, the inside dimensions shown in the following table or shall be the manufacturer's nearest standard size:

Motor Horsepower	Height, Inches	Width, Inches	Depth, Inches
0 thru 3	Manufacturer's Standard		
5 thru 25	8	6	6
30 thru 50	9	7	7
60 thru 75	12	8	8
100 thru 125	12	10	10
150 thru 200	14	12	12

b. All terminal boxes shall have a bolt-type copper ground connector, sized as follows and brazed, welded or bolted inside the box:

Motor Horsepower	Size, AWG
0 thru 7-1/2	12
10 thru 20	10
25 thru 60	8
75 thru 100	6
125	4
150 thru 250	2

c. Separate terminal boxes or approved condulets or fittings shall be furnished for terminating all heater, thermocouple, thermostat, etc., wiring as required. When space allows, wiring shall be terminated with ring-type connectors on washer-head screw terminal blocks.

d. Motors Rated 2300 Volts or Higher

Terminal boxes shall have the following minimum dimensions for the type cable specified in the Equipment Specification:

Shielded and Unshielded Cable

(1) 18 inches high
(2) 12 inches wide
(3) 10 inches deep

e. Where possible, the terminal boxes shall be designed for installation in any position in 90 degree steps from the bottom entry vertical position.

G. Bracing

Motors shall be braced for an occasional full voltage bus transfer within an interruption time not exceeding 6 cycles.

H. Noise

Motors shall operate with an equivalent A-weighted sound level not exceeding 90 dBA, unless otherwise approved. Noise shall be determined in accordance with IEEE Standard No. 85, "Test Procedure for Airborne Noise Measurements on Rotating Electric Machinery."

I. Painting

All motors shall be prime painted and finish painted in accordance with manufacturer's standards. Preferred color shall be ANSI Z55.1, No. 61, light gray.

J. Accessories

a. All motors rated above 10 horsepower which are to be located outdoors and have totally-enclosed or weather-protected enclosures shall be furnished with space heaters. Space heaters shall be of sufficient capacity to keep the motor windings and internal parts dry when the motors are not running. Heaters shall be chrome steel sheath strip, ring or disc elements.

b. All space heaters shall be rated 240 volts and sized for operation on 120 volts single phase.

c. All weather-protected motors shall be furnished with filters and guard screens. Filters shall be arranged to be readily removable for cleaning and replacement while the motor is in service. Guard screens shall be of stainless steel or an approved corrosion-resistant material.

d. Motors specified on the Motor Data Sheets No. JF16.02.02-1 for outdoor installation shall be conditioned for outdoor use, with special attention to corrosion-resisting finish of the metal parts and special bearing seals.

e. All totally-enclosed motors shall be furnished with drain-breather elements, Crouse-Hinds Type ECD "Universal," or approved equal.

f. All motors shall be provided with suitable lifting devices or attachments for motor installation and removal.

g. When required by the Motor Data Sheets No. JF16.02.02-1, stator thermocouples or RTD's, stator thermostatic type protection, and/or bearing thermocouples or thermostats shall be furnished. All thermostatic-type sensing elements shall have normally closed circuit configurations.

h. When required by the Motor Data Sheets No. JF16.02.02-1, soleplates or baseplates shall be furnished with the motors.

K. Nameplate

a. Nameplate data shall be furnished in accordance with NEMA Standard MG1-10.38, except that temperature rise by resistance at service conditions and the service conditions (ambient temperature and elevation) shall be shown on the nameplate.

b. All motors required to be approved for use in hazardous locations shall have the nameplate stamped with the class, group and operating temperature or temperature range for which they are approved. The temperature range shall be indicated by identification number shown in Table 500-2(b) of the 1978 edition of the National Electrical Code.

c. Direction of rotation shall be permanently marked on the motor where the motor is suitable for only one direction of rotation.

6. LOSS EVALUATION

Vendors are encouraged to offer high efficiency motors since total motor full load losses will be evaluated on all integral horsepower motors.

DIVISION USAGE					
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JD40.4.10

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SPECIFICATION FOR HORIZONTAL CENTRIFUGAL PUMPS

ISSUED 10/24/75
REVISED 11/3/78

1. GENERAL

A. Each pump and its accessories shall be in accordance with the Design Data Sheets and the Equipment Specification to which this supplement is attached, and with the requirements specified herein.

B. The equipment to be furnished hereunder shall consist of the pump manufacturer's standard design and first line quality which meet or exceed the requirements of this Specification. The equipment shall be in accordance with the "Hydraulic Institute Standards" as specified in the Equipment Specification. Materials shall be in accordance with ASTM requirements, be new and of first quality, and shall be free of all defects which would affect performance or service life of the equipment, or which would cause unsightly or unworkmanlike appearance.

C. 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, and/or any other applicable statute, ordinance or code, then the requirement which is most stringent or has governing jurisdiction shall apply. Seller will not be liable for factors over which it has no control, e.g., installation, operation and maintenance.

2. PUMP REQUIREMENTS

A. Each pump shall be horizontal centrifugal, the type to be as specified on the Design Data Sheet, with its nozzles conforming to ANSI flange requirements for the specified conditions of service.

B. Each pump shall have a constantly rising characteristic curve from the design point to shutoff.

C. Each pump shall be designed to withstand all start-up and shut-down hydraulic surges and thrusts against closed valves or open pipe conditions.

D. The casing shall be able to withstand a hydrostatic test pressure of at least 1-1/2 times the maximum possible discharge pressure of the specified impeller(s) diameter.

E. The pump casing shall have a tapped and plugged vent connection on the top, if not self-venting, and an easily accessible drain plug at the bottom.

F. Impellers shall be finished smooth and securely fixed to the pump shaft in such a way that they may be readily dismounted. The application of maximum or minimum diameter impellers usable in the pump casing size recommended shall not be allowed. All impellers shall be dynamically balanced unless specified otherwise in the Equipment Specification.

2. PUMP REQUIREMENTS (CONTD)

G. Shafts shall be accurately ground. Each shaft, when required by design or specified in the Design Data Sheet, shall be equipped with sleeves extending through the stuffing boxes and all water passages, and secured to the shaft so that they cannot become loose or rotate on the shaft due to backward rotation of the pump. Provisions shall be made to prevent water leaking longitudinally between the shaft and sleeves.

H. Pump bearings shall have easily accessible lubrication fittings as specified in the Design Data Sheet.

I. A baseplate shall be provided as specified in the Design Data Sheet. The Seller shall factory align the equipment on the baseplate, when he supplies the driver, to facilitate realignment in the field. If the driver is not provided by the Seller under the Equipment Specification, the Buyer will provide Seller with certified driver drawing to enable the Seller to properly design the baseplate, and the Seller shall provide the Buyer with all necessary instructions, bolts, dowels, fill plates and shims, for jobsite alignment.

J. The pump discharge may be connected to a rubber expansion joint. The pump discharge flange shall be capable of accepting the necessary expansion joint control device mounting brackets and their associated forces at pump shutoff pressure conditions. If special provisions are required for these devices by the pump manufacturer, they shall be included in his bid price.

3. ELECTRIC MOTORS (WHERE SPECIFIED)

Unless specified otherwise in the Equipment Specification to which this is a supplement, pump motor drivers shall be horizontal type in accordance with the attached Electric Motor Specification.

4. COUPLINGS (WHERE SPECIFIED)

Each pump unit shall be provided with a coupling of adequate size, designed for the full driver rating and capable of withstanding starting and overload torques. Each coupling half shall be factory fitted and keyed to its shaft. In the instance of Buyer-supplied drivers, the Seller shall ship the drive half coupling to the driver manufacturer who will be responsible for boring, fitting and mounting the coupling half. All couplings shall be provided with coupling guards designed to meet the intent of OSHA.

5. STUFFING BOXES (WHERE SPECIFIED)

Stuffing boxes shall have a minimum of five (5) rings of packing and shall have a lantern ring (for either an external or internal source of liquid) if the stuffing box is subjected to less than atmospheric pressure or if required for external flushing.

6. MECHANICAL SEALS (WHERE SPECIFIED)

Mechanical seals shall be John Crane or approved equal.

7. NAMEPLATES

Each pump and its driver shall have a rust resistant metal nameplate with all pertinent information clearly inscribed thereon. Each nameplate shall be permanently attached in a conspicuous place on its piece of equipment.

8. TESTS

A. Where shop testing is specified, the tests shall be in accordance with the "Hydraulic Institute Standards" as specified in the Equipment Specifications. If witness tests are specified, the Seller shall give the Buyer at least two (2) weeks notice of such tests. Certified test curves and certified test reports shall be submitted for approval, prior to shipment, in accordance with specified documentation requirements.

B. Where no shop testing is specified, certified performance curves shall be submitted in accordance with specified documentation requirements.

C. Following installation of the pumps, the Buyer may conduct preliminary operational checks to determine that the equipment meets the specified operational requirements. Should these checks indicate that the equipment does not meet the specified performance requirements, the cost of necessary corrective measures and subsequent substantiating checks shall be borne by the Seller. Field checks will be made at the expense of the Buyer except that the Seller may, at his own expense, furnish qualified technicians to witness such checks.

9. FINISHING AND PAINTING

A. General

All equipment surfaces shall be cleaned and all surfaces requiring painting shall be painted by the pump manufacturer before shipment.

9. FINISHING AND PAINTING (CONTD)

B. Cleaning and Closures

All internal and external surfaces of equipment shall be cleaned of all mill scale, loose metal particles, weld spatter, slag, dirt, grease, oil and other foreign matter. All burrs shall be removed and all sharp edges shall be eased. Following cleaning, all openings shall be suitably sealed against entry of paint, water, dirt and debris during painting, shipment and field handling.

C. Painting

a. Unless specified otherwise in the Equipment Specification to which this is a supplement, painting of electric motors shall be in accordance with the attached Electric Motor Specification.

b. Unless otherwise specified in the Equipment Specification, all exposed surfaces of the equipment, excluding name and data plates, tags, and machined mating surfaces shall be given one (1) shop coat each of equipment manufacturer's standard rust inhibitive primer and standard finish paint that are suitable for the maximum operating conditions that will be encountered.

c. Nameplates and other exposed finished ferrous surfaces shall be coated with a slushing compound.

10. PREPARATION FOR SHIPMENT

For shipment, each unit shall be disassembled only to such extent as may be necessary to facilitate field handling and to prevent damage during shipment. Each assembly or component shall be skidded, crated, boxed or otherwise suitably protected against damage or loss during shipment, and to facilitate field handling. All openings shall be closed with temporary closures to prevent entry of dust, dirt or other foreign matter.

11. SPECIAL TOOLS AND DEVICES

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

12. NOISE EMISSION

The Buyer is obligated to comply with the laws of the state where the equipment is installed and the Federal Government as to permissible noise exposures to personnel within the plant area and maximum permissible noise levels at the site boundaries. Accordingly, certain noise emission data is requested from the Seller in the Equipment Specification Bid Data Section for each pertinent piece of equipment furnished by the Seller.

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.

B. In addition, the Seller shall offer all performance guarantees specified in Bid Data, Paragraph PERFORMANCE GUARANTEES.

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.

DIVISION USAGE					
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STANDARD NUMBER
JD40.4.11

PAGE 1 OF 5

SPECIFICATION FOR VERTICAL CENTRIFUGAL PUMPS

ISSUED 10/24/75
REVISED 12/18/78

1. GENERAL

A. Each pump and its accessories shall be in accordance with the Design Data Sheets and the Equipment Specification to which this supplement is attached, and with the requirements specified herein.

B. The equipment to be furnished hereunder shall consist of the pump manufacturer's standard design and first line quality which meet or exceed the requirements of this Specification. The equipment shall be in accordance with the "Hydraulic Institute Standards" and "American National Standard for Deep Well Vertical Turbine Pumps," published by American Water Works Association, ANSI B58.1 (AWWA E101) as specified in the Equipment Specification. Materials shall be in accordance with ASTM requirements, be new and of first quality, and shall be free of all defects which would affect performance or service life of the equipment, or which would cause unsightly or unworkmanlike appearance.

C. 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, and/or any other applicable statute, ordinance or code, then the requirement which is most stringent or has governing jurisdiction shall apply. Seller will not be liable for factors over which it has no control, e.g., installation, operation and maintenance.

2. PUMP REQUIREMENTS

A. Bowl Assemblies

a. Each bowl assembly shall be single or multistage with the discharge coaxial with the shaft. Bearings shall be provided above and below each impeller. The bowls shall be capable of withstanding a hydrostatic pressure equal to 1-1/2 times shutoff pressure based on specified diameter impellers.

b. Impellers shall be of the type specified herein for the specified service. Each impeller shall be statically balanced, finished smooth and securely fixed to the pump shaft in such a way that it may be readily dismounted. The application of maximum or minimum diameter impellers usable in the pump casing size recommended shall not be allowed.

c. Each pump shall have a constantly rising characteristic curve from the design point to shutoff.

d. Strainers, where specified, shall be cast or heavy fabricated type with a free area of at least four (4) times the area of the suction connection. The openings shall be of such size so as to restrict the passage of a 1/2-inch sphere.

B. Column and Lineshaft Assemblies

a. The ends of the column pipe shall be machined to ensure alignment. All column flange faces, where applicable, shall be parallel and machined for rabbet fit to permit accurate alignment. The column lengths shall be interchangeable, no more than 10 feet long and of ample number to ensure proper suction submergence.

b. Lineshaft bearings shall be spaced such that no critical speed is within 20 percent of the operating speed. When a variable speed driver is specified, the first critical speed shall be at least 25 percent above the maximum revolutions per minute.

c. Where required by the specified service conditions, all equipment required for bearing prelubrication or continuous flushing shall be included. This includes, as applicable, pumps, filters, tubing and solenoid valves as required for an operable system.

C. Discharge Head

a. The discharge head shall be capable of withstanding a hydrostatic test pressure of at least 1-1/2 times the maximum possible discharge pressure.

b. The pump discharge may be connected to a rubber expansion joint. The pump discharge head and/or flange shall be capable of accepting the necessary expansion joint control device mounting brackets and their associated forces at pump shutoff pressure conditions. If special provisions are required for these devices by the pump manufacturer, they shall be included in his bid price.

c. The driver (gear) mounting surface shall be machined to accept a NEMA-P base or NEMA-P style base.

d. Lifting lugs shall be provided for lifting the entire assembled unit.

D. Foundation Plate (Where Specified)

The plate shall be separate, and drilled and tapped to accept the discharge head. It will be anchored to the user's foundation and shall be capable of carrying the weight of the complete pump and driver assembly. It shall have a center hole of ample size to permit withdrawal of the entire assembly below it.

E. Can (Where Specified)

Each can shall be capable of withstanding a hydrostatic test pressure of at least 1-1/2 times the maximum suction pressure or 250 psig, whichever is greater.

3. ELECTRIC MOTORS (Where Specified)

Unless specified otherwise in the Equipment Specification to which this is a supplement, pump motor drivers shall be vertical type, with NEMA-P bases or NEMA-P style bases and in accordance with the attached Electric Motor Specification.

4. COUPLINGS (Where Specified)

The headshaft coupling shall be adjustable flanged with vertical solid shaft motor and rigid flanged with vertical hollow shaft motor, of adequate size designed for the full driver rating and maximum pump downthrust, and capable of withstanding starting and overload torques. If the pump has a mechanical seal, a coupling spacer shall be provided for removal of the seal without requiring removal of the driver. Each coupling half shall be separately dynamically balanced, factory fitted and keyed to its shaft. In the instance if Buyer-supplied drivers, the Seller shall ship the driver half coupling to the driver manufacturer who will be responsible for boring, fitting and mounting the coupling half. All couplings shall be provided with coupling guards designed to meet the intent of OSHA.

5. STUFFING BOXES (Where Specified)

Stuffing boxes shall have a minimum of five (5) rings of packing. The shaft shall be fitted with a hardened corrosion-resistant shaft sleeve in the packing area.

6. MECHANICAL SEALS (Where Specified)

Mechanical seals shall be John Crane or approved equal.

7. NAMEPLATES

Each pump and its driver shall have rust resistant metal nameplate with all pertinent information clearly inscribed thereon. Each nameplate shall be permanently attached in a conspicuous place on its piece of equipment.

8. TESTS

A. Where shop testing is specified the tests shall be in accordance with ANSI B58.1 and, where applicable, the "Hydraulic Institute

Standards," as specified in the Equipment Specification. If witness tests are specified, the Seller shall give the Buyer at least two (2) weeks notice of such tests. Certified test curves and certified test reports shall be submitted for approval, prior to shipment, in accordance with specified documentation requirements.

B. Where no shop testing is specified, certified performance curves shall be submitted in accordance with specified documentation requirements.

C. Following installation of the pumps, the Purchaser may conduct preliminary operational checks to determine that the equipment meets the specified operational requirements. Should these checks indicate that the equipment does not meet the specified performance requirements, the cost of necessary corrective measures and subsequent substantiating checks shall be borne by the Seller. Field checks will be made at the expense of the Buyer except that the Seller may, at his own expense, furnish qualified technicians to witness such checks.

9. FINISHING AND PAINTING

A. General

All equipment surfaces shall be cleaned and all surfaces requiring painting shall be painted by the pump manufacturer before shipment.

B. Cleaning and Closures

All internal and external surfaces of equipment shall be cleaned of all mill scale, loose metal particles, weld spatter, slag, dirt, grease, oil and other foreign matter. All burrs shall be removed and all sharp edges shall be eased. Following cleaning, all openings shall be suitably sealed against entry of paint, water, dirt and debris during painting, shipment and field handling.

C. Painting

a. Unless specified otherwise in the Equipment Specification to which this is a supplement, painting of electric motors shall be in accordance with the attached Electric Motor Specification.

b. Unless otherwise specified in the Equipment Specification, all exposed ferrous surfaces of the equipment, exluding name and data plates, tags and machined mating surfaces shall be given one (1) shop coat each of equipment manufacturer's standard rust inhibitive primer and standard finish paint that are suitable for the maximum operating conditions that will be encountered.

c. Nameplates and other exposed finished ferrous surfaces shall be coated with a slushing compound.

10. PREPARATION FOR SHIPMENT

For shipment, each unit shall be disassembled only to such extent as may be necessary to facilitate field handling and to prevent damage during shipment. Each assembly or component shall be skidded, crated, boxed or otherwise suitably protected against damage or loss during shipment, and to facilitate field handling. All openings shall be closed with temporary closures to prevent entry of dust, dirt or other foreign matter.

11. SPECIAL TOOLS AND DEVICES

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

12. NOISE EMISSION

The Buyer is obligated to comply with the laws of the state where the equipment is installed and the Federal Government as to permissible noise exposures to personnel within the plant area and maximum permissible noise levels at the site boundaries. Accordingly, certain noise emission data is requested from the Seller in the Equipment Specification Bid Data Section for each pertinent piece of equipment furnished by the Seller.

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.

B. In addition, the Seller shall offer all performance guarantees specified in Bid Data, Paragraph PERFORMANCE GUARANTEES.

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.

DIVISION USAGE					
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STANDARD NUMBER
JD40.4.16

APPROVALS
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Sect. Supv.
Div. WHO

SPECIFICATION
FOR
VERTICAL SUMP PUMPS

ISSUED 4/21/75
REVISED 3/12/79

1. GENERAL

A. Each pump amd its accessories shall be in accordance with Engineering Standard No. JD40.4.16-1 and the Equipment Specification to which this Specification is attached, and with the requirements of this Specification.

B. The equipment to be furnished hereunder shall consist of the pump manufacturer's standard design and first line quality which meet or exceed the requirements of this Specification. The equipment shall be in accordance with the "Hydraulic Institute Standards" as specified in the Equipment Specification. Materials shall be in accordance with ASTM requirements, be new and of first quality, and shall be free of all defects which would affect performance or service life of the equipment, or which would cause unsightly or unworkmanlike appearance.

C. 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, and/or any other applicable statute, ordinance or code, then the requirement which is most stringent or has governing jurisdiction shall apply. Seller will not be liable for factors over which it has no control, e.g., installation, operation and maintenance.

2. PUMP REQUIREMENTS

A. General

a. Unless specified otherwise, sump pumps will be set in a concrete sump pit with the motor driver mounted at floor level above the sump pit.

b. A duplex pump arrangement, when specified, shall consist of two (2) pumps supported by a common mounting plate.

c. A single pump arrangement, when specified, shall consist of one (1) pump supported by an individual mounting plate.

d. Each pump shall be of the vertical shaft, centrifugal type, supported from its motor mounting base by means of a column pipe of the required length. Pump and motor shall be direct connected by means of a flexible coupling, resulting in a self-contained unit which can be readily lifted from the sump pit. All parts of the equipment shall be readily accessible for inspection, adjustment and repairs.

e. Pumps shall be capable of continuous operation, and shall perform equally well at maximum, minimum or any intermediate condition.

f. Each pump shall have a constantly rising characteristic curve from the design point to shutoff.

B. Casing and Column Pipe

a. Casing shall be volute type, rigidly secured to the column pipe. The casing suction shall be at the bottom and, when submerged wet pit pumps are specified, shall include a strainer. When a dry pit arrangement is specified, the bottom suction shall be an ANSI Class 150 flange.

b. Column pipe ends shall be machined to ensure perfect alignment.

C. Shaft and Impeller

a. Pump shaft shall be of steel and of the required diameter to prevent whipping under any operating condition. All parts shall be designed to withstand stresses set up by full voltage starting motors.

b. Impellers shall be of the type specified in Engineering Standard No. JD40.4.16-1 for the specified service. Each impeller shall be statically balanced, finished smooth and securely fixed to the pump shaft in such a way that it may be readily dismounted. The application of maximum or minimum diameter impellers usable in the pump casing size recommended shall not be allowed.

D. Bearings

a. Bearings shall be renewable sleeve type of approved design with ample wearing surfaces and shall have provisions for external lubrication or flushing as required by the Equipment Specification.

b. The bottom bearing shall normally be as close to the impeller as design will permit. Cantilever type pumps for abrasive services shall have no submerged bearings.

c. Intermediate bearings shall be provided where necessary.

d. Thrust bearing shall be antifriction type and may be furnished with the electric motor or separately. If separate, the bearing shall be located above the sump cover plate.

E. Stuffing Boxes

a. When submerged wet pit sump pumps are specified, the pump shall have no stuffing box.

b. Stuffing boxes shall be furnished on all dry pit applications, and in wet pit applications only when, because of the nature of the pumped fluid, a vapor tight arrangement is necessary.

F. Discharge Pipe

a. The discharge pipe shall terminate above the mounting plate. If a vapor tight arrangement is required, the discharge pipe shall be sealed at the mounting plate.

b. The discharge pipe assembly shall include the necessary elbow from the pump casing and pipe through the mounting plate. The discharge pipe shall terminate above the mounting plate with an ANSI Class 150 flange. If pipe is 2 inches or smaller, threaded connection may be used.

G. Mounting Plate

Mounting plate shall be of heavy construction, made of steel plate unless otherwise specified. Should plate consist of two (2) or more parts, the latter shall be flanged and bolted together.

H. Pump Control

a. Each single or duplex pump shall be provided with a level control as specified in Engineering Standard No. JD40.4.16-1. The specified control switch shall be situated on the mounting plate.

b. When specified, an automatic mechanical alternating level control shall be provided to alternate the base operation of duplex unit pumps and also to start the second pump if the sump fluid level continues to rise above the normal high level setting.

I. Motor Support

The motor support shall be rigidly secured to the mounting plate and shall be arranged for mounting a NEMA-P or NEMA-C base motor.

3. ELECTRIC MOTORS

Unless specified otherwise in the Equipment Specification, pump motor drivers shall be vertical type, with NEMA-P or NEMA-C bases, and in accordance with the attached Electric Motor Specification.

4. COUPLINGS (Where Specified)

The couplings shall be flanged, sized and designed for the full driver rating and maximum pump downthrust, and capable of withstanding starting and overload torques. Each coupling half shall be factory fitted and keyed to its shaft. In the instance of Buyer-supplied drivers, the Seller shall ship the driver half coupling to the driver manufacturer who will be responsible for boring, fitting and mounting the coupling half. All couplings shall be provided with coupling guards designed to meet the intent of OSHA.

5. NAMEPLATES

Each pump and its driver shall have a rust resistent metal nameplate with all pertinent information clearly inscribed thereon. Each nameplate shall be permanently attached in a conspicuous place on its piece of equipment.

6. TESTS

A. Where shop testing is specified, the tests shall be in accordance with the "Hydraulic Institute Standards," as specified in the Equipment Specification. If witness tests are specified, the Seller shall give the Buyer at least two (2) weeks notice of such tests. Certified test curves and certified test reports shall be submitted for approval, prior to shipment, in accordance with specified documentation requirements.

B. Where no shop testing is specified, certified performance curves shall be submitted in accordance with specified documentation requirements.

C. Following installation of the pumps, the Buyer may conduct preliminary operational tests to determine that the equipment meets the specified operational requirements. Should these tests indicate that the equipment does not meet the specified performance requirements, the cost of necessary corrective measures and subsequent substantiating tests shall be borne by the Seller. Field tests will be made at the expense of the Buyer except that the Seller may, at his own expense, furnish qualified technicians to witness such tests.

7. NOISE EMISSION

The Buyer is obligated to comply with the laws of the state where the equipment is installed and the Federal Government as to permissible noise exposures to personnel within the plant area and maximum permissible noise levels at the site boundaries. Accordingly, certain noise emission data is requested from the Seller in the Equipment Specification Bid Data Section for each pertinent piece of equipment furnished by the Seller.

8. FINISHING AND PAINTING

A. General

All equipment surfaces shall be cleaned and all surfaces requiring painting shall be painted by the pump manufacturer before shipment.

B. Cleaning and Closures

All internal and external surfaces of equipment shall be cleaned of all mill scale, loose metal particles, weld spatter, slag, dirt, grease, oil and other foreign matter. All burrs and flashing shall be removed and all sharp edges shall be eased. Following cleaning, all openings shall be sealed against entry of paint, water, dirt and debris during painting, shipment and field handling.

C. Painting

a. Unless specified otherwise in the Equipment Specification, painting of electric motors shall be in accordance with the attached Electric Motor Specification.

b. Unless specified otherwise in the Equipment Specification, all exposed ferrous surfaces of the equipment, excluding name and data plates, tags and machined mating surfaces, shall be given one (1) shop coat each of equipment manufacturer's standard rust inhibitive primer and standard finish paint that are compatible with the maximum operating conditions that will be encountered.

c. Nameplates, data plates, tags and machined mating surfaces shall be coated with a slushing compound.

9. PREPARATION FOR SHIPMENT

For shipment, each unit shall be completely drained of all liquid, then disassembled only to such extent as may be necessary to facilitate field handling and to prevent damage during shipment. Each assembly or component shall be skidded, crated, boxed or otherwise protected against damage or loss during shipment, and to facilitate field handling. All openings shall be closed with temporary closures to prevent entry of dust, dirt or other foreign matter.

10. SPECIAL TOOLS AND DEVICES

One (1) complete set of new, unused special tools and devices required for operation and maintenance of equipment furnished under this Specification shall be furnished and delivered with the equipment, in a separate container clearly identified with the name of the equipment. The tools and devices shall be containerized for long term toolroom storage.

11. 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. In addition, where required, the Seller shall offer all performance guarantees specified in Bid Data, Paragraph PERFORMANCE GUARANTEES.

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.

DIVISION USAGE					
MM	P	PP	SH	FI	SP
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Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JD40.4.14

APPROVALS
Des. Sect. BCK
Sect. Supv.
Div.

SPECIFICATION
FOR
ROTARY PUMPS

ISSUED 5/1/75
REVISED 3/8/79

1. GENERAL

A. Each pump and its accessories shall be in accordance with Engineering Standard No. JD40.4.14-1 and the Equipment Specification to which this Specification is attached, and with the requirements of this Specification.

B. The equipment to be furnished hereunder shall consist of the pump manufacturer's standard design and first line quality which meet or exceed the requirements of this Specification. The equipment shall be in accordance with the "Hydraulic Institute Standards" as specified in the Equipment Specification. Materials shall be in accordance with ASTM requirements, be new and of first quality, and shall be free of all defects which would affect performance or service life of the equipment, or which would cause unsightly or unworkmanlike appearance.

C. 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, and/or any other applicable statute, ordinance or code, then the requirement which is most stringent or has governing jurisdiction shall apply. Seller will not be liable for factors over which he has no control, e.g., installation, operation and maintenance.

2. PUMP REQUIREMENTS

A. Each pump shall be of the rotary type giving a positive displacement.

B. Casing

Casings for rotary pumps handling fuel oil, lubricating oil or other hydrocarbons shall be cast steel. Cast or ductile iron will not be permitted.

C. Connections

Suction and discharge connections shall be ANSI B16.5 flanged or screwed in accordance with the attached Engineering Standard No. JD40.4.14-1.

D. Baseplates

Common baseplates shall be provided to accept each complete pump, coupling, coupling guard and driver. The Seller shall factory align the equipment on the baseplate when he supplies the driver to facilitate realignment in the field. If the driver is not provided by the Seller under the Equipment Specification, the Buyer will provide Seller with certified driver drawing to enable the Seller to

design the baseplate, and the Seller shall provide the Buyer with all necessary instructions, bolts, dowels, fill plates and shims, for jobsite alignment. Baseplates shall be extra heavy cast iron or welded structural steel and equipped with drip lips.

E. Safety Relief Valves

Each pump shall be furnished with an integral or separate safety relief valve with pressure setting as recommended by the Seller but not to exceed system design pressure.

3. ELECTRIC MOTORS (Where Specified)

Unless specified otherwise in the Equipment Specification, pump motor drivers shall be horizontal type in accordance with the attached Electric Motor Specification. Each motor shall be sized to drive the pump at its relief valve setting at maximum viscosity specified in the Engineering Standard No. JD40.4.14-1.

4. COUPLINGS (Where Specified)

Each pump unit shall be provided with a coupling sized and designed for the full driver rating and capable of withstanding starting and overload torques. Each coupling half shall be factory fitted and keyed to its shaft. In the instance of Buyer-supplied drivers, the Seller shall ship the driver half coupling to the driver manufacturer who will be responsible for boring, fitting and mounting the coupling half. All couplings shall be provided with coupling guards designed to meet the intent of OSHA.

5. STUFFING BOXES OR MECHANICAL SEALS

Stuffing boxes or mechanical seals shall be provided as specified in Engineering Standard No. JD40.4.14-1 and shall be subjected to suction pressure only. Boxes or seals shall be capable of operation under the specified service.

6. NAMEPLATES

Each pump and its driver shall have a rust resistant metal nameplate with all pertinent information clearly inscribed thereon. Each nameplate shall be permanently attached in a conspicuous place on its piece of equipment.

7. TESTS

A. Where shop testing is specified, the tests shall be in accordance with the "Hydraulic Institute Stnadards" as specified in the Equipment Specification. If witness tests are specified, the Seller shall give the Buyer at least two (2) weeks notice of such tests. Certified test curves and certified test reports shall be submitted

for approval, prior to shipment, in accordance with specified documentation requirements.

B. Where no shop testing is specified, certified performance curves shall be submitted in accordance with specified documentation requirements.

C. Following installation of the pumps, the Buyer may conduct preliminary operational tests to determine that the equipment meets the specified operational requirements. Should these tests indicate that the equipment does not meet the specified performance requirements, the cost of necessary corrective measures and subsequent substantiating tests shall be borne by the Seller. Field tests will be made at the expense of the Buyer except that the Seller may, at his own expense, furnish qualified technicians to witness such tests.

8. NOISE EMISSION

The Buyer is obligated to comply with the laws of the state where the equipment is installed and the Federal Government as to permissible noise exposures to personnel within the plant boundaries. Accordingly, certain noise emission data is requested from the Seller in the Equipment Specification Bid Data Section for each pertinent piece of equipment furnished by the Seller.

9. FINISHING AND PAINTING

A. General

All equipment surfaces shall be cleaned and all surfaces requiring painting shall be painted by the pump manufacturer before shipment.

B. Cleaning and Closures

All internal and external surfaces of equipment shall be cleaned of all mill scale, loose metal particles, weld spatter, slag, dirt, grease, oil and other foreign matter. All burrs and flashing shall be removed and all sharp edges shall be eased. Following cleaning, all openings shall be sealed against entry of paint, water, dirt and debris during painting, shipment and field handling.

C. Painting

a. Unless specified otherwise in the Equipment Specification, painting of electric motors shall be in accordance with the attached Electric Motor Specification.

b. Unless otherwise specified in the Equipment Specification, all exposed surfaces of the equipment, excluding name and data

plates, tags, and machined mating surfaces, shall be given one (1) shop coat each of equipment manufacturer's standard rust inhibitive primer and standard finish paint that are compatible with the maximum operating conditions that will be encountered.

c. Nameplates, data plates, tags and machined mating surfaces shall be coated with a slushing compound.

10. PREPARATION FOR SHIPMENT

For shipment, each unit shall be completely drained of all liquid, then disassembled only to such extent as may be necessary to facilitate field handling and to prevent damage during shipment. Each assembly or component shall be skidded, crated, boxed or otherwise protected against damage or loss during shipment, and to facilitate field handling. All openings shall be sealed with temporary closures to prevent entry of dust, dirt or other foreign matter.

11. SPECIAL TOOLS AND DEVICES

One (1) complete set of new, unused special tools and devices required for operation and maintenance of the equipment furnished under this Specification shall be furnished and delivered with the equipment, in a separate container clearly identified with the name of the equipment. The tools and devices shall be containerized for long term toolroom storage.

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. In addition, the Seller shall offer all performance guarantees specified in Bid Data, Paragraph PERFORMANCE GUARANTEES.

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.

DIVISION USAGE					
MM	P	PP	SH	FI	SP

APPROVALS

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Stearns-Roger INCORPORATED

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JC 10.22.14 .1

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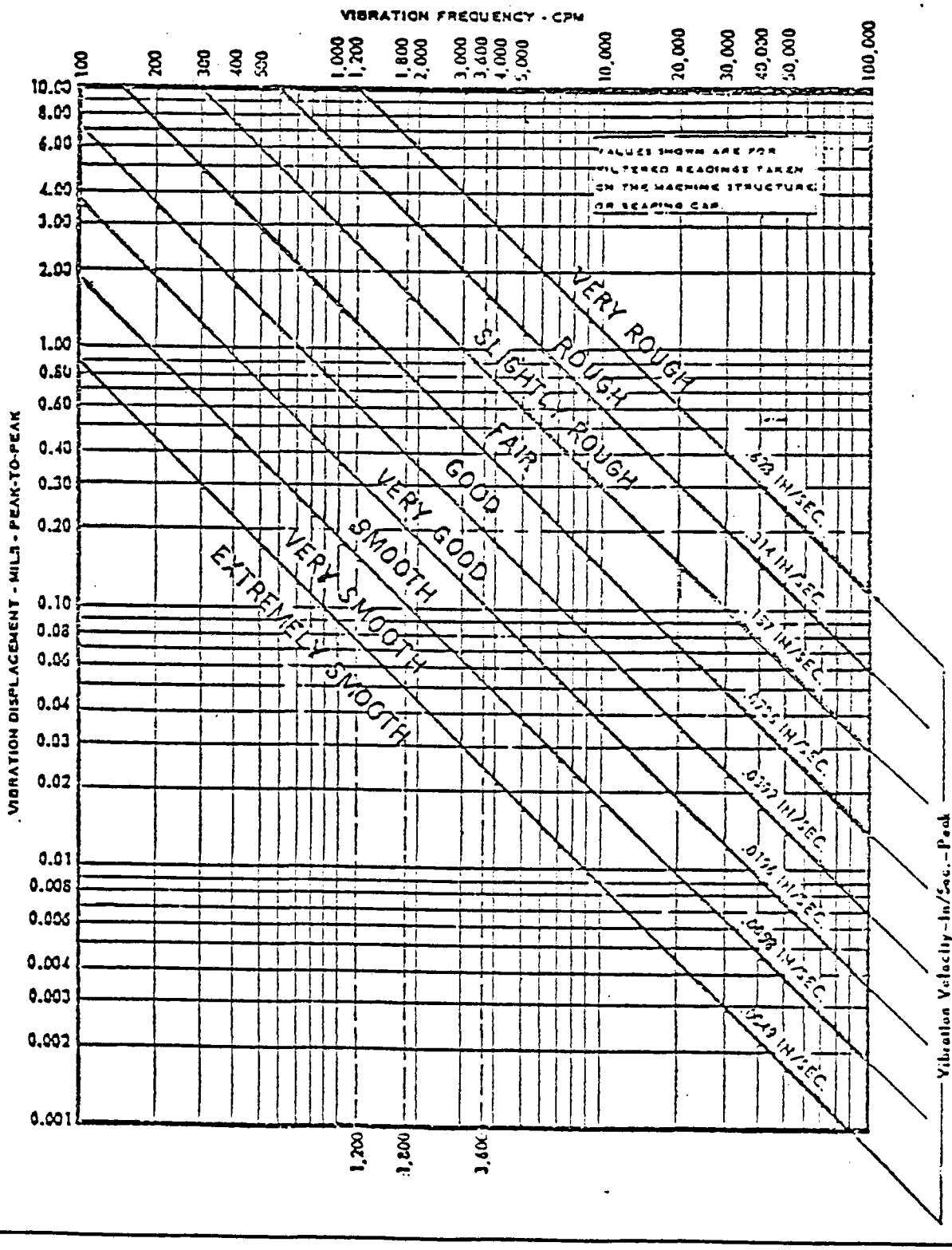
ISSUED 11/18/74

REVISED

GENERAL MACHINERY VIBRATION SEVERITY CHART

For use as a GUIDE in judging vibration as a warning of impending trouble.



SPECIFICATION FOR PAINTING AND FINISHING HVAC EQUIPMENT

1. SCOPE

The information contained herein consists of the requirements for Painting and Finishing HVAC Equipment.

2. CODES AND STANDARDS

Steel Structures Painting Council

SSPC-SP6 63, Surface Preparation Specification No. 6, Commercial Blast Cleaning.

3. CODES AND STANDARDS

A. All ferrous equipment furnished under the applicable Specification shall be suitably cleaned and coated by the manufacturer unless specified otherwise (excluding name and data plates, tags and machined mating surfaces). Generally, the manufacturer's standard cleaning procedures and coating system will be acceptable, subject to Engineer's approval. This approval will be based on evaluation of details submitted by the manufacturer in the Bid Data.

B. Complete details of methods and procedures must be submitted. The intent of the surface preparation is to clean all surfaces free of mill scale, loose metal, weld spatter, slag, dirt, grease, oil and other foreign matter, equivalent to SSPC-SP6 63. The method(s) used shall be appropriate for the surfaces and coatings used. Following cleaning, all openings shall be suitably sealed against entry of paint, water, dirt and debris during painting, shipment and field storage and handling.

4. PAINTING (Prime and Finish)

A. Unless otherwise specified, the manufacturer's prime and finish coats will be acceptable. For approval, technical data on both prime and finish coats must be submitted which include manufacturer, generic type, method of application, method of cure and dry film thickness.

B. Performance data on the coating system shall be provided which indicates its ability to withstand the conditions of exposure, including operating temperature; compatibility with other generic types of coatings; and general resistance to weathering, chemical and moisture exposure.

C. Unless otherwise specified, the finish color will be the manufacturer's standard.

D. Nameplates and other uncoated ferrous surfaces shall be coated with a suitable slushing compound.

BID DATA

NAME OF BIDDER _____

Bidder shall fill in all spaces of the following Bid Data.

1. SURFACE PREPARATION: _____

   (Details of methods and procedures) _____

   _____

   _____

2. PRIME COAT

   A. Manufacturer _____

   B. Generic type _____

   C. Method of application _____

   D. Method of cure _____

   E. Dry film thickness, mils _____

3. FINISH COAT(S)

   A. Manufacturer _____

   B. Generic type _____

   C. Method of application _____

   D. Number of coats _____

   E. Method of cure _____

   F. Dry film thickness, mils _____

4. TOTAL SYSTEM

   Maximum temperature resistance, °F _____

DIVISION USAGE					
MM	P	PP	SH	FI	SP

Stearns-Rogers INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JC 10.15.01.1

APPROVALS
Res. Sect. _____
Sect. Supv. _____
Div. _____

RECOMMENDED SHEET METAL GAUGES AND CONSTRUCTION FOR RECTANGULAR DUCT

ISSUED 9/16/74
REVISED 4/12/78

LOW PRESSURE—2" W.G. MAX. LOW VELOCITY—2000 F.P.M. MAX.

Dimension of Longest Side of Duct	Steel Metal Gauges		AT JOINTS					Intermediate Reinforcing Between Joints
	Steel	Aluminum	Plain "S" Slip (B), Pocket Lock (K), Drive Slip (A)	Hemmed "S" Slip (C), Bar Slip (E), Standing Seam (I)*	Reinforced Bar Slip (G)	Angle Slip (H)†, Alternate Bar Slip (F), Angle RFD Pocket (L)	Companion Angles (M), Angle Reinforced Standing Seam (J)	
Thru 12"	24	22 (.025)	A-B K	—	—	—	—	
13" thru 18"	24	22 (.025)	A-B K	—	—	—	—	
19" thru 30"	24	22 (.025)	K	C-E	—	—	—	1"x1"x⅛" @ 5'-0" cc
31" thru 42"	22	20 (.032)	K	E-G-K	—	—	—	1"x1"x⅛" @ 5'-0" cc
43" thru 54"	22	20 (.032)	K	E	G	—	—	1½"x1½"x⅛" @ 5'-0" cc
55" thru 60"	20	18 (.040)	K	E	G	—	—	1½"x1½"x⅛" @ 5'-0" cc
61" thru 84"	20	18 (.040)	—	—	G	H F L	J	1½"x1½"x⅛" @ 2'-6" cc
85" thru 96"	18	16 (.051)	—	—	—	H L	M J	1½"x1½"x⅛" @ 2'-6" cc
Over 96"	18	16 (.051)	—	—	—	H L	M	2"x2"x⅛" @ 2'-0" cc

H (height dimension)—up to 42" = 1"
H (height dimension)—42" to 96" = 1½"
H (height dimension)—over 96" = 2"
*Roll formed slip shall be 1½" maximum and 2" reinforcing angle fastened to slip when 'H' dimension requires 2" height

DIVISION USAGE					
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Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JC10.15.01.2

APPROVALS
Des. Sect.
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Div.

RECOMMENDED SHEET METAL GAUGES AND CONSTRUCTION FOR ROUND DUCTS

PAGE 1 OF 1

ISSUED 7/22/76
REVISED

RECOMMENDED CONSTRUCTION FOR ROUND SHEET METAL DUCT
Low and High Pressure Systems (Except Industrial Exhaust Ducts)

DUCT DIMENSION (in.)	MATERIAL GAGE		RECOMMENDED CONSTRUCTION	
	STEEL U.S. GAGE	ALUMINUM B & S GAGE	REINFORCING	JOINTS AND SEAMS
UP TO 8	24	22		ROUND DUCT SECTIONS ARE JOINED TOGETHER BY WELDING, BY A COUPLING, OR BY BELLING OUT ONE END OF DUCT.
9 TO 24	22	20		
25 TO 36	20	18	1 1/4" X 1 1/4" X 1/8" GIRTH ANGLE REINFORCING SPACED ON 8' CENTERS.	
37 TO 48	20	18	1 1/4" X 1 1/4" X 1/8" GIRTH ANGLE REINFORCING SPACED ON 6' CENTERS.	THE SEAMS ON ROUND DUCT MAY BE CONTINUOUS WELDED OR GROOVED LONGITUDINAL SEAM.
49 TP 72	18	16	1 1/2" X 1 1/2" X 1/8" GIRTH ANGLE REINFORCING SPACED ON 4' CENTERS.	
73 AND UP	16	14		

DIVISION USAGE					
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Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

TYPICAL DUCT CONNECTIONS
CROSS JOINTS

STANDARD NUMBER
JC 10.15.02

PAGE 1 OF 2

ISSUED 9/16/74
REVISED 10/28/75

Fig. A – DRIVE SLIP – Ends of ducts inserted under cleat. For narrow sides of ducts that are 18" or less. Drive slips that are 19" – 30" must be reinforced with 1" x 1" x 1/8" angle.

NOTE – A combination of drive slip A and any "S" slip B, C, E, F, G, H completes the transverse joint.

Fig. B – PLAIN "S" SLIP – Ends of ducts inserted into open ends of "S". Use on wide sides of small ducts. (Use Drive Slip (A) on narrow sides.)

Fig. C – HEMMED "S" SLIP – Similar to Plain "S" Slip (B) except with edges hemmed to produce stiffness.

Fig. E – BAR SLIP – Similar to Plain "S" Slip (B) except for standing edge which is formed to provide reinforcing.

Fig. F – ALTERNATE BAR SLIP (STANDING "S" SLIP) Same as Bar Slip (E) except standing leg is folded to three thicknesses for stiffness.

Fig. G – REINFORCED BAR SLIP – Similar to Bar Slip (E) except for the addition of a steel reinforcing bar inserted in the standing edge.

Fig. H – ANGLE SLIP – Same as Reinforced Bar Slip (G) except for the use of a reinforcing angle in place of the reinforcing bar. Angle may be inside or fastened to outside of slip.

Fig. I – STANDING SEAM – Ends of adjoining ducts are joined as shown with button punch at six-inch centers added after assembly.

Fig. J – ANGLE REINFORCED STANDING SEAM – Same as Standing Seam (I) except for reinforcement with angle, one leg of which is fastened to the duct and the other leg is secured to the standing edge of the seam.

Fig. K – POCKET LOCK – Normally used on four sides of a duct. The pocket section is clip punched or "hickey" punched to the duct near corners and then every six inches; the other end is flanged outward to join with second sheet and then hammered down.

Fig. L – ANGLE REINFORCED POCKET LOCK – Same as Pocket Lock (K) with added angle stiffener.

Fig. M – COMPANION ANGLES – Angle frames are riveted, bolted or welded to duct ends and are then bolted together with gasket or caulking to prevent air leakage. Recommended for use where duct sections must be removed periodically.

Some of the above connections may be favored over others in certain parts of the country, and all of them are not listed in JC10.15.01.1. Substitutions can be made for those that are listed provided the same quality of construction is maintained.

NOTE – Arrows on JC10.15.02 indicate preferred air flow direction.

NOTE – "H" on JC10.15.02 indicates dimension as specified in JC10.15.01.1.

DIVISION USAGE					
MM	P	PP	SH	FI	SP

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Stearns-Rogger INCORPORATED

ENGINEERING STANDARD

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ISSUED 9/16/74

REVISED

TYPICAL DUCT CONNECTIONS

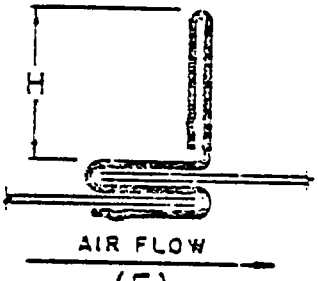
CROSS JOINTS

H=HEIGHT REFERRED TO IN DIMENSIONS

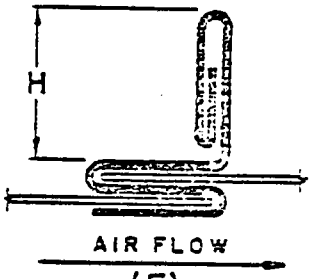
(A)
DRIVE SLIP

(B)
PLAIN "S" SLIP

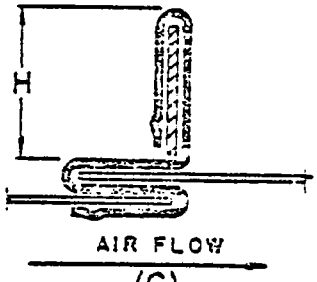
(C)
HEMMED "S" SLIP



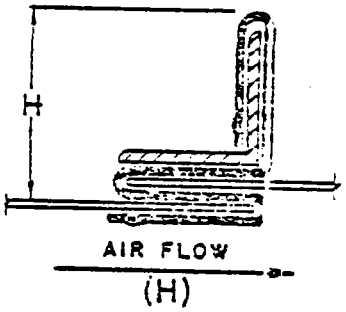
(E)
BAR SLIP



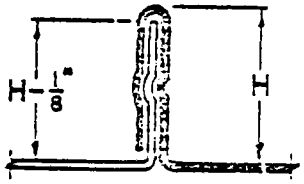
(F)
ALTERNATE BAR SLIP
(STANDING "S" SLIP)



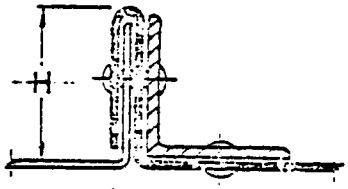
(G)
REINFORCED
BAR SLIP (CLEAT)



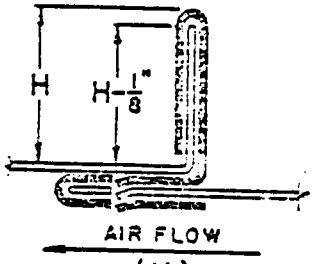
(H)
ANGLE SLIP



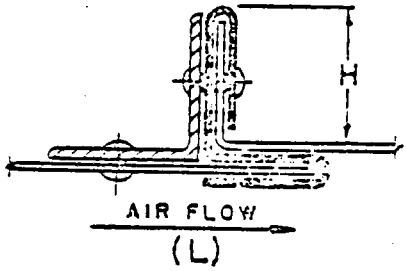
(I)
STANDING SEAM



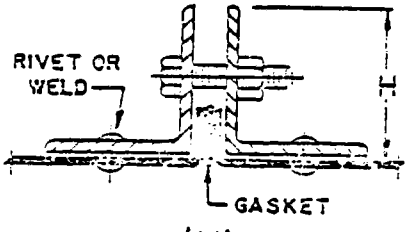
(J)
ANGLE REINFORCED
STANDING SEAM



(K)
POCKET LOCK



(L)
ANGLE REINFORCED
POCKET LOCK



(M)
COMPANION ANGLES
(CAULK OR GASKET)

(NOT TO SCALE)

DIVISION USAGE					
MM	P	PP	SH	FI	SP

APPROVALS
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Stearns-Rogers INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JC 10.15.03

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ISSUED 9/16/74
REVISED

LONGITUDINAL SEAMS

Longitudinal seams which run horizontally on the duct sections are important because these locks must hold the duct pieces securely and tightly-should not leak under pressure-and should be readily and swiftly put together on the job or in the shop.

Fig. N – The commonest type of longitudinal seam is the Pittsburgh lock. Originally formed in the brake or press brake, today roll forming machines are used to form the pocket in one piece and the flange in the other piece. After one piece is inserted in the pocket the "tail" is hammered over to close the lock.

Fig. O – The Acme lock originally called a "lock grooved seam" was popular because it provided snug nesting and a smooth exterior surface. Today this lock is used to join two flat sheet for increased width.

Fig. P – Standing seams or double standing seams are used mostly on the inside of ducts and for certain sizes of ducts where their use leads to economical sheet cutting.

Fig. Q – The "Button Punch Snap Lock" is a recent inovation. Originally the "continuous" snap lock was used on light gauge stove and furnace pipe to permit shipping nested. The pipe section was then "snapped" together.

The "button punch" spaces the "buttons" on approximately two inch centers along the flange to be inserted in the pocket. The continuous sharp fold on the pocket permits the buttoned flange to be "snapped" into the pocket. Detail 1.

The dimensions of the pocket and the flange are critical in high pressures. The pocket and the flange must be formed in a machine suited to the gauge of metal being formed. If this is not adhered to, the pocket will be "loose" and stiffness and air tightness will be lessened.

NOTE – SMACNA has conducted a lengthy testing program on high pressure duct construction. Attention was paid to the button punch snap lock. An official test report on button punch snap lock is included in this manual.

NOTE – Snap lock not recommended for aluminum.

DIVISION USAGE					
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APPROVALS

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Sect. Supv. _____

Div. _____

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Stearns-Roger INCORPORATED

ENGINEERING STANDARD

LONGITUDINAL SEAMS

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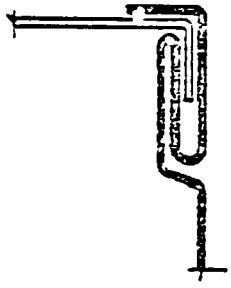


FIG. "N"

PITTSBURGH LOCK

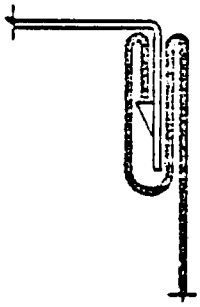


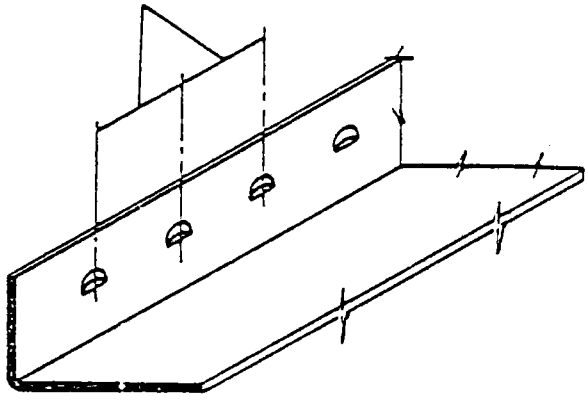
FIG. "Z"

BUTTON PUNCH SNAP LOCK

FIG. "O"

ACME LOCK-GROOVED SEAM

APPROXIMATELY 2" SPACING BETWEEN "BUTTONS"



DETAIL NO. 1

MALE PIECE-SNAP LOCK

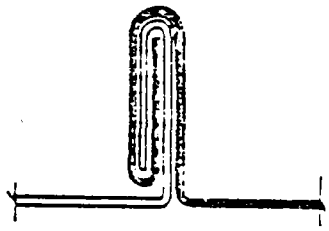


FIG. "T"

DOUBLE SEAM

DIVISION USAGE					
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ELBOWS

FIG. A – SMALL ELBOW CONSTRUCTION

All elbows are constructed with Pittsburgh Locks on all corners, with the lock placed on the sides and the top and bottom flanged to fit the lock. The gauge of metal and the end joints are the same as recommended in duct construction JC10.15.01.1.

FIG. B – STANDARD RADIUS ELBOW R=W

To eliminate air turbulance and unnecessary static pressure loss, the radius of the throat should be equal to the width of the elbow.

FIG. C – LARGE ELBOW CONSTRUCTION

Pittsburgh Locks used on all corners. The gauge of metal and end joints are as specified in duct construction Table I. When end joints other than the Standing Seam are used, angles as specified for duct size in JC10.15.01.1, are installed for reinforcing. When Standing Seam construction is used, the joints are spaced so that the Standing Seams will reinforce the sides. Standing Seams should be riveted.

FIG. D – SHORT RADIUS ELBOW – R LESS THAN W

When space will not allow the use of a standard radius elbow, a short radius elbow of construction shown is recommended.

A vane is placed in the elbow, spaced according to the formula on drawing. The vane spacing (S) and the length of vane section (L), are equal to 1/3 of the duct width. Vane is made of same gauge of metal as elbow and is riveted or spot welded securely to duct sides to prevent vibration. Ends should be hemmed for stiffening.

DIVISION USAGE					
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ELBOWS

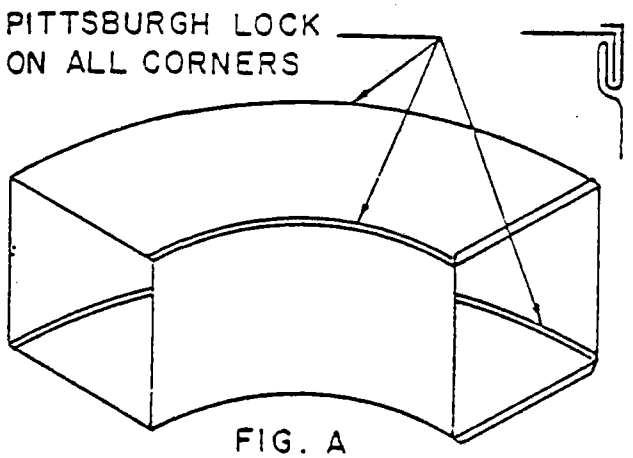

FIG. A

SMALL ELBOW CONSTRUCTION
SEE DUCT CONSTRUCTION
DETAILS FOR CONNECTIONS

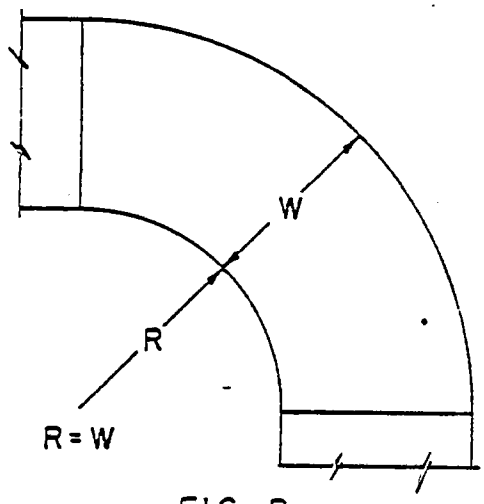

FIG. B

STANDARD RADIUS ELBOW

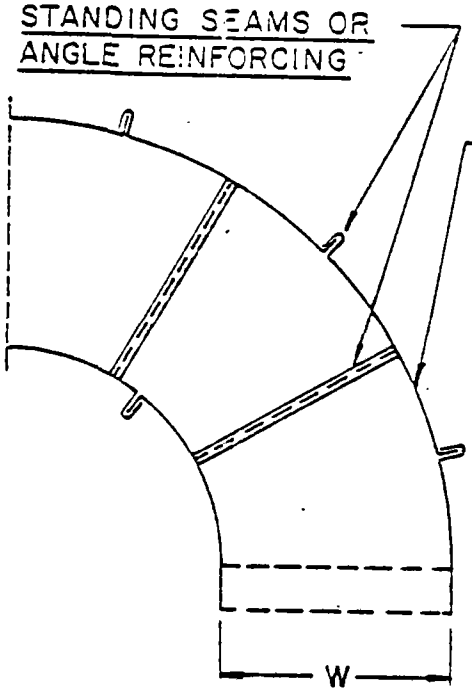

FIG. C

LARGE ELBOW CONSTRUCTION
REQUIRING MULTIPLE SHEETS

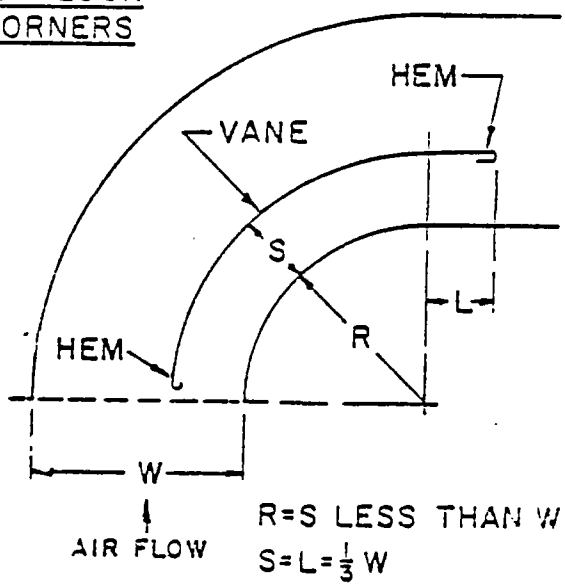

FIG. D

SHORT RADIUS ELBOW

DIVISION USAGE					
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VANED ELBOWS

FIG. A – INDICATES THE POSITION AND SPACING OF SINGLE TYPE VANES IN A 90 DEGREE ELBOW.

The width of the vanes, parallel with the air flow, should be maintained as shown to insure an even air flow thru the turn without causing turbulence.

Detail 1 – Indicates the radius and width of each vane when spaced as shown in Fig. A.

Detail 2 – Indicates a section of the runner that holds the vanes in place. The runner is riveted, spot welded or metal screwed to the duct sides.

The runners (Details 2 and 5) are available from several manufacturers or may be made by the contractor.

FIG. B – INDICATES THE POSITION AND SPACING OF DOUBLE VANES IN A 90 DEGREE ELBOW VANES, SIZES UP TO 36 in. IN WIDTH.

In ducts of greater dimension two vanes of equal length should be installed. Intermediate runner should be securely fastened together (rivet, etc.) to assure rigidity.

The width of the vanes, parallel with the air flow, should be maintained.

Detail 3 – Indicates the radius and width of both pieces of a small double vane and method of assembly of individual vane.

ALTERNATE METHOD OF CONSTRUCTION

FIG. C – INDICATES THE POSITION AND SPACING OF DOUBLE VANES IN A 90 DEGREE ELBOW.

The width of the vanes should be maintained as before mentioned.

Detail 4 – Indicates the radius and width of both pieces of a large double vane and method of assembly.

Detail 5 – Indicates the shape and size of the runner that holds the large vanes in place. The runner is riveted, spot welded or metal screwed to the duct sides.

All vanes and runners are made of the same gauges of metal as are used for ducts and elbows.

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VANED ELBOW DETAILS

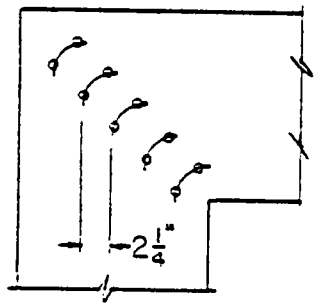
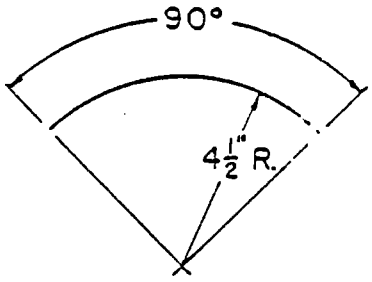
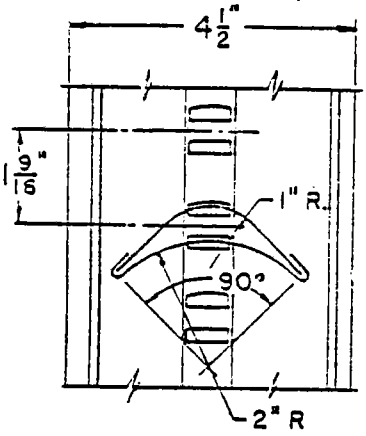


FIG. A
SINGLE VANE ELBOW



DETAIL 1
SINGLE VANE



DETAIL 2
RUNNER

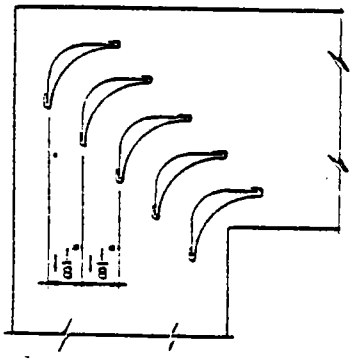
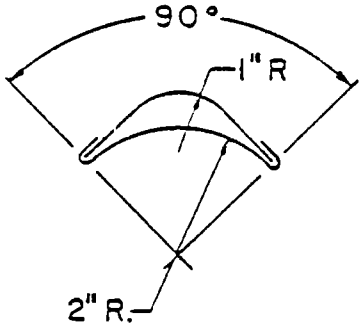
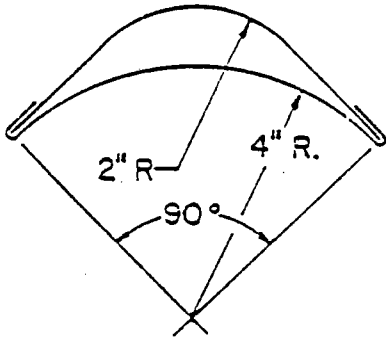


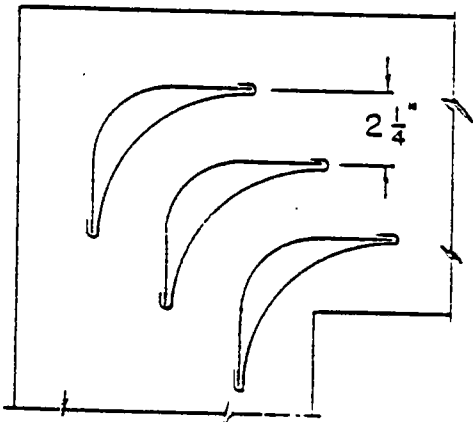
FIG. B
SMALL DOUBLE VANE
SQUARE ELBOW



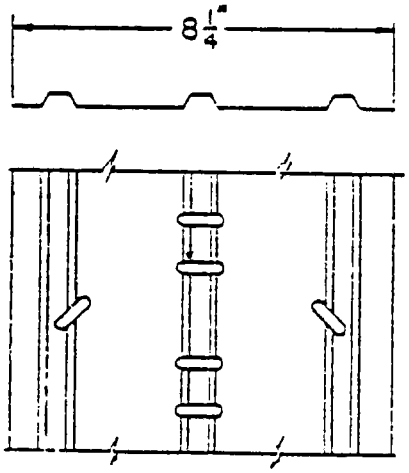
DETAIL 3
SMALL DOUBLE VANE



ALTERNATE DETAIL 4
LARGE DOUBLE VANE



ALTERNATE FIG. C
LARGE DOUBLE VANE
SQUARE ELBOW



ALTERNATE DETAIL 5
LARGE DOUBLE VANE RUNNER

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TAPERS AND OFFSETS

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FIG. A – Indicates construction of an equal Taper with end joints on the top and bottom. This is one of the methods recommended in Table 1. The end joints on the sides should be in accordance with JC10.15.01.1. Pocket Locks (K) are used on all sides.

The longitudinal joints of Tapers are made with Pittsburgh Locks (N) or button punch snap locks (Z) on all corners.

Metal gauge and reinforcing to be as shown in JC10.15.01.1.

FIG. B – When a Taper is used in a "diverging" air flow and the duct size increased, the sides are to be pitched to a maximum of 20 degrees to prevent turbulence or an additional increase of static pressure.

FIG. C – When a Taper is used in a "contracting" air flow and the duct size is decreasing, the sides should be pitched to a maximum of 30 degrees to prevent turbulence or an additional increase of static pressure.

FIG. D – Indicates an Offset to avoid an obstruction where space limitation will not allow a full radius turn. Square elbows with turning vanes as described on JC10.15.05 should be installed to eliminate turbulence and to keep the static pressure increase as low as possible.

FIG. E – Indicates an Offset to change direction of the duct either horizontally or vertically. The minimum radius of the Offset turn is to be equal to the duct width as shown.

DIVISION USAGE					
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TAPERS - OFFSETS

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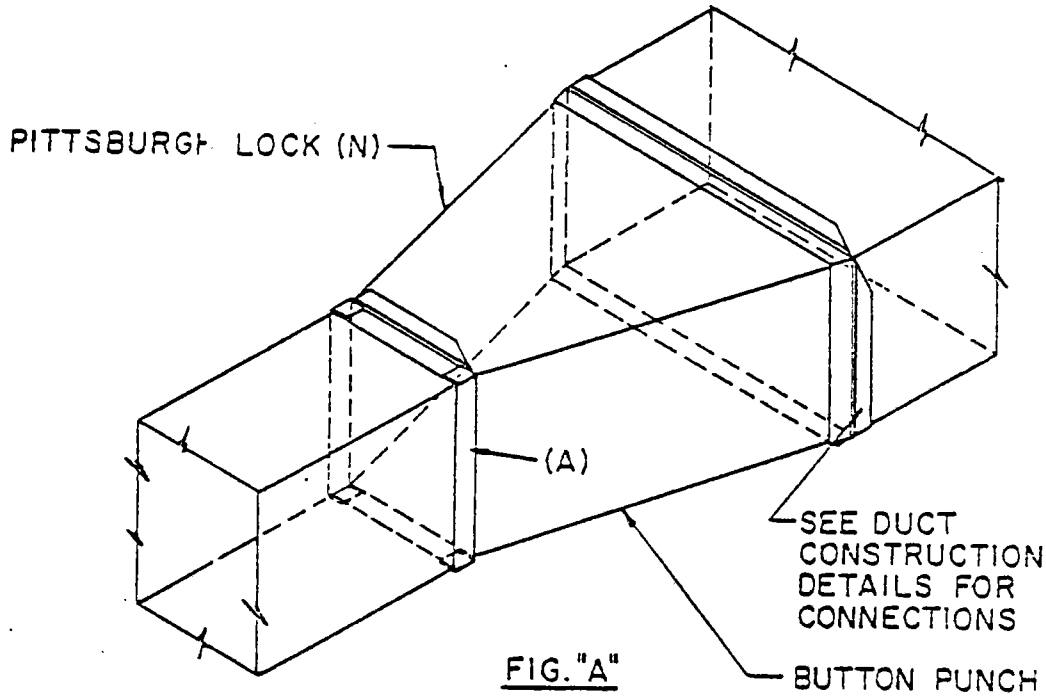

FIG. "A"
TAPER

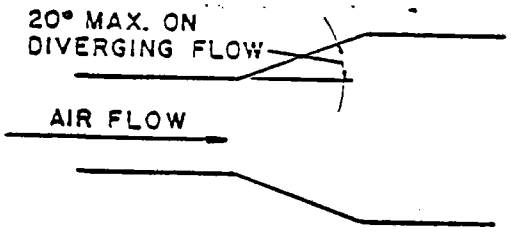

FIG. "B"

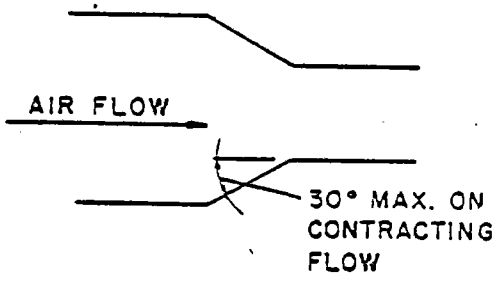

FIG. "C"

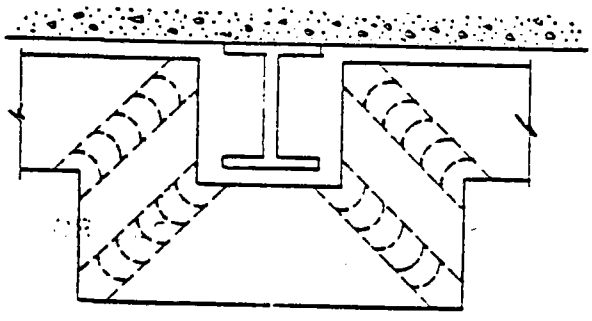

FIG. "D"

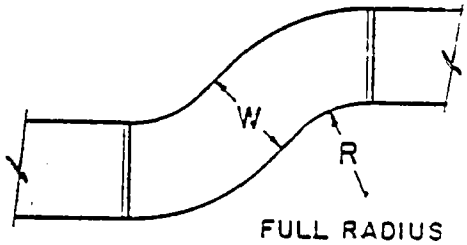

FIG. "E"

DIVISION USAGE					
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REGISTER & GRILLE CONNECTIONS

ISSUED 9/16/74

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FIG. A – Shows a grille installed in the side of a duct. A short tee is clinch locked into the duct with the end flanged to receive the grille.

An "air extractor" is shown, by which even distribution of air over the grille area is achieved.

FIG. B – Shows a register installed with the Tee extended for installation of a multiple blade type of volume damper for air adjustment. The air extractor may be in a fixed position to supply even distribution of air over grille area.

Note: The method of fastening the grille to the terminous of the duct shall be in accordance with the manufacturers recommendations.

NOTE – Same detail applies to ceiling diffusers.

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REGISTER & GRILLE CONNECTIONS

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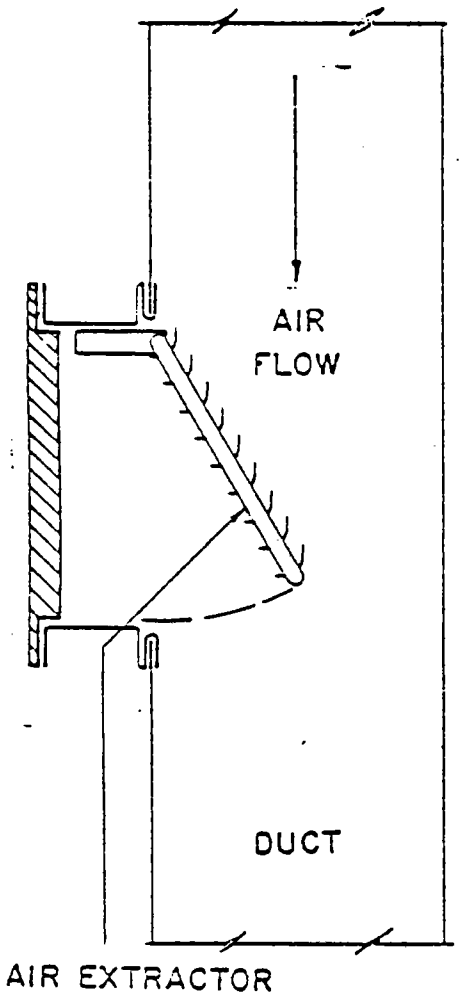

FIG. A

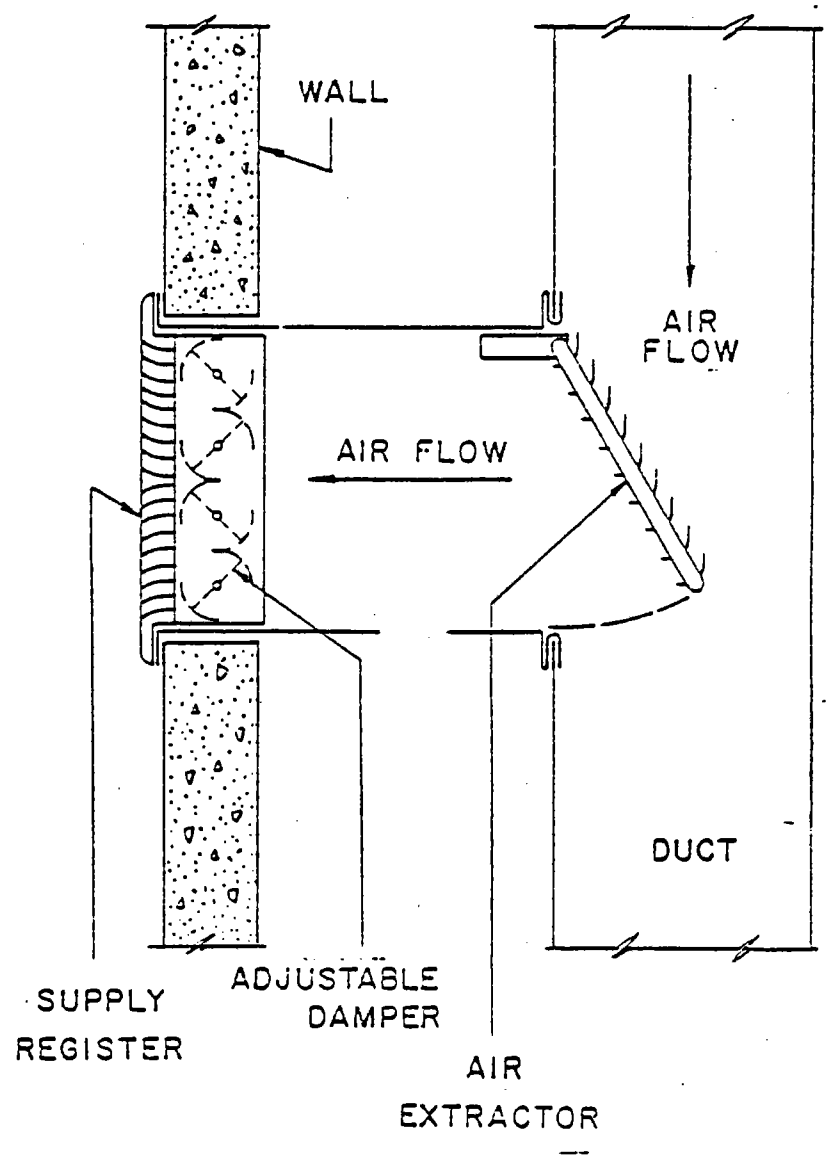

FIG. B

NOTE:
REGISTER CONTAINS VOLUME CONTROL AT GRILLE. GRILLE HAS NO VOLUME CONTROL.

DIVISION USAGE					
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Multiple Fan Unit Discharge Connections

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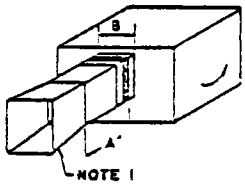

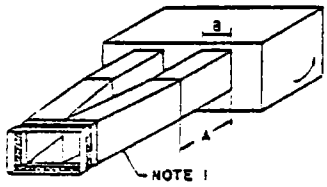

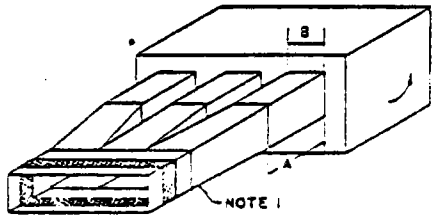

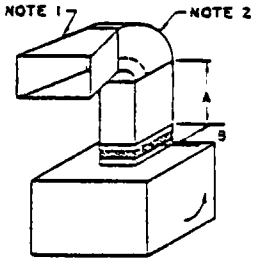

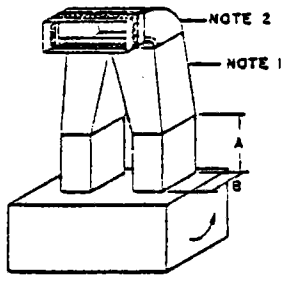

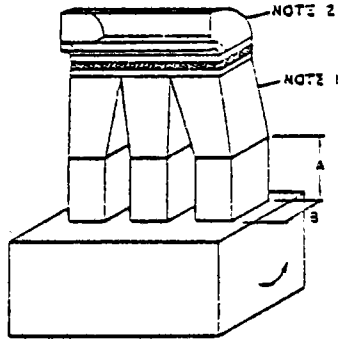

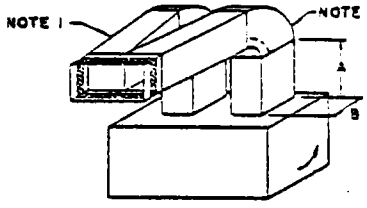

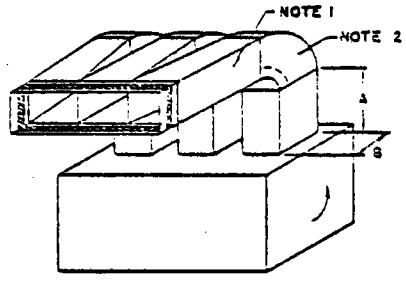

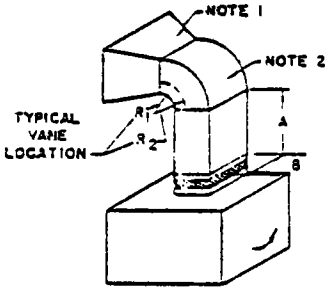

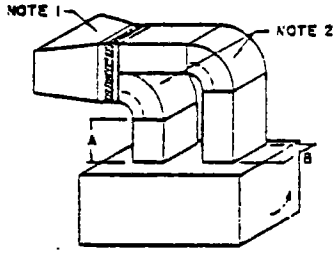

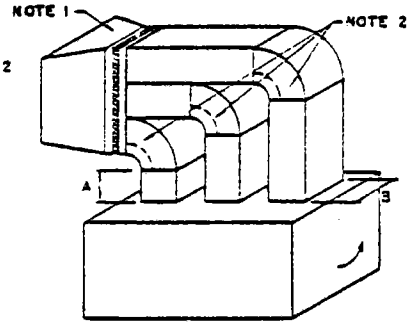

$R_1 = 6°$; R_2 DETERMINED FROM CHART 6, VANE SPACING

A = $1\frac{1}{2}$ B TO $2\frac{1}{2}$ B

B = LONGEST DIMENSION OF OUTLET OPENING

NOTES:

1. Transformations to supply duct have maximum slope of 1" in 7".
2. Square elbows with double thickness vanes may be substituted.
3. Do not install ducts so that the air flow is counter to fan rotation. If necessary, turn fan section.
4. Transformations and units shall be adequately supported so no weight is on the flexible fan connection.

DIVISION USAGE					
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FLEXIBLE DUCT CONNECTIONS

Flexible connections should be installed between a fan unit and metal ducts or casings to prevent transfer of fan or motor vibration.

Flexible materials must be in folds (not drawn tight).

If canvas is used, it should not be painted.

The following is quoted from Standard No. 90-A of the National Fire Protection Association.

Par. 113 (b) Vibration connectors in duct systems, other than as covered by paragraph 113 (c), shall be made of woven asbestos or approved flame proofed fabric or shall consist of sleeve joints with packing of rope asbestos or other approved non-combustible material.

Vibration connectors of fabric shall not exceed 10 inches in length.

FIG. A – An elevation of a fan unit showing a flexible connection at fan discharge, also collar and flexible connection to fan inlet. To avoid turbulance and air pulsation the width of the duct leading to the fan inlet should be equal or wider than the fan wheel diameter.

FIG. B – A side view of fan showing the position and rotation of the fan in relation to the duct elbow above. The rise of duct should be equal to or greater than the fan wheel diameter.

Detail 1 – Flexible material installed between sections of round duct using draw bands for fastening same to duct. The same detail applies at fan intake collar.

Detail 2 – Indicates method of clamping the draw band on round ducts, drawing band tight with bolt.

Detail 3 – A flexible connector on a rectangular duct, indicating method of locking the fabric to the metal duct.

Note: Flexible connections with metal collars are available from several manufacturers.

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FLEXIBLE DUCT CONNECTIONS

W = FAN WHEEL DIA. MIN.

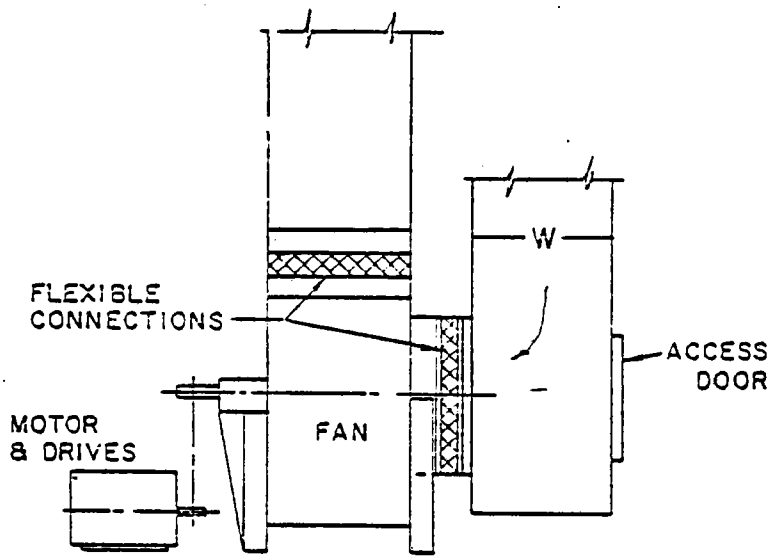


FIG. A

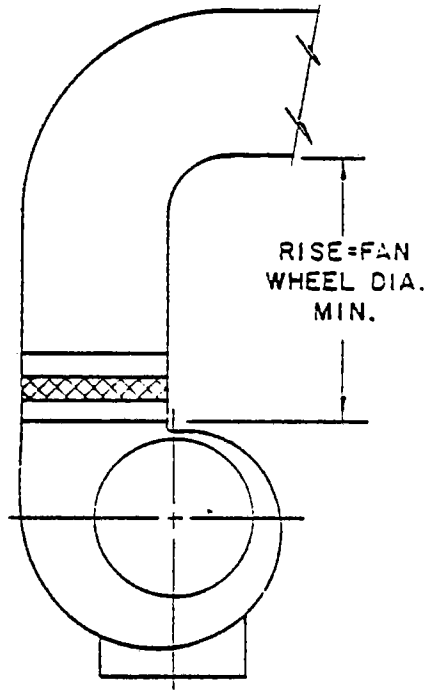
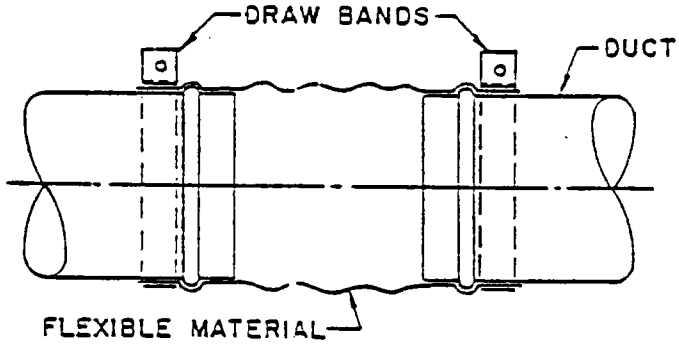


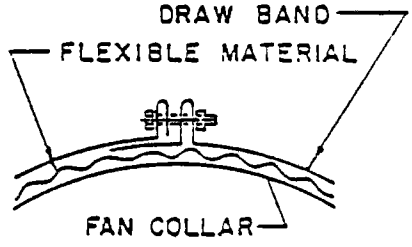
FIG. B

RECOMMENDED FAN CONNECTIONS



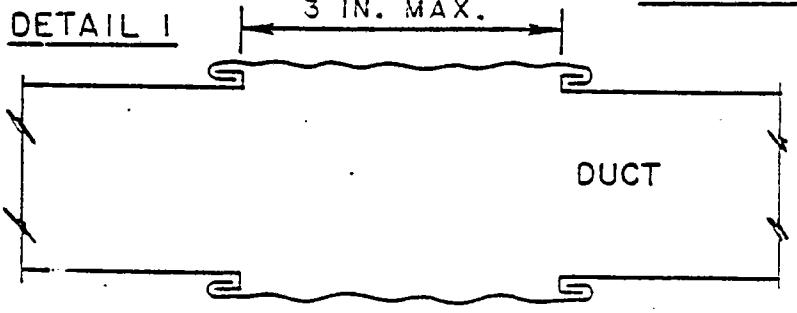
ROUND DUCT

DETAIL 1



DRAW BAND DETAIL

DETAIL 2



DETAIL 3

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X			X	X

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ACCESS DOORS IN DUCTS

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FIG. A – On hinged or unhinged doors, too small to walk through, sash locks, operable from outside only, are permissable. Construction of door and frame as shown.

FIG. B – Detail of an insulated door showing how the gasket seal is locked into the door construction. Frame is made with hinges and fasteners as shown in Figure A.

FIG. C – Elevation of reach-thru door with hinges and sash locks. Door constructed as in Fig. A.

FIG. D – Elevation of small door without hinges, showing latch locations.

Fig. E – Shows a sliding type door with the track riveted or spot welded to duct side. Section A-A shows how the track is offset to receive the door.

Fig. F – Shows a sliding type door with standing edge type track. Section B-B shows track tee locked to duct with door sliding in standing edge.

Fig. G – In this access door the frame is clinch locked or tee locked to the duct side with the outer edge flanged inward to receive the door. The pan type door is fastened to the flange with bolts and wing nuts, metal screws, or sash locks. If bolts are used, the bolt should be welded to the flange. A gasket is used to make the door air tight.

Fig. H – This type of door may be insulated or uninsulated. The frame is clinch locked to the duct side with the outer edge flanged outward, hemmed back for reinforcing and wide enough to receive the the hinges and latches. The hinges and sash locks are installed with spacers on the duct side, bolted or riveted to duct and door. The door is formed and locked together as shown with the outer flange lapped over the frame flange. The gasket is applied to either frame or door with adhesive. Sash locks are used to tighten the door on the gasket. When required, insulation is installed in the door. When insulation is installed on the outside of the duct, the flange depth should be equal to the thickness of the insulation.

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X			X	X

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ACCESS DOORS IN DUCTS

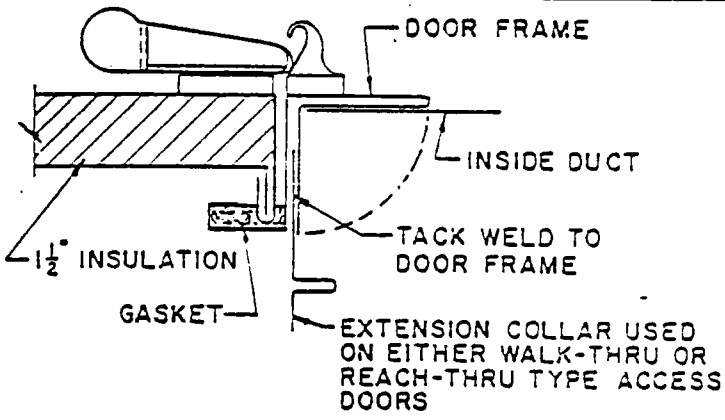


FIG. A

SASH LOCK FOR REACH-THRU DOOR

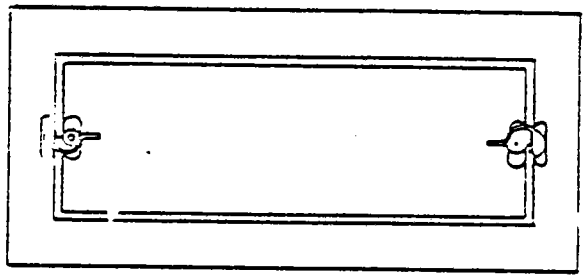


FIG. D

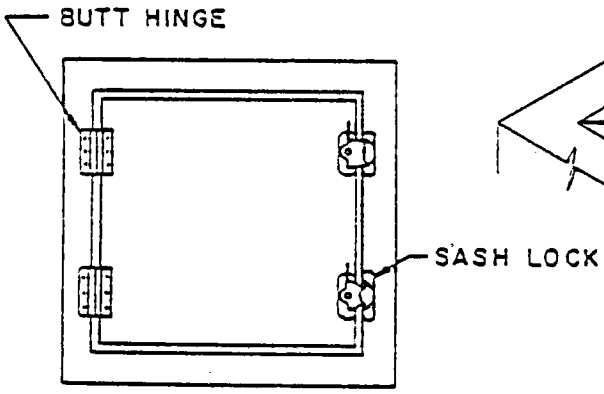


FIG. C

STANDARD REACH-THRU DOOR

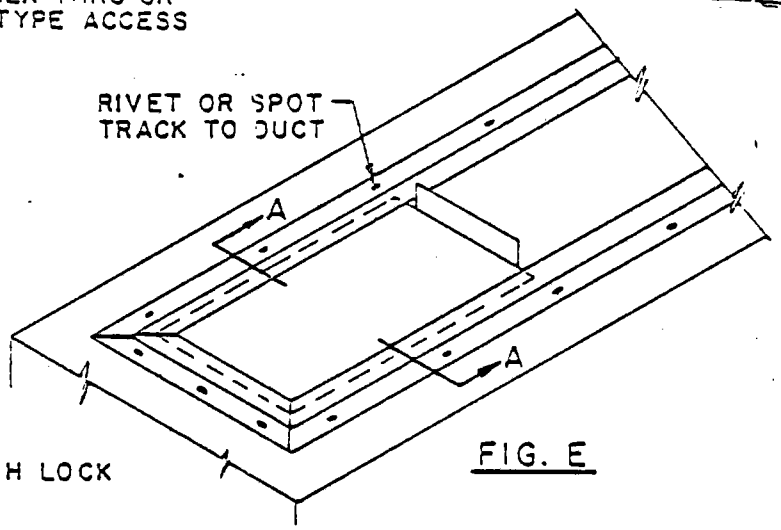
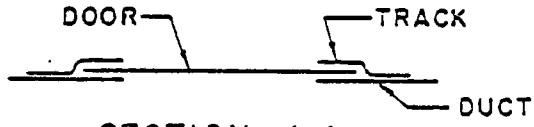
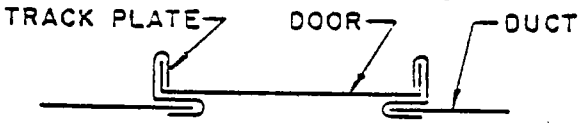


FIG. E



SECTION A-A



SECTION B-B

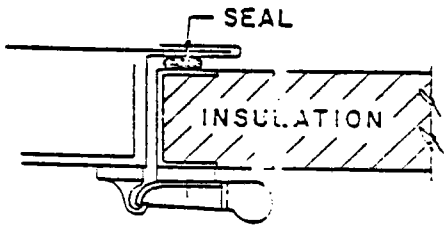


FIG. B

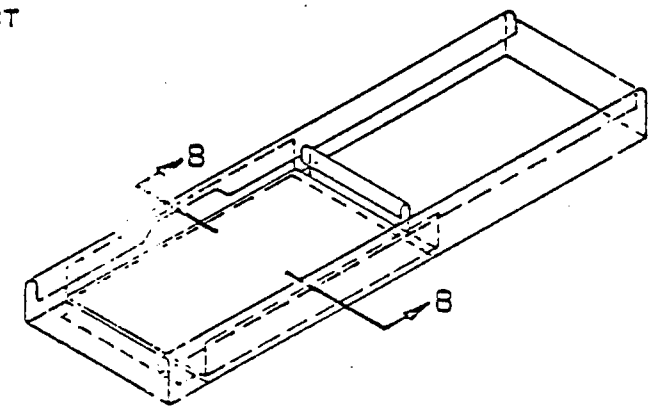


FIG. F

SLIDING DOORS

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X			X	X

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ACCESS DOORS IN DUCTS

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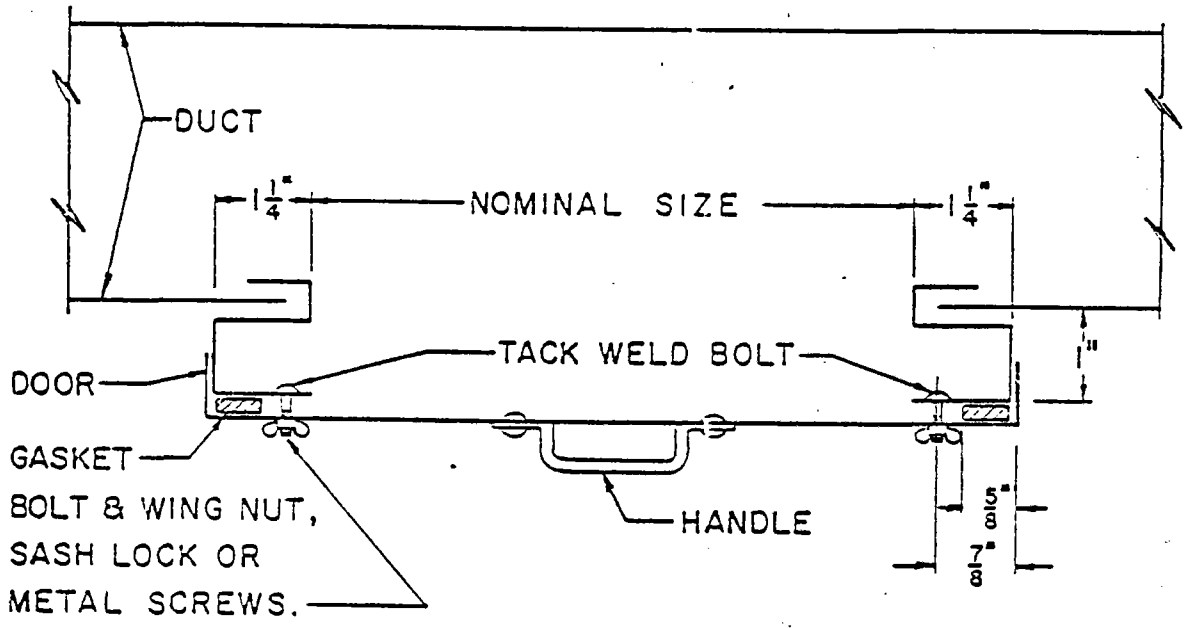

FIG. G

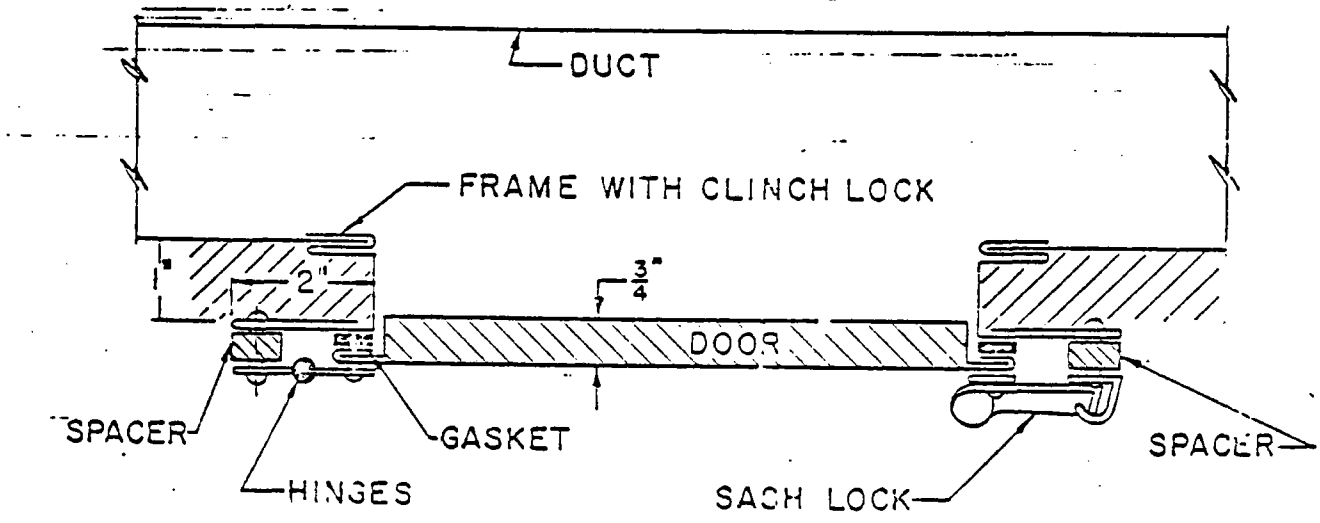

FIG. H

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X			X	X

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HANGERS FOR DUCTS

STRAP HANGERS

The strap hanger is metal screwed to the duct sides. The size of strap and spacing will vary with the duct size. (See Table below.)

The strap hanger is fastened to the supporting member by clamps, anchor bolts, metal screws, bolted or nailed.

Note: If other material in addition to the duct work is to be supported, increase the recommended hanger sizes to support the additional weight.

The strap hanger is then metal attached, to the duct as illustrated on Page 4

TRAPEZE HANGERS

Trapeze type hangers are recommended for the larger ducts. The supporting shelf, or trapeze, may be attached to the supporting rods, straps, or angles by welding, bolting or push nuts as illustrated on page 4

RECOMMENDED HANGER SIZES FOR RECTANGULAR DUCT

Longest Dimension of Duct	Round Hangers	Strap Hangers	Trapeze Shelf Angles	Maximum Spacing
Up Thru 18"	8 Ga. Wire	1" x 16 Ga.	1" x 1" x 1/8"	10' 0"
19" Thru 30"	8 Ga. Wire	1" x 16 Ga.	1" x 1" x 1/8"	10' 0"
31" Thru 42"	1/4" Rod	1" x 16 Ga.	1½" x 1½" x 1/8"	10' 0"
43" Thru 60"	3/8" Rod	1" x 16 Ga.	1½" x 1½" x 1/8"	10'
61" Thru 84"	3/8" Rod	1½" x 16 Ga.	2" x 2" x 1/8"	8'
85" Thru 96"	3/8" Rod	1½" x 16 Ga.	2" x 2" x 3/16"	8'
Over 97"	3/8" Rod		2" x 2" x 1/4"	8'

RECOMMENDED HANGER SIZES FOR ROUND DUCT

Duct Diameter	Round Hangers	Strap Hangers	Maximum Spacing	Number of Hangers
Up Thru 18"	8 Ga. Wire	1" x 16 Ga.	10' 0"	1
19" Thru 36"		1" x 12 Ga.	10' 0"	1
37" Thru 50"		2" x 16 Ga.	10' 0"	1
51" Thru 84"		2" x 16 Ga.	10" 0"	

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X			X	X

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HANGERS FOR DUCTS

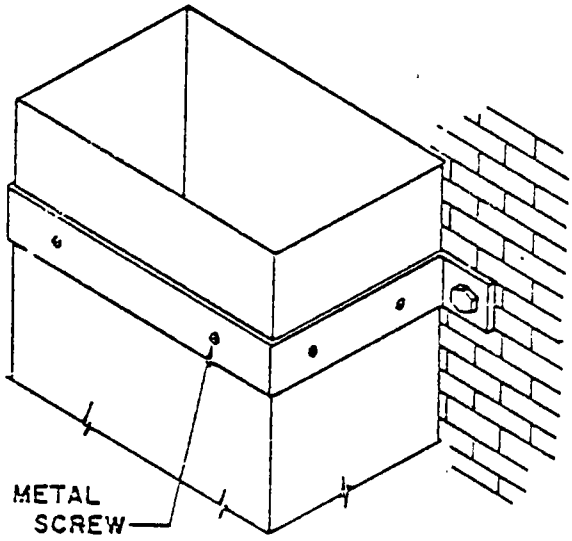

FIG. A

FIG. A-SUGGESTED SIZING

DUCT SIZE	BAND	SPACING
18" x 12"	1½" x 16 Ga.	12'-0" O.C.
24" x 15"	1½" x 16 Ga.	12'-0" O.C.
24" x 20"	1½" x 16 Ga.	12'-0" O.C.

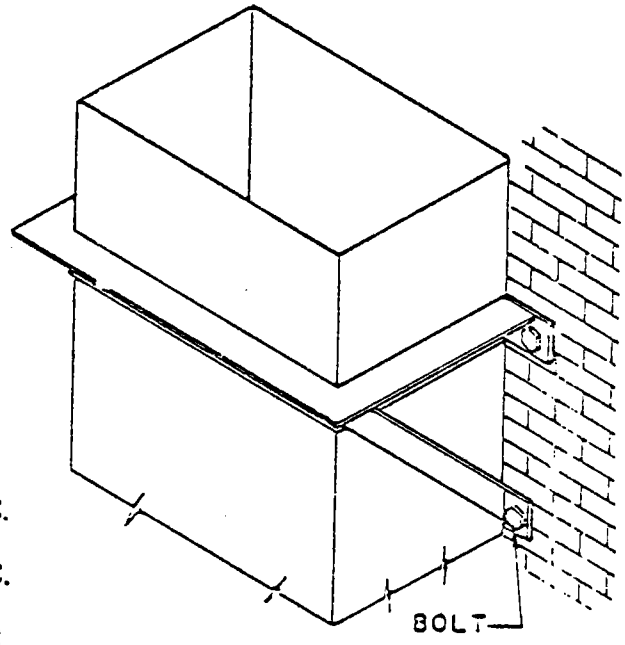

FIG. B

FIG. B-SUGGESTED SIZING

DUCT SIZE	ANGLE	SPACING
30" x 12"	1" x 1" x ⅛"	12'-0" O.C.
36" x 18"	1" x 1" x ⅛"	12'-0" O.C.
42" x 24"	1¼" x 1¼" x ⅛"	12'-0" O.C.
48" x 30"	1¼" x 1¼" x ⅛"	12'-0" O.C.

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X			X	X

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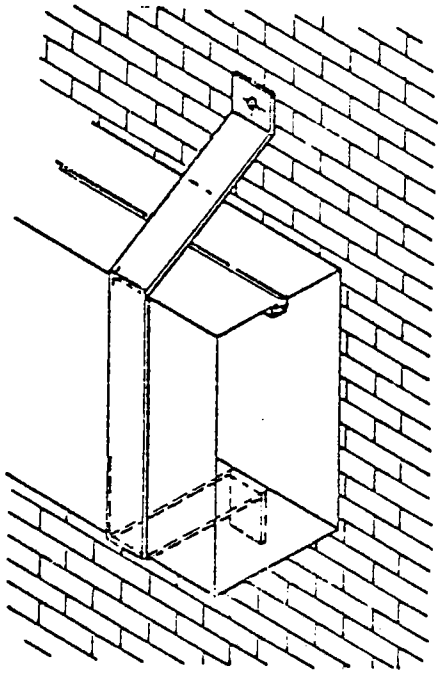

FIG. A

FIG. A - SUGGESTED SIZING

DUCT SIZE	BAND	SPACING
12" x 18"	1½" x 16 Ga.	8'-0" O.C.
15" x 24"	1½" x 16 Ga.	8'-0" O.C.
18" x 35"	1½" x 16 Ga.	8'-0" O.C.

FIG. B - SUGGESTED SIZING

DUCT WIDTH	ANGLE	SPACING
UP TO 18"	1" x 1" x ⅛"	8'-0" O.C.
19" THRU 30"	1½" x 1½" x ⅛"	8'-0" O.C.
31" THRU 40"	1½" x 1½" x ⅛"	8'-0" O.C.
41" & OVER	1½" x 1½" x ⅛"	4'-0" O.C.

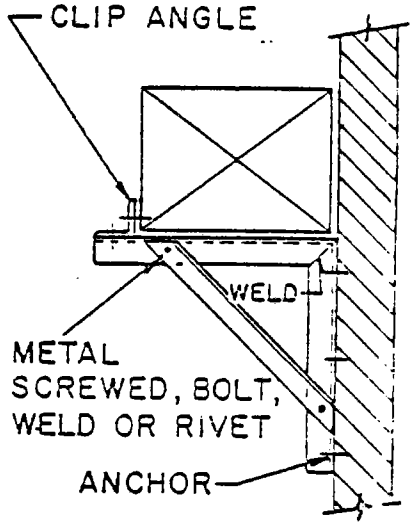

FIG. B

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X			X	X

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HANGERS FOR DUCTS

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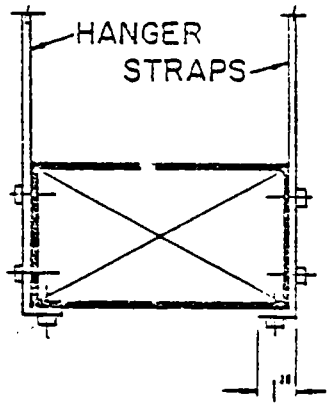
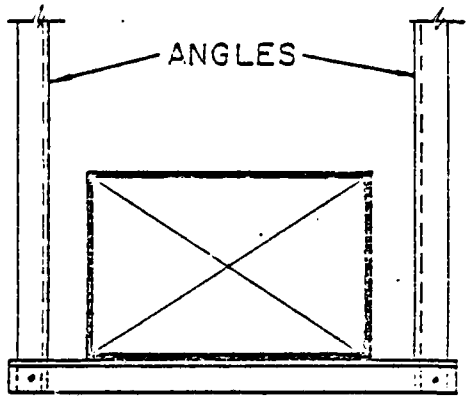
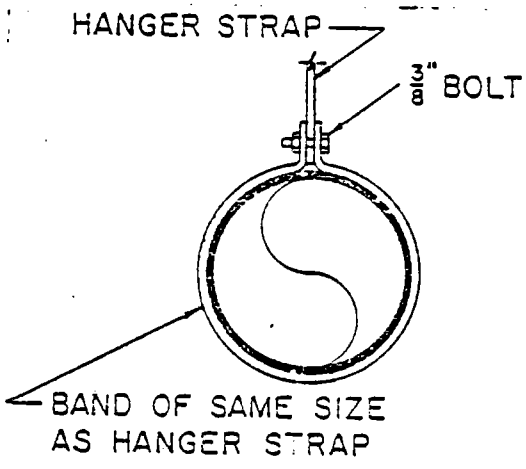
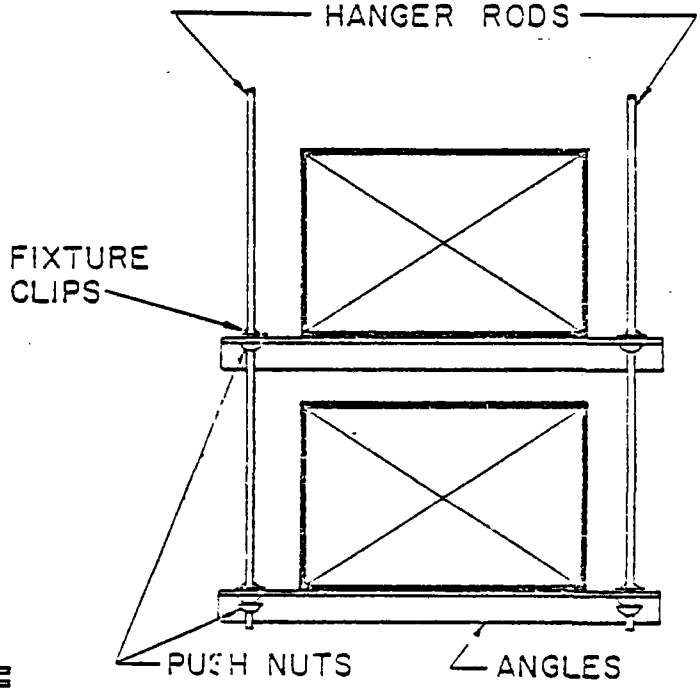
STRAP HANGERS

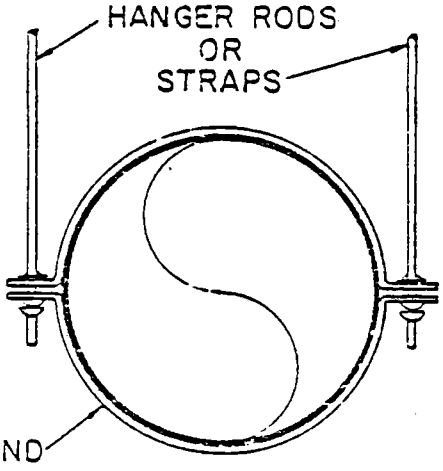


TRAPEZE HANGERS









HANGERS FOR HOT & COLD DUCTS

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X			X	X

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HANGERS FOR DUCTS
FLOOR PENETRATIONS

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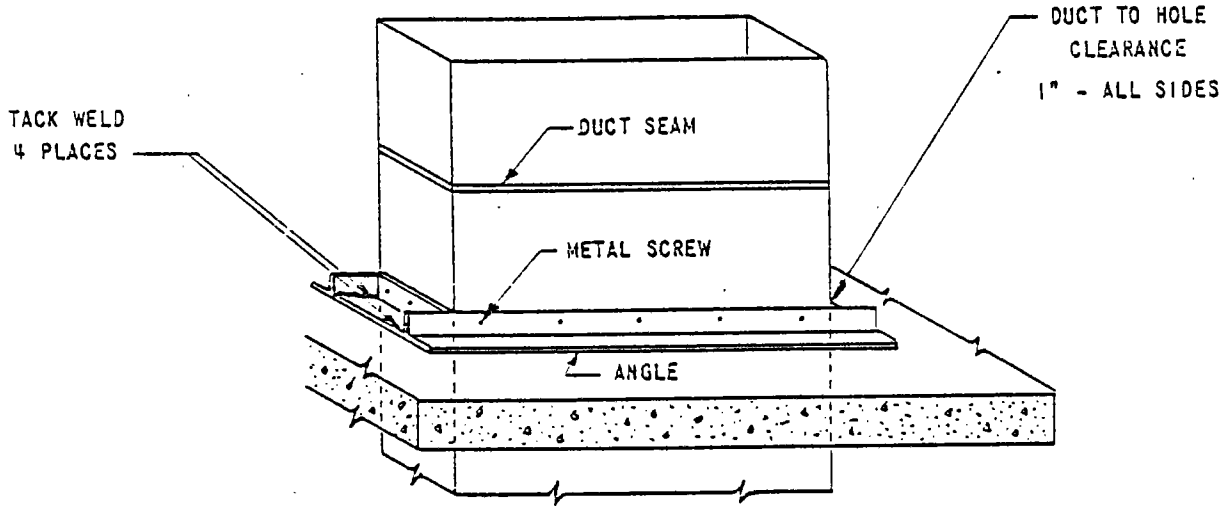
REVISED 3/31/77



SUGGESTED SIZING

DUCT SIZE	ANGLE
36" x 18"	2" x 2" x ¼"
48" x 24"	3" x 3" x ¼"
60" x 30"	3" x 3" x ¼"
OVER 60"	3" x 3" x ¼"

NOTE:

SEE STD. JC10.15.25 FOR PROPER METHODS OF SEALING AND FIRE STOPPING FLOOR AND WALL PENETRATIONS ON DUCT INSTALLATIONS.

Many parts of a building, such as heating, plumbing and sprinkler pipe, electrical conduits and fixtures, and ceilings, require hanging. Consequently, there is a continuing effort to improve hanging systems.

The duct hanging system is composed of three elements -- the upper attachment to the building; the hanger itself; and the lower attachment to the duct.

Upper Attachments

Concrete Inserts (page 7)

The concrete inserts illustrated must be installed prior to placing the concrete. They are used primarily where the duct layout is simple and there is enough lead time to determine accurate placement. Fig. 1 and 2 show manufactured inserts available individually or in long lengths; the latter are generally used where many hangers will be installed in a small area, or where individual inserts cannot be precisely spotted at the time of placing concrete.

Concrete Fasteners (page 7)

Concrete fasteners are installed after the placement of the concrete and the removal of the concrete forms. Their application allows greater flexibility than concrete inserts because their exact location can be determined after all interferences between various trades' work have been coordinated.

Expanding concrete anchors should be made of steel. Non-ferrous anchors tend to creep with vibration. Fig. 4 illustrates expanding fasteners, the holes for which are drilled either by a carbide bit or by teeth on the fastener itself. The expansion shield is "set" by driving it into the hole and expanding it with the conical plug.

In the case of all of the above fasteners, there are possibilities of interference with steel reinforcing in the concrete. The installer must exercise good judgment and have some knowledge of typical reinforcing patterns.

Structural Steel Fasteners (page 7)

Fig. 3' illustrates the use of a C-clamp which should be used with a retaining clip. Fig. 5 0 shows a welded stud placed by special welding equipment.

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X			X	X

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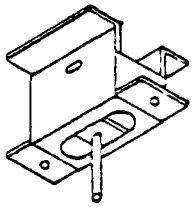
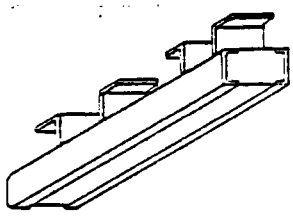
HANGERS FOR DUCTS UPPER ATTACHMENTS

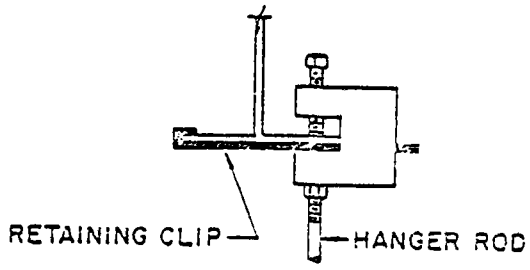




MANUFACTURED CONCRETE INSERTS

Fig. 1

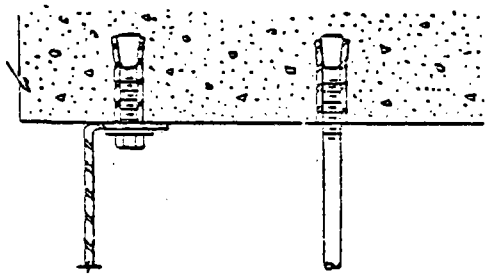
Fig. 2



FOR DUCTS UP TO 36" MAXIMUM DIMENSION

C-CLAMP W/RETAINING CLIP

Fig. 3



EXPANSION SHIELDS

CONCRETE ANCHORS

Fig. 4

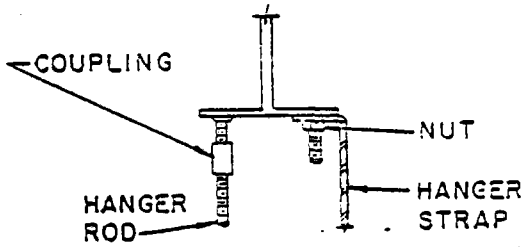


Fig. 5

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X			X	X

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ACOUSTICAL TREATMENT - DUCT LINING

ISSUED 9/16/74

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There are many materials available for the acoustical lining of ducts. The materials vary as to density thickness and coatings.

There are also numerous methods of attaching the liner to the duct - adhesive, pins, clips, staples.

Where adhesive is used the coverage should be 100 percent of the duct surface whether brushed or sprayed on. The adhesive should be a material approved by National Fire Protection Association.

Fasteners should be on 18-inch centers both ways of the surface and should be not more than 3 inches in from the ends of the liner.

Pins of all types should have washers. Washers should be placed on the air side of the acoustical material.

Ends of the acoustical liner should be treated with adhesive.

Ducts under 18 inches by 18 inches do not require pins but the liner on the top, inside surface of the duct is the critical surface and fasteners may be desirable.

Where the acoustical liner is "coated" the coated surface should be in the air stream.

FIG. A – Where ducts are to be lined the lining should be indicated by cross hatching and the cross hatching should appear for the entire length of the duct sections to be lined.

FIG. B – On rectangular ducts, pins and adhesive are recommended for large ducts and the spacing of the pins should be 18-inch centers with the first row of pins no more than 3 inches from the end of the liner.

DIVISION USAGE					
MMI	P	PP	SH	FI	SP
	X			X	X

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ACOUSTICAL TREATMENT DUCT LINING

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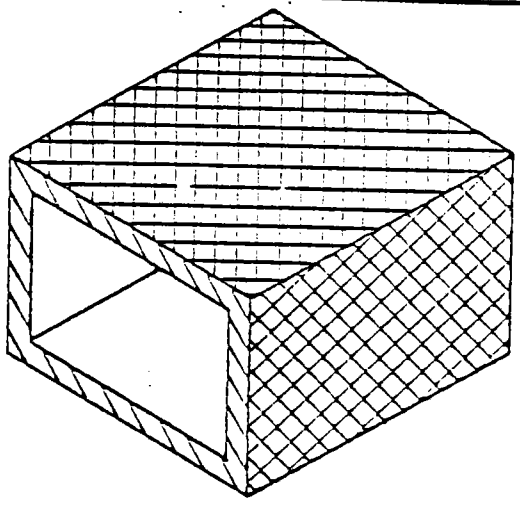


FIG. A

NOTES:

- DUCTS TO BE ACOUSTICALLY LINED SHALL BE DESIGNATED BY CROSS-HATCHING TO EXTENT OF LINING. THICKNESS SHALL BE AS SPECIFIED.
- DUCTS LINED WITH ACOUSTICAL MATERIAL SHOULD BE FASTENED WITH CLIP OR ADHESIVE OR PINS.

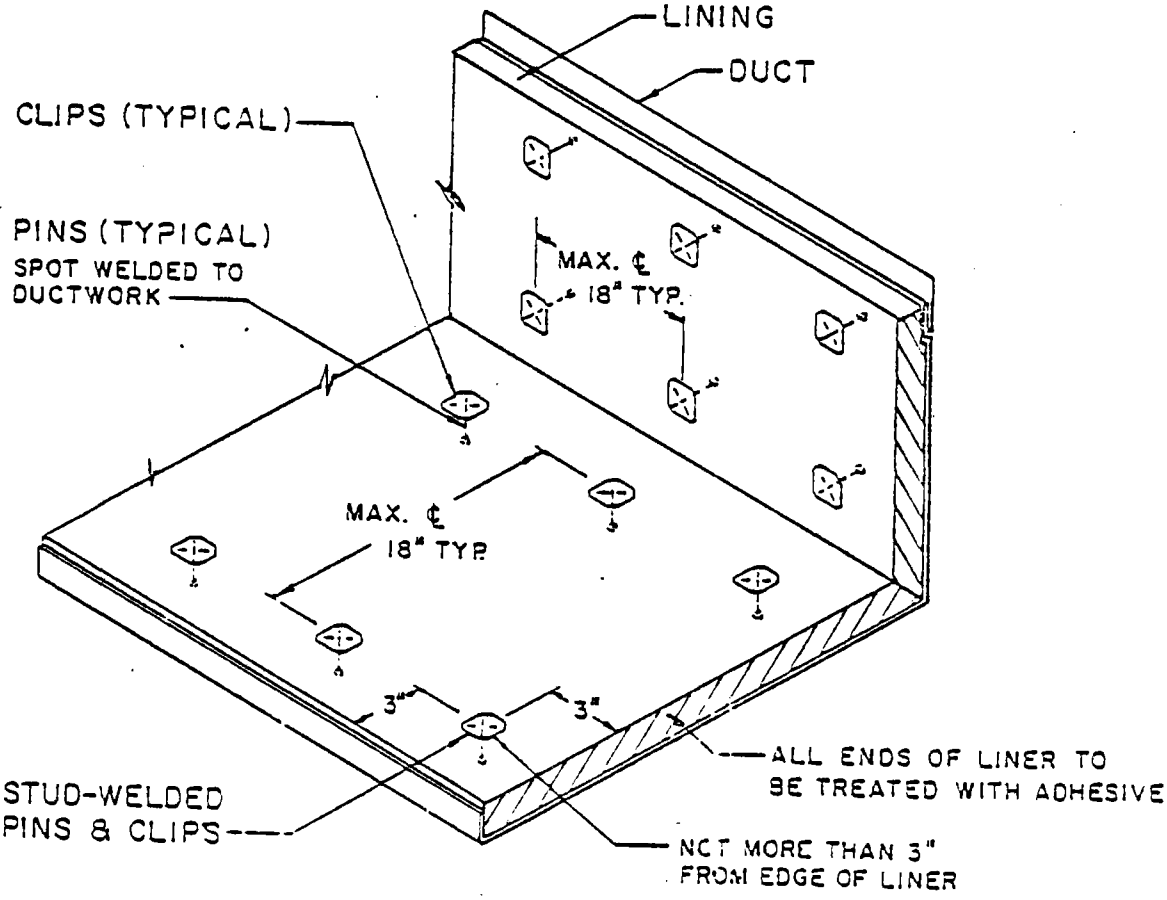
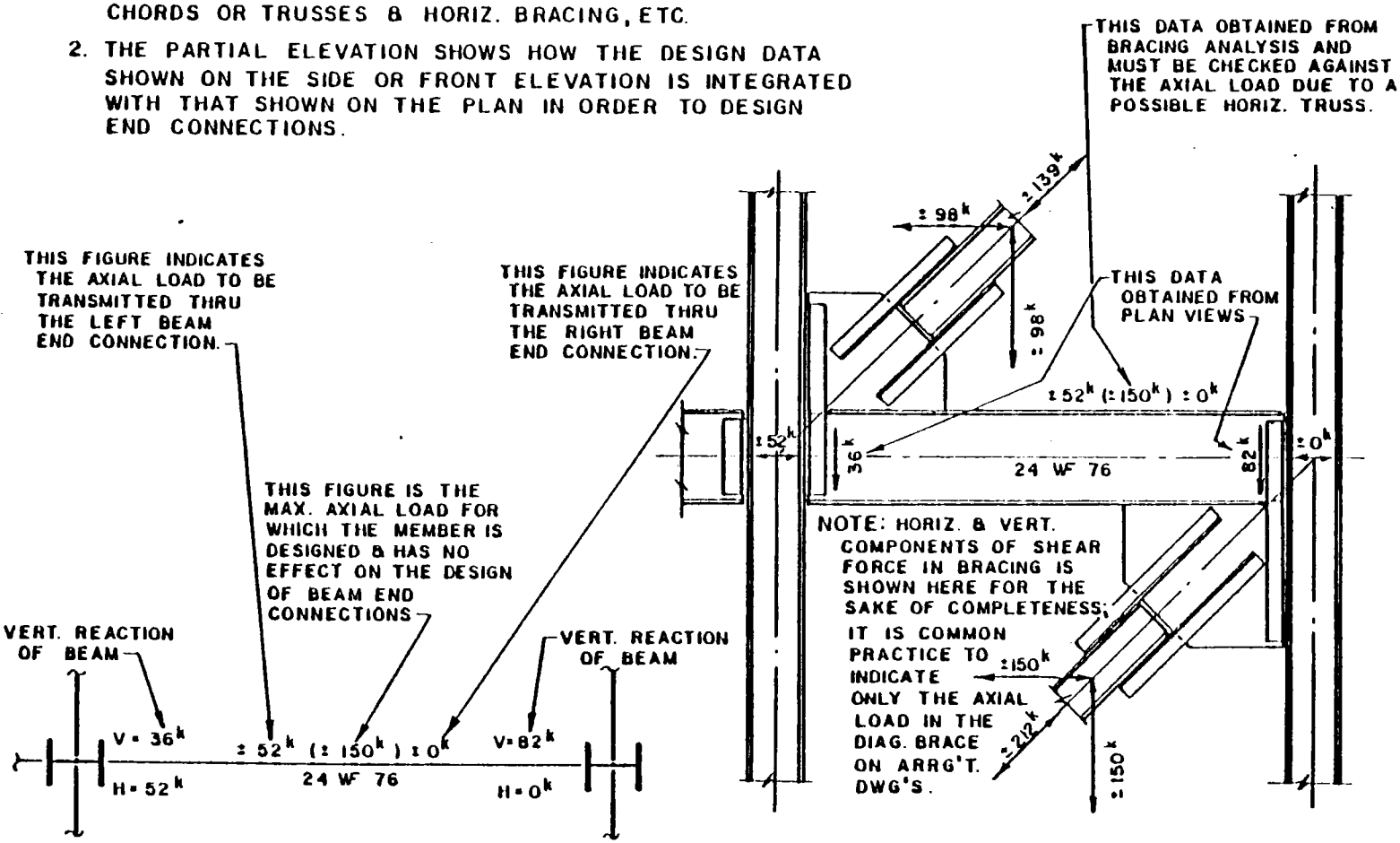


FIG. B

NOTES:

1. THE PARTIAL PLAN SHOWS METHOD OF INDICATING DESIGN DATA FOR AXIAL LOADS IN MEMBERS OTHER THAN COLUMNS & DIAGONAL BRACES. THIS INCLUDES SUCH MEMBERS AS CHORDS OR TRUSSES & HORIZ. BRACING, ETC.
2. THE PARTIAL ELEVATION SHOWS HOW THE DESIGN DATA SHOWN ON THE SIDE OR FRONT ELEVATION IS INTEGRATED WITH THAT SHOWN ON THE PLAN IN ORDER TO DESIGN END CONNECTIONS.



PARTIAL PLAN

PARTIAL ELEVATION

DIVISION USAGE

MM	P	PP	SH	FI	SP
X				X	

METHOD OF INDICATING DESIGN DATA ON STEEL ARRANGEMENT DRAWINGS

Stearns-Roger

Engineering Standard

ISSUED 3/6/70

REVISED

EP 14.32.1

DIVISION USAGE					
MH	P	PP	SH	FI	SP
	X				

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
FJ 60.60

APPROVALS
Des. Sec.
Sect. Supv.
Div.

DOCUMENTATION REQUIREMENTS
PROJECT: SOLAR ONE
CONTRACT/REQUISITION NUMBER: CONSTRUCTION PKG. #9
TITLE: PIPING AND MECHANICAL EQUIPMENT INSTALLATION

C-21700

ISSUED 7/16/79
REVISED

TYPE OF DOCUMENTATION	TYPE OF COPIES	FOR REVIEW NO. OF COPIES	FOR REVIEW WEEKS AFTER AWARD*	FINAL NO. OF COPIES	FINAL "X" IF REQ'D	REVIEW REQ'D BEFORE FAB.**	CERTF. FINAL ISSUE ***
1-ENGINEERING DRAWINGS	Reproducibles	4		4			
	Prints	8		8			
A-Outline, General Arrangement and Principal Dimensions			6-8		X	X	X
B-Cross Sections			6-8		X	X	X
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			6-8		X	X	X
External and Interconnecting					X	X	X
H-Standard Hardware Items			6-8		X	X	X
2-ERECTION OR INSTALLATION INFO.	Reproducibles	4		4			
	Prints	8		8			
A-Shop Fabrication Drawings					X	X	X
B-Erection or Installation Drawings			6-8		X	X	X
C-Erection or Install. Instructions	Copies	8	6-8	8	X	X	X
3-SPECIAL DOCUMENTATION							
A-Performance Data, including Curves	Copies			8	X		X
B-Design Calculations	Copies	2	6-8	2	X		X
C-Test Reports/Procedures	Copies	2	8	8	X		X
D-Code Papers and Certificates	Copies			2	X		X
E-Shop Fab. and/or Welding Proced.	Copies			8	X		X
F-Shop Fabrication Reports	Copies			8	X		X
G-Welder's Qualification Reports	Copies	2	4	8	X		X
H-Operating Certificates	Copies						
4-MISCELLANEOUS							
A-Operation and Maintenance Manuals	Manuals			8	X		
B-Recommended Spare Parts List for 2 Year's Operation, with Unit Prices	Copies			8	X		X
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.

This form supplements requirements, where specified, in Article 4.0 in the Specification..

6

PROJECT	Stearns-Roger ENGINEERING CORPORATION	PROJECT NO.
	CONSTRUCTION TEST CHECKLIST	SYSTEM NO.

													COMMENTS

CHECKLIST COMPLETED (DATE) _____ BY _____

RELEASED (DATE) _____ BY _____

APPENDIX 1

GOVERNMENT-FURNISHED EQUIPMENT

Area 200 (RS)

RECEIVER MODULE ERECTION & INSTALLATION PROCEDURE

The preheater and boiler modules will be delivered to the construction site on open flat-bed truck trailers. Utilizing the GFE horizontal lifting fixture (T-8200848-2) and overhead mobile crane or two fork-lift trucks, the modules shall be unloaded in an area assigned by the Construction Manager.

Bracing and Shoring

Throughout installation and erection, the Contractor shall provide and install all blocking, bracing, shoring, guying and miscellaneous support necessary to protect all equipment and construction from damage or displacement, and as required to ensure safety of personnel. Repair of any such damage or displacement shall be at the Contractor's expense.

Storage

The modules shall be stored and protected utilizing the shipping support cribbing to store the modules in a panel-up attitude (as shipped). The shipping cribbing shall remain attached to the module. The modules shall remain in the initial storage location until painting and insulation work is completed. 1

Erection Procedure

1. Remove heat shielding at the 17th level (EL-331'6") and install module guide rails as shown on drawings 40M2005131965 and 40M2005131966, listed in Appendix 2. 1

2. Attach upper lifting fixture, lower rotation/installation fixture and rotation support fixture as shown in drawings 40M2005131966 and 40M2005131967.

3. Load module on flat-bed truck trailer utilizing horizontal lifting spreader sling and overhead/mobile crane or two fork-lift trucks. The module shall be supported by the shipping cribbing* and rotation support fixture. 1
Secure module and rotation support fixture to trailer as required for moving to tower.

4. Transport module to rotation position at tower. Attach the receiver crane to the upper lifting fixture on module. Remove attachments securing module to trailer and shipping cribbing to module.

5. Lift with the receiver crane and rotate the module to the vertical position. Translation of the truck trailer may be required during the rotation operation.

* Modified by the Contractor as necessary after insulation. 1

6. Attach tag lines to the module and detach from the rotation support fixture.

7. Attach module installation guide to lower rotation/installation fixture as shown in Drawing 40M2005131967. 1

8. Shipping support struts installed in the module shall be removed in this vertical position. Piping interface struts shall not be removed.

9. Raise module to final elevation using tag lines to guide and steady module.

10. Switching tag lines from ground control to control at the module level using inching speed move module guide rail into rail guides at 17th level as shown in Drawing 40M2005131966. 1

11. Inch module into position and rest module on angle at 21st level as shown in drawing 40M2005131965.

12. With module still attached to crane and resting on top support angle, check alignment and clearances. Using shims as required to maintain alignment and clearance, bolt into final position.

13. Remove installation fixtures from the module and lower to ground. Remove guide rails from structure at the 17th level and either lower to ground or store at 17th level for reuse. Reinstall heat shield panels.

14. Weld piping interfaces and remove piping interface struts.

FLASH TANK INSTALLATION PROCEDURE

The flash tank may be placed horizontally at the interface level (El. 311'0") at the south side of the tower and moved into position under its final location (see drawings 40M2005131934 and 40M2005131940). Remove the two C6 x 8.2 channels on each side of the tank position on the 16th level shown in zone D-3 of drawing 40C2005131787. Install a hoisting beam between the floor beams on the 18th level (see drawing 40C2005131783). Erect and hoist the flash tank to its proper elevation and rotate to install. Reinstall the 6" channels that support grating only.

Area 200 (RS)

PREHEATER MODULE ASSY

TAG NOS. RP-201 THRU RP-203, RP-222 THRU RP-224

Drawing Nos.:	40M2005131658 and 40M2005131660	1
Function:	Heating water prior to entry into the boiler modules.	
Main Components:	Panel, structure, piping, drain valve instrumentation.	
Overall Dimen.:	4-1/2' long 3' wide 53' high	
Weight:	Dry: 7900 lb. Operating: 8200 lb.	
Interfaces:	Water, GN_2, Air and Electrical Inputs. Water, Instrumentation and Drain Outputs.	1
Placement Requirements:		
Lifting:	Fixtures (provided by Contractor) shown on drawings 40M2005131966 and 40M2005131967. Use portable cranes and GFE horizontal lifting fixture (drawing T-8200848-2) or two fork lift trucks for handling on ground. Use crane on top of receiver for installing.	1 1
Positioning:	Interference fit of light shields (drawing R0012841 - Panel Assembly) between adjacent modules.	
Anchoring:	Bolting details on drawing 40M2005131965.	1

Area 200 (RS)

BOILER MODULE ASSY

TAG NOS. RB-204 THRU RB-221

Drawing No.:	40M2005131659	
Function:	Conversion of liquid water to superheated steam.	
Main Components:	Panel, structure, piping, control and drain valves, moisture separator.	
Overall Dimen.:	4-1/2' long 3' wide 53'high	
Weight:	Dry: 8500 lb. Operating: 8800 lb.	
Interfaces:	Feedwater, Air and Electrical Inputs. Steam, Drain, Condensate (from moisture separator) and Instrumentation Outputs.	2
Placement Requirements:		
Lifting:	Fixtures (provided by Contractor) shown on drawings 40M2005131966 and 40M2005131967. Use portable cranes and GFE horizontal lifting fixture (drawing T-8200848-2) or two forklift trucks for handling on ground. Use crane on top of receiver for installing.	2 2
Positioning:	Interference fit of light shields (drawing R0012841 - Panel Assembly) between adjacent modules.	
Anchoring:	Bolting details on drawing 40M2005131965.	2

3

Area 200 (RS)

FLASH TANK

TAG NOS. V-201 (RF) 2

Drawing No.:	TBD	
Function:	Separation of water and steam effluent from boilers and regulation of back pressure during startup and cloud transients.	
Main Components:	Vessel, nozzles, attachment lugs.	
Overall Dimen.:	28" O.D. 116" length	
Weight:	Dry:	3100 lb.
	Operating:	5200 lb.
Interfaces:	Inputs:	Steam/water from boilers, water from bypass line, GN_2
	Outputs:	Steam and water

Placement Requirements:

Lifting: Slings under mounting ears and around top of tank.

Positioning: $\pm$ 1/4 inch and vertical within $\pm$ 2 degrees

Anchoring: Three 1 inch bolts as shown on drawing 40C2005131787. 2

Area 300 (TSS)

FLASH TANK - DESUPERHEATER

SKID ASSEMBLY

TAG NOS. SA-301

Drawing No.:	GA000-90907-M30
Function:	Desuperheating of steam from receiver and flashing of condensate from thermal storage oil heater
Main Components:	Steam Desuperheater DS-301 Flash Tank V-304
Overall Dimen.:	30' - 6" long 13' - 11" wide 13' - 2" high
Weight:	Dry: 50,000 lbs. Operating: 63,300 lbs.
Interfaces:	Steam, Water, Condensate, Power, Instrumentation and Control, Instrument Air, Drain
Placement Requirements:	
Foundation:	Level surface
Leveling:	+ 1/4" from horizontal at any corner of base frame.
Anchoring:	Size 1" dia. anchor bolts - see dwg. for arrangement.
Lifting:	With slings to be attached to lifting points of Lifting Frame (shown on dwg. GA000-90907-M75). Lifting Frame will be GFE.

Area 300 (TSS)

THERMAL STORAGE HEATER

SKID ASSEMBLY #1

TAG NO. SA 302

Drawing No.:	GA000-90907-M35 GA000-90907-M36
Function:	Heating of oil, Caloria, HT-43
Main Components:	Thermal Storage Condenser E-301 Thermal Storage Surge Tank V-309 Thermal Storage Subcooler E-311 Thermal Storage Steam Trap V-305
Overall Dimen.:	49' - 0" Long 13' - 0" Wide 14' - 0" High
Weight:	Dry: 113,000 lbs. Operating: 146,000 lbs.
Interfaces:	Steam, Condensate, Oil, Power, Instrumentation and Control, Instrument Air, Drain.
Placement Requirements	
Foundation:	Level surface
Leveling:	+ 1/4" from horizontal at any corner of base frame.
Anchoring:	Six 1" dia. anchor bolts - see dwg. for arrangement.
Lifting:	With slings to be attached to lifting points of Lifting Frame (shown on dwg. GA000-90907-M75). Lifting Frame will be GFE.

Area 300 (TSS)

THERMAL STORAGE HEATER

SKID ASSEMBLY #2

TAG NO. SA 303

Drawing No.:	GA000-90907-M35 GA000-90907-M36
Function:	Heating of oil, Caloria, HT-43
Main Components:	Thermal Storage Condenser E-302 Thermal Storage Surge Tank V-310 Thermal Storage Subcooler E-312 Thermal Storage Steam Trap V-306
Overal Dimen.:	49' - 0" Long 13' - 0" Wide 14' - 0" High
Weight:	Dry: 113,000 lbs. Operating: 146,000 lbs.
Interfaces:	Steam, Condensate, Oil, Power, Instrumentation and Control, Instrument Air, Drain.
Placement Requirements	
Foundation:	Level surface
Leveling:	± 1/4" from horizontal at any corner of base frame.
Anchoring:	Six 1" dia. anchor bolts - see dwg. for arrangement.
Lifting:	With slings to be attached to lifting points of Lifting Frame (shown on dwg. GA000-90907-M75). Lifting Frame will be GFE.

PRESSURE GAGE LIST

DATA SHEET _____
PAGE _____
G-R PROJECT _____
ACCOUNT _____
DATE _____
BY _____

CLIENT DEPT OF ENERGY
PROJECT 10 MW SOLAR THERMAL PLANT
LOCATION DAGGETT, CALIF.
REVISIONS 1 _____ BY _____ 2 _____ BY _____ 3 _____ BY _____ 4 _____ BY _____
MANUFACTURER _____ SOURCE: QUOTE OF _____

GENERAL

1 TYPE: [X] DIRECT RDG [ ] 3-15# RECEIVER [ ] OTHER _____
2 MTG: [X] SURFACE [ ] LOCAL [ ] FLUSH
3 DIAL: DIAMETER 4½" COLOR BLACK
4 CASE: [ ] CAST IRON [ ] ALUMINUM [X] PHENOL [ ] OTHER _____
5 RING: [X] SCREWED [ ] HINGED [ ] SLIP [ ] SNAP OTHER _____
6 BLOWOUT: [ ] NONE [ ] BACK [X] DISC [ ] OTHER _____
7 LIQ.FIL: [ ] GLYCERINE [ ] SILICONE OTHER NONE
8 WINDOW: [ ] GLASS [X] PLASTIC [ ] OTHER _____
9 MODEL NUMBER _____

ELEMENT

10 PRESS ELEMENT: [X] BOURDON [ ] BELLOWS [ ] OTHER _____
11 ELEM MTL: [X] BRONZE [ ] STEEL _____ SS [ ] OTHER
12 SOCK MTL: [X] BRASS [ ] STEEL _____ SS [ ] OTHER _____
13 CONN: NPT [ ] 1/4" [X] ½" OTHER _____ [ ] BOTTOM [ ] BACK
14 MOVEMENT: [ ] BRONZE [X] SS [ ] NYLON [ ] OTHER _____
15 ZERO ADJUSTMENT YES
16 ACCURACY: [ ] 1/4% [ ] 1/2% [ ] 1% [ ] 2% [X] 5%

REV	TAG NO	NO REQD	ACCT NO	RANGE PSIG	OP PRES PSIG	SERVICE	ROCKETDYNE DESIGNATION	NOTES
	PI-2011	1		0 TO 600	400	GN_2	RNPG-1	
	PI-2014	1		0 TO 60	10	GN_2	RNPG-2	
	PI-2020	1		0 TO 2000	1500	GN_2 AND WATER	RMSPG	
	PI-2017	1		0 TO 3000	2000	GN_2 AND WATER	RPSPG	

NOTES:

Area 300 (TSS)

CHARGING PUMP SKID ASSEMBLY

TAG NO. SA 304

Drawing No.:	GA000-90907-M40
Function:	Pumping of oil, Caloria HT-43 through the charging loop.
Main Components:	Charging Oil Pump P-301 Charging Oil Pump P-302 Charging Oil Filter PF-TO-3-301 Charging Oil Filter PF-TO-3-302
Overal Dimen.:	35' - 0" Long 13' - 0" Wide 12' - 0" High
Weight:	Dry: 50,000 lbs. Operating: 54,000 lbs.
Interfaces:	Oil, Water, Power, Instrumentation and Control, Instrument Air, Drain
Placement Requirements	Foundation: Level surface
	Leveling: ± 1/4" from horizontal at any corner of base frame.
	Anchoring: Six 1" dia. anchor bolts - see dwg. for arrangement.
	Lifting: With slings to be attached to lifting points of Lifting Frame (shown on dwg. GA000-90907-M75). Lifting Frame will be GFE.

Special Requirements:

After the skid assembly is placed in its permanent location, the pumps shall be aligned and lubricated. The procedure is given in Appendix 1 of this Specification.

TAG NO.	VALVE STD. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	CONTR. OR REQ. NO.	ROCKETDYNE DESIGNATION	REMARKS	REV. NO.
PCV-2009	SP42 -009	1"	PRESS REDUCE	900	NPT	WCB	FISHER	(1)	GFE	RNPR-1	SET @ 400 PSIG	
PCV-2013	SP42 -010	1"	PRESS REDUCE	300	NPT	WCB	FISHER	(1)	GFE	RNPR-2	SET @ 10 PSIG	

(1) P & ID NO. 40P2005131767

REV.	DATE
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ROCKWELL INTERNATIONAL, ROCKETDYNE

PRESSURE REGULATOR LIST

CUSTOMER DEPT. OF ENERGY

PROJECT 10 MWe SOLAR PILOT PLANT

LOCATION DAGGETT, CALIF.

SYSTEM RS

ORDER NO. PAGE OF

Appendix 1

Division Head					
	X				

ROCKWELL INTERNATIONAL, ROCKETDYNE

Engineering Standard

Appendix 1

Page OF

Project 10 MWe SOLAR PILOT PLANT

FLOW ORIFICE (RESTRICTION) INSTRUMENT DATA SHEET

ISSUED

REVISED

Tag No	FO-CO-201-201	FO-ST-203-2[illegible]
Service	DRAIN	BYPASS
Location	3"-CO-201-QEX	1"-ST-203-QE[illegible]
Type	PADDLE	PADDLE
Fluid	CONDENSATE	BLANKET STEAM
Flow, LB/HR	1500	334
Temp. MAX	1010 °F	1010 °F
Inlet Press. MAX	1780 PSIA	17[illegible]0 PSIA
Diff Press		
Orifice Size	0.100 ±0.005 IN. DIA.	0.097 ±0.005 IN. DIA.
System Des. Press		
End Conn-Size/Type	1"-2500 LB WN-RF FLANGE	1"-2500 LB WN-RF FLANGE
Pipe Schedule	80	80
Remarks		
ROCKETDYNE DESIGNATION	RAWO	RFSO-1
Supplied By		
Manufacturer		
Model No		
[illegible] Dwg.	40P2005131767	40P2005131767
[illegible] Spec.	SP42-050	SP42-051

Tag No	FO-VT-1-201	
Service	BYPASS	
Location	1"-VT-1-KEX	
Type	PADDLE	
Fluid	BLANKET STEAM	
Flow, LB/HR	334	
Temp. MAX	9[illegible]0 °F	
Inlet Press. MAX	615 PSIA	
Diff Press		
Orifice Size	0.208 ±0.005 IN. DIA.	
System Des. Press		
End Conn-Size/Type	1"-900 LB WN-RF FLANGE	
Pipe Schedule	80	
Remarks		
ROCKETDYNE DESIGNATION	RFSO-2	
Supplied By		
Manufacturer		
Model No		
[illegible] Dwg.	40P2005131767	
[illegible] Spec.	SP42-052	

TAG NO.	VALVE STD. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	CONTR. OR REQ. NO.	ROCKETDYNE DESIGNATION	REMARKS	REV. NO.
PV-2002	SP42 -003	1"	GLOBE	1500	BW	WCB	VALTEK	(1)	GFE	RWBV	LVDT, I/P TRANS., SOL VALVE, REGULATOR, POSITIONER, FILTER	
UV-2905	SP42 -013	6"	GLOBE	2500	BW	WC9	VALTEK	(1)	GFE	RDSIV	SAME AS ABOVE PLUS MICRO SWITCH	
PV-2906	SP42 -012	4"	GLOBE	900	BW	WC9	VALTEK	(1)	GFE	RFSPCV	LVDT, I/P TRANS, SOL. VALVE REGULATOR, POSITIONER, FILTER	

(1) P&ID NO. 40P2005131767

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ROCKWELL INTERNATIONAL, ROCKETDYNE

MODULATING CONTROL VALVE LIST

CUSTOMER DEPT. OF ENERGY

PROJECT 10MWe SOLAR PILOT PLANT

LOCATION DAGGETT, CALIF.

SYSTEM RS

ORDER NO. PAGE OF

Appendix 1

TAG NO.	VALVE STD. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	CONTR. OR REQ. NO.	ROCKETDYNE DESIGNATION	REMARKS	REV. NO.
PS-2018	SP42-023	1/4"	BOURDON TUBE		NPT		BARKSDALE	(1)	GFE	RNPS-1	SET PRESSURES: 300 PSIG ON DECREASING AND 500 PSIG ON INCREASING	
PS-2015A	SP42-024	1/4"	BELLE-VILLE		NPT		NEO-DYN	(1)	GFE	RNPS-2-1	SET PRESSURE: 5 PSIG ON DECREASING	
PS-2015B	SP42-024	1/4"	BELLE-VILLE		NPT		NEO-DYN	(1)	GFE	RNPS-2-2	SET PRESSURE: 30 PSIG ON INCREASING	

(1) P&ID NO. 40P200513176?

REV.	DATE
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ROCKWELL INTERNATIONAL, ROCKETDYNE

PRESSURE SWITCH LIST

CUSTOMER DEPT. OF ENERGY

PROJECT 10MWe SOLAR PILOT PLANT

LOCATION DAGGETT, CALIF.

SYSTEM 12S

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Appendix 1

Area 300 (TSS)

PREHEATER SKID ASSEMBLY #1

TAG NO. SA-305

Drawing No.:	GA000-90907-M50	
Function:	Preheating of water for steam generation	
Main Components:	Preheater E-303	
Overall Dimen.:	29' - 0" long 8' - 0" Wide 10' - 11" High	
Weight:	Dry: Operating:	25,000 lbs. 32,000 lbs.
Interface:	Water, Oil, Power, Instrumentation and Control, Instrument Air, Drain	
Placement Requirements	Foundation:	Level surface
	Leveling:	+ 1/4" from horizontal at any corner of base frame
	Anchoring:	Six 1" dia. anchor bolts - see dwg. for arrangement.
	Lifting:	With slings to be attached to lifting points of Lifting Frame (shown on dwg GA000-90907-M75). Lifting Frame will be GFE.

Area 300 (TSS)

PREHEATER SKID ASSEMBLY #2

TAG NO. SA-306

Drawing No.:	GA000-90907-M50	
Function:	Preheating of water for steam generation.	
Main Components:	Preheater E-304	
Overall Dimen.:	29' - 0" long 8' - 0" Wide 10' - 11" High	
Weight:	Dry: Operating:	25,000 lbs. 32,000 lbs.
Interface:	Water, Oil, Power, Instrumentation and Control, Instrument Air, Drain	
Placement Requirements	Foundation:	Level surface
	Leveling:	+ 1/4" from horizontal at any corner of base frame
	Anchoring:	Six 1" dia. anchor bolts - see dwg. for arrangement.
	Lifting:	With slings to be attached to lifting points of Lifting Frame (shown on dwg GA000-90907-M75). Lifting Frame will be GFE.

Area 300 (TSS)

BOILER AND SUPERHEATER

SKID ASSEMBLY #1

TAG NO. SA-307

Drawing No.:	GA000-90907-M55 GA000-90907-M56	
Function:	Steam generation and superheating of steam	
Main Components:	Boiler E-305 Superheater E 307	
Overall Dimen.:	53' - 6" long 13' - 10" Wide 17' - 0" High	
Weight:	Dry: Operating:	154,000 lbs. 216,000 lbs.
Interface:	Water, Steam, Oil, Power, Instrumentation and Control, Instrument Air, Drain	
Placement Requirements	Foundation:	Level surface
	Leveling:	+ 1/4" from horizontal at any corner of base frame
	Anchoring:	Six 1" dia. anchor bolts - see dwg. for arrangement.
	Lifting:	With slings to be attached to lifting points of Lifting Frame (shown on dwg GA000-90907-M75). Lifting Frame will be GFE.

Special Requirements:

Due to the excessive height of the skid, some components will be shipped separately. Those components shall be reassembled by the Contractor at the site, after the skid is placed in its permanent location. The drawings indicate the points of connection. After reassembling, the skid assembly shall be leak tested as described in the procedure given in Appendix 1.

Area 300 (TSS)

BOILER AND SUPERHEATER

SKID ASSEMBLY #2

TAG NO. SA-308

Drawing No.:	GA000-90907-M55 GA000-90907-M56
Function:	Steam generation and superheating of steam
Main Components:	Boiler E-306 Superheater E-308
Overall Dimen.:	53' - 6" long 13' - 10" Wide 17' - 0" High
Weight:	Dry: 154,000 lbs. Operating: 216,000 lbs.
Interface:	Water, Steam, Oil, Power, Instrumentation and Control, Instrument Air, Drain
Placement Requirements	
Foundation:	Level surface
Leveling:	± 1/4" from horizontal at any corner of base frame
Anchoring:	Six 1" dia. anchor bolts - see dwg. for arrangement.
Lifting:	With slings to be attached to lifting points of Lifting Frame (shown on dwg GA000-90907-M75). Lifting Frame will be GFE.

Special Requirements:

Due to the excessive height of the skid, some components will be shipped separately. Those components shall be reassembled by the Contractor at the site, after the skid is placed in its permanent location. The drawings indicate the points of connection. After reassembling, the skid assembly shall be leak tested as described in the procedure given in Appendix 1.

Area 300 (TSS)

EXTRACTION PUMP SKID ASSEMBLY

TAG NO. SA-309

Drawing No.: GA000-90907-M60

Function: Pumping of oil, Caloria HT-43 through the extraction loop.

Main Components: Extraction Oil Pump P-303
Extraction Oil Pump P-304
Auxiliary Extraction Oil Pump P-305

Overall Dimen.: 30' - 0" long
13' - 0" Wide
12' - 0" High

Weight: Dry: 38,500 lbs.
Operating: 40,000 lbs.

Interface: Oil, Water, Power, Instrumentation and Control, Instrument Air, Drain

Placement Requirements Foundation: Level surface

Leveling: ± 1/4" from horizontal at any corner of base frame

Anchoring: Six 1" dia. anchor bolts - see dwg. for arrangement.

Lifting: With slings to be attached to lifting points of Lifting Frame (shown on dwg GA000-90907-M75). Lifting Frame will be GFE.

Special Requirements:

After the Skid Assembly is placed in its permanent location, the pumps shall be aligned and lubricated. The procedure is given in Appendix 1 of this specification.

Area 300 (TSS)

ULLAGE MAINTENANCE UNIT

SKID ASSEMBLY

TAG NO. SA-311

Drawing No.:	GA000-90907-M8
Function:	Maintenance of the pressure in the ullage space of the TSU within required limits.
Main Components:	Fluid Tank, Burn Stack with Blower, Fluid Pump, Nitrogen Supply System.
Overall Dimen.:	10' - 0" long 10' - 0" Wide 23' - 0" High 5
Weight:	Dry: 7,000 lbs. Operating: 8,000 lbs.
Interface:	Gas from TSU, Fluid to TSU, Nitrogen, Power, Instrumentation and Control, Instrument Air, Drain.
Placement Requirements	Foundation: Level surface
	Leveling: ± 1/4" from horizontal at any corner of base frame
	Anchoring: Eight 5/8" dia. anchor bolts - see dwg. for arrangement.
	Lifting: With slings to be attached to lifting points.

NOTE: The upper part of the burn stack will be removed and shipped separately. This part will require reinstalling at the site. The height of the remaining portion of the skid assembly will be 16 feet. 5

Area 300(TSS)

TSU Air Receiver 4

Tag No. AA-10

Function: Air Accumulator for Thermal Storage Unit Valves

Overall Dim: 12-inch diameter, 17 inches long

Weight: 90 lbs

Connections: Inlet - 1-inch NPT, Outlet - 3/4-inch NPT, Drain 3/4-inch NPT

Area 300 (TSS)

REASSEMBLING AND TESTING PROCEDURE FOR SKID MOUNTED ASSEMBLIES SA-307 AND SA-308

Due to the excessive height of Skids SA-307 and SA-308, some components will be shipped separately. Those components shall be reassembled by the Contractor at the site, after the skid is placed in its permanent location. The drawings indicate the points of connection. After reassembling, the skid assembly shall be leak tested.

All reassembled pipes and tubes shall be pneumatically leak tested at the operating pressure specified on the line list. The burst discs and relief valves shall be isolated from the system during the leak test.

After the leak test is completed, the isolation of burst discs and relief valves shall be removed and an additonal leak test at 90% of line pressure shall be performed to test the burst discs and relief valves.

All flanged, threaded, and welded joints shall be leak tested with leak test compound (MIL-L-25567). All traces of tape and leak test compound shall be removed following satisfactory completion of testing.

The contractor shall repair all leaks found in the reassembled parts of the skids and at the points of connection.

PUMP ALIGNMENT AND LUBRICATION PROCEDURE

The builder shall align and lubricate all pumps and motors on Skids SA-304 and SA-309 following setting of the skids on the foundations. 3

1. Pump Alignment

Misalignment of the pump and water shafts is of two kinds. The first of these is angular misalignment where the axis of one shaft is at an angle from the other. The other is offset alignment where the center of one shaft is offset from the ceneter of the other shaft. These effects usually occur together so that both angular and offset misalignment are present.

Coincident alignment of the driver and pump shaft is measured at the faces of the coupling hubs. Because of the variety of coupling types furnished at customer's request, the procedure here given is general in nature but may be applied by simple adaption to most coupling types.

The first step is to remove the spacer from the coupling. To one of the remaining coupling hubs, firmly seated on the shaft, attach a dial indicator. Let the indicator button ride on the face of the other coupling hub and near the outside diameter. Rotate the shaft on which the dial indicator is mounted, allowing the indicator button to move on the stationary coupling hub. The indicator dial movement will show the difference in distance between the two hubs. This indicates the amount of angular misalignment between the hubs and therefore the shaft axes. Alignment shall be within 0.002" T.I.R.

To check the offset alignment, mount the dial indicator with the indicator button on an outside diameter of the stationary coupling hub. Rotate the shaft on which the dial indicator is mounted, allowing the indicator button to ride on the outside diameter of the stationary hub. The indicator dial movement will show the difference in the center locations of the two shafts. Alignment shall be within 0.002" T.I.R.

Angular and offset alignment is adjusted by placing thin metal shims under the driver mounting feet to bring the driver into exact alignment with the bolted down pump. If misalignment is of major proportions, the baseplate has been improperly installed on the foundation and must be releveled before proceeding with alignment.

Moderate alignment adjustments may be made by using the jack bolts provided on some bearing housing feet. Loosen the two bearing housing foot hold-down bolts and the jack bolt lock nuts. Adjustments of the jack bolts may then be made.

After each change, by shims or jack bolts, it is necessary to recheck both angular and offset alignment of the coupling. After the pump and driver are aligned, tighten all hold-down and jack bolt lock nuts and then recheck alignment.

2. Pump Lubrication

The ball type radial and thrust bearings are oil lubricated from the bearing housing oil sump. The oil level is controlled by an adjustable constant level oiler. This oiler is removed from the pump and packed separately for pump shipment to avoid damage. Install the oiler in the upper of the two pipe tapped holes on the side of the bearing housing. The lower is the oil drain hole.

Adjust the oiler height by loosening the three set screws in the outer sleeve, setting and retightening the screws. Heights are 1/8" for R430 Series pumps and 0" for R450 and R480 Series pumps.

Failure to level pump when installed on the foundation may result in an improper oil level. Use care in installation. Fill with a rust and oxidation inhibited, non-foaming, industrial oil of 250-350 SSU viscosity @ 100°F.

Oil filling may be made through the opening with the vent plug removed. Fill only until the oil appears in the very bottom of the constant level oiler base when the cup is removed. Replace the vent plug. Fill the oil reservoir cup and install it. The oil will slowly bubble into the bearing housing until the proper level is reached. Remove, refill, and repalce the oil cup. The oil level will remain constant as long as oil remains in the oil cup. To mainatin the oil level between oil changes, keep the oil cup refilled. Do not overfill the bearing housing.

Area 600 (BCS)

BEAM CHARACTERIZATION SUBSYSTEM
TARGETS

1. The Mechanical Contractor shall be required to perform the following work relating to the BCS target panels:

   a. Unloading the BCS Target components at the Plant site.

   b. Assembling and erecting the BCS Targets, including the shutter mechanisms, at the Plant site.

   c. Field touch-up painting of the BCS Targets.

   d. Purchase, install and checkout the BCS heat flux transducer cooling system. (Reference Appendix 4 for details.)

2. The BCS targets are described in the following drawings which are included as a part of this Construction Package.

   Stearns-Roger Engineering Corp. Drawings

Drawing No.	S-R Dwg. No.	Sheet No.	Rev. No.	Title	
40M6005132902	XL22934	M150-1	0	BCS Target Elevations, Sections and Details.	2
40M6005132903	XL22934	M150-2	0	BCS Target Sections and Details.	2
40M6005132904	XL22934	M150-3	1	BCS Target Sensor/Shutter Locations and Details.	2
40M6005132905	XL22934	M150-4	0	BCS Target Shipping Crate Details.	2

3. The erection sequence for the BCS targets is described in the drawings and the targets will be packaged to facilitate the desired erection sequence.

4. The cooling system for the target heat flux transducer shall be a self-contained unit consisting of a coolant pump, coolant receiver, an air cooled heat rejection device and the associated interconnecting piping, valves and controls. This cooling system is described in detail in Appendix 4 since it will be Contractor furnished.

Area 700 (PSS)

PRIMARY ELECTRIC FIRE PUMP (P-705)

1. One (1) Primary Electric Fire Pump and Drive

   (a) One (1) horizontal split case centrifugal fire pump and accessories.

   (b) One (1) 150 horsepower, 480 volt, 3 phase, 60 hertz electric drive motor. 4

   (c) One (1) structural base.

   (d) One (1) electric fire pump motor controller in a NEMA 12 enclosure.

   (e) Miscellaneous fittings, valves and instrumentation.

   (f) Assorted spare parts for two (2) years operation boxed seperately.

2. The unit will be shipped with the pump and motor assembled to the base plate. All half couplings will be installed on the shafts but not permanently connected.

3. The spare parts will not be installed by the Contractor and will remain in the custody of the Construction Manager.

DIVISION USAGE					
WM	P	PP	SH	FI	SP
	X				

Stearns-Roger INCORPORATED
ENGINEERING STANDARD REVISION 3

STANDARD NUMBER JD40.4.10-1

APPROVALS
Des. Sect. [illegible]
Sect. Supv. [illegible]
Div. WHZ

DESIGN DATA SHEET
HORIZONTAL CENTRIFUGAL PUMPS

ISSUED 11/1/73
REVISED 11/3/78

1	Job No. C-21700 Customer DOE-STMPO NO. 40M70014S		
2	Project 10 MWe SOLAR PILOT PLANT (SOLAR ONE) By JRB		Date 11/15/79
3	Equipment Nomenclature PRIMARY ELECTRIC FIRE PUMP		
4	No. of Pumps ONE (1) Driver by Vendor:		[X] Yes [ ] No
5	CONDITIONS OF SERVICE (EACH)		
6	Fluid Pumped (Characteristics, if known, are specified elsewhere)		Raw Water
7	Flow Design	USGPM	1000
8	Operating Range Minimum to Maximum (If required)	USGPM	- / 1500
9	Design Temperature	°F	60
10	Discharge Pressure	PSIG	125
11	Suction Pressure	PSIG	11.7
12	Specific Gravity @ Design Temp, (Ref. 60 °F)		1.0
13	Required Total Head	Ft.	289
14	Available NPSH	Ft.	31.1
15	Barometric Pressure	PSIA	13.7
16	Vapor Pressure @ Design Temp.	PSIA	0.2563
17	Viscosity @ Design Temp.	SSU (or Cp)	1.1Cp
18	Max. Allowable Shut Off Head	Ft.	Per NFPA20
19	Cooling Water (If Required) Max. Temp.	°F	--------
20	Installation Indoors or Outdoors		Indoors
21			
22	DESIGN REQUIREMENTS		
23	Pump Type	[X] Single Stage	[ ] Multi-Stage
24	Casing Split	[X] Axial [ ] Radial	[ ] Back Pull [ ] Front Pull
25	Drive Arrangement	[X] Coupled [ ] Close Coupled	[ ] V-Belt
26	Base Type	[ ] Cast Iron [X] Fab. Steel	[ ] Drain Rim
27	Mount. Arrangement	[X] Common [ ] Separate	[ ] Vertical In-Line
28	Rotation (From Cplg. End)	[ ] Clockwise	[X] Counter Clockwise
29	Pumps Identical?	[ ] Yes [ ] No	RPM Maximum 1775
30	Impeller Type	[X] Enclosed [ ] Semi-Enclosed	[ ] Open [ ] Non-Clog
31	Type of Operation	[X] Parallel [ ] Series CL175	[ ] Single CL175
32	Nozzle Detail	Required Min. Press Rating: Suction	Discharge
33	Suction Location	[X] Side [ ] End	[ ] Bottom
34	Suction Type	[X] Flanged [ ] Screwed	[ ] Welded
35	Discharge Location	[X] Side [ ] Top [ ] Tangential	[ ] Centerline
36	Discharge Type	[X] Flanged [ ] Screwed	[ ] Welded
37	Bearing Detail	Lube Medium: [ ] Oil	[X] Grease
38	Radial	[X] Ball	[ ] Split Sleeve
39	Radial Lube./Cooling	[ ] Ring [ ] Flood [ ] Pressure [ ] Sealed	[ ] Watercooled
40	Thrust	[X] Ball [ ] Spherical Roller	[ ] Kingsbury
41	Thrust Lube/Cooling	[ ] Ring [ ] Flood [ ] Pressure [ ] Sealed	[ ] Watercooled
42	Sealing Detail	[X] Packed Box [ ] Mech. Seal	[ ] Injection Seal
43	Sealing Cooling	[X] None [ ] Water Jacketed	[ ] Heat Exchanger
44	Driver Type	[X] Motor [ ] Turbine [ ] Engine	[ ] Other
45	Driver Enclosure (Specify)		
46	Factory Tests	Certified curves	[X] Yes [ ] No
47	Performance	[ ] None [X] Non-Witnessed	[ ] Witnessed
48	Hydrostatic	[ ] None [X] Non-Witnessed	[ ] Witnessed
49	NPSH	[ ] None [X] Non-Witnessed	[ ] Witnessed
50			
51			

FORM 02 224 REV 11 76

Area 700 (PSS)

SECONDARY DIESEL FIRE PUMP (P-706)

1. One (1) Secondary Diesel Fire Pump and Drive

   (a) One (1) vertical turbine type fire pump and accessories.

   (b) One (1) vertical hollow shaft, nonreverse ratchet right angle gear with NEMA P style base.

   (c) One (1) diesel engine driver complete with muffler, flexible exhaust connector, exhaust pipe, dual batteries and base.

   (d) One (1) diesel fuel system including piping, storage tank, fill connection, flame arrestors and instrumentation.

   (e) One (1) diesel fire pump controller in a NEMA 12 enclosure.

   (f) Miscellaneous fittings, valves and instrumentation.

   (g) Assorted spare parts for two (2) years operation boxed separately.

2. The spare parts will not be installed by the Contractor and will remain in the custody of the Construction Manager.

REVISION 3

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER JD 40.4.11-1
MM	P	PP	SH	FI	SP		
	X						
APPROVALS Des. Sect. [signature] Sect. Supv. [signature] Div. [signature]						DESIGN DATA SHEET VERTICAL CENTRIFUGAL PUMPS	PAGE 1 OF 1 ISSUED 11/1/73 REVISED 12/18/78

3

1	Job No. C-21700 Customer DOE-STMPO NO. 40M70014S	
2	Project 10 MWe SOLAR PILOT PLANT (SOLAR ONE) By JRB Date 11/15/79	
3	Equipment Nomenclature SECONDARY DIESEL FIRE PUMP	
4	Number of Pumps ONE (1) Driver by Vendor ☒ Yes ☐ No	
5	CONDITIONS OF SERVICE (EACH)	
6	Fluid Pumped (Characteristics, if known, are specified elsewhere)	Raw Water
7	Design Flow/Temp. USGPM/°F	1000 / 60
8	Operating Range, Minimum to Maximum (if required) USGPM	- / 1500
9	Discharge Pressure PSIG	125
10	Suction Pressure PSIG	Submerged
11	Specific Gravity at Design Temp (Ref 60°F)	1.0
12	Required Total Head (exclusive of pump losses) Ft.	295
13	Available NPSH/Reference Point Ft.	15/Min. W.L.
14	Barometric Pressure PSIA	13.72
15	Vapor Pressure at Design Temp. PSIA	0.256
16	Viscosity at Design Temp. SSU (or Cp)	1.1 Cp
17	Maximum Allowable Shut Off Head Ft.	Per NFPA 20
18	Installation Indoors or Outdoors	Indoors
19	Height, Centerline of Discharge Nozzle Above Mounting Surface Ft.-In.	-------
20	Length, Mounting Surface to Bottom of Suction or Strainer	20' - 9"
21	(If required) Ft.-In.	
22	Sump Depth, Mounting Surface to Bottom of Sump Ft.-In.	22' - 9"
23	Static Head, Mounting Surfaces to Minimum Liquid Level Ft.-In.	
24	DESIGN REQUIREMENTS	
25	Pump Type ☒ Vertical Turbine ☐ Mixed Flow ☐ Propeller	
26	Drive Arrangement ☐ Direct ☒ Gear ☐ Other	
27	Foundation Plate ☒ Yes ☐ No Dimensions:	
28	Impeller Type ☒ Enclosed ☐ Semi-Open Parallel Operation ☐ Yes ☐ No	
29	Pumps Identical? ☐ Yes ☐ No RPM Maximum 1800	
30	Lineshaft Bearing Lubrication ☒ Open ☐ Enclosed	
31	(If Enclosed) Lineshaft Bearing Lubrication ☐ Oil ☐ Grease ☐ Water ☐ Pumped Fluid	
32	Enclosing Tube: Material Coating	
33	Can, if required ☐ Furnished by Vendor ☐ By others	
34	Can Dimensions, if required Dia. Length Suction Size Coating	
35	Strainer ☒ Yes ☐ No Material Galvanized Steel	
36	Suction ☒ Suction Case or ☒ Suction Bell	
37	Bowls ☒ Threaded or ☐ Flanged	
38	Column Pipe ☒ Threaded or ☒ Flanged ☐ Coated	
39	Discharge ☒ Above Mounting ☐ Below Mounting	
40	Discharge Pipe Diameter, Inches 8 ☒ Flanged ☐ Threaded ☐ Plain End	
41	(If flanged) ANSI Rating 175	
42	Sealing Detail ☒ Packed Box ☐ Mechanical Seal	
43	Sealing Lube, if required ☐ Filtered Pumped Medium ☐ Outside Water	
44	Spacer Type Coupling ☐ Yes ☒ No	
45	Driver Type ☐ Motor ☐ Turbine ☒ Engine ☐ Other	
46	(If motor or right angle gear) ☒ Vertical Hollow Shaft ☐ Vertical Solid Shaft	
47	Driver Enclosure (specify) ☒ Non Reverse Ratchet ☐ Self Release Coupling	
48	Factory Tests Certified Curves ☒ Yes ☐ No	
49	Performance ☐ None ☒ Non-Witnessed ☐ Witnessed	
50	Hydrostatic ☐ None ☒ Non-Witnessed ☐ Witnessed	
51	NPSH ☒ None ☐ Non-Witnessed ☐ Witnessed	
52		

FORM 02-224 REV. 9-75

Area 700 (PSS)

FIRE MAINTENANCE JOCKEY PUMP (P-707)

1. One (1) Fire Maintenance Jockey Pump and Drive

   (a) One (1) horizontal centrifugal pump and accessories.

   (b) One (1) 5 horsepower, 480 volt, 3 phase, 60 hertz electric drive motor. 4

   (c) One (1) jockey fire pump motor controller in NEMA 12 enclosure.

   (d) Miscellaneous fittings, valves and instrumentation.

   (e) Assorted spare parts for two (2) years operation boxed separately.

2. The unit will be shipped with the pump and motor assembled to the base plate.

3. Spare parts will not be installed by the Contractor and will remain in the custody of the Construction Manager.

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X				

Stearns-Roger
INCORPORATED

ENGINEERING STANDARD REVISION 3

STANDARD NUMBER JD40.4.10-1

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Sect. Supv. [signature]
Div. [signature]

DESIGN DATA SHEET
HORIZONTAL CENTRIFUGAL PUMPS

PAGE 1 OF 1 3

ISSUED 11/1/73
REVISED 11/3/78

1	Job No. C-21700 Customer DOE-STMPO NO. 40M70014S		
2	Project 10 MWe SOLAR PILOT PLANT (SOLAR ONE) By JRB Date 11/15/79		
3	Equipment Nomenclature FIRE MAINTENANCE JOCKEY PUMP		
4	No. of Pumps ONE (1) Driver by Vendor: [X] Yes [ ] No		
5	CONDITIONS OF SERVICE (EACH)		
6	Fluid Pumped (Characteristics, if known, are specified elsewhere)		Raw Water
7	Flow Design	USGPM	25
8	Operating Range Minimum to Maximum (If required)	USGPM	- / -
9	Design Temperature	°F	60
10	Discharge Pressure	PSIG	125
11	Suction Pressure	PSIG	11.7
12	Specific Gravity @ Design Temp. (Ref. 60 °F)		1.0
13	Required Total Head	Ft.	289
14	Available NPSH	Ft.	31.1
15	Barometric Pressure	PSIA	13.72
16	Vapor Pressure @ Design Temp.	PSIA	0.2563
17	Viscosity @ Design Temp.	SSU (or Cp)	1.1 Cp
18	Max. Allowable Shut Off Head	Ft.	Per NFPA 20
19	Cooling Water (If Required) Max. Temp.	°F	--------
20	Installation Indoors or Outdoors		Indoors
21			
22	DESIGN REQUIREMENTS		
23	Pump Type	[X] Single Stage [ ] Multi-Stage	
24	Casing Split	[ ] Axial [ ] Radial [ ] Back Pull [ ] Front Pull	
25	Drive Arrangement	[X] Coupled [ ] Close Coupled [ ] V-Belt	
26	Base Type	[ ] Cast Iron [ ] Fab. Steel [ ] Drain Rim	
27	Mount. Arrangement	[X] Common [ ] Separate [ ] Vertical In-Line	
28	Rotation (From Cplg. End)	[X] Clockwise [ ] Counter Clockwise	
29	Pumps Identical?	[ ] Yes [ ] No RPM Maximum 3600	
30	Impeller Type	[ ] Enclosed [ ] Semi-Enclosed [X] Open [ ] Non-Clog	
31	Type of Operation	[X] Parallel [ ] Series CL175 [ ] Single CL175	
32	Nozzle Detail	Required Min. Press Rating: Suction Discharge	
33	Suction Location	[X] Side [ ] End [ ] Bottom	
34	Suction Type	[ ] Flanged [X] Screwed [ ] Welded	
35	Discharge Location	[X] Side [ ] Top [ ] Tangential [ ] Centerline	
36	Discharge Type	[ ] Flanged [X] Screwed [ ] Welded	
37	Bearing Detail	Lube Medium: [ ] Oil [ ] Grease	
38	Radial	[X] Ball [ ] Split Sleeve	
39	Radial Lube./Cooling	[ ] Ring [ ] Flood [ ] Pressure [ ] Sealed [ ] Watercooled	
40	Thrust	[X] Ball [ ] Spherical Roller [ ] Kingsbury	
41	Thrust Lube/Cooling	[ ] Ring [ ] Flood [ ] Pressure [ ] Sealed [ ] Watercooled	
42	Sealing Detail	[ ] Packed Box [X] Mech. Seal [ ] Injection Seal	
43	Sealing Cooling	[X] None [ ] Water Jacketed [ ] Heat Exchanger	
44	Driver Type	[X] Motor [ ] Turbine [ ] Engine [ ] Other	
45	Driver Enclosure (Specify)		
46	Factory Tests	Certified curves [X] Yes [ ] No	
47	Performance	[ ] None [X] Non-Witnessed [ ] Witnessed	
48	Hydrostatic	[X] None [ ] Non-Witnessed [ ] Witnessed	
49	NPSH	[X] None [ ] Non-Witnessed [ ] Witnessed	
50			
51			

FORM 02 224 REV 11 76

Area 700 (PSS)

Piping spools for the following primary piping line numbers shall be furnished by the Government F.O.B. Jobsite for installation by the Contractor:

Line No.	Size	Spec.	2
AS-7	6"	FEA	2
			2
			2
			2
CO-3	3"	MBA	4
CO-12	2-1/2"	FEA	2
FW-2	4"	MBA	2
FW-9	2-1/2"	MBA	2
MS-2	6"	QEB	2
MS-3	6"	QEB	2
MS-5	10"	FEA	2
MS-6	6"	QEB	2
MS-7	10"	FEA	2
MS-8	4" & 6"	QEB	4
MS-9	6"	FEA	2
MS-10	3" & 4"	QEB	2
ST-9	4"	FEA	2
ST-13	3"	FEA	2
ST-17	4"	QEB	2
ST-18	4" & 8"	HEA	2
ST-19	8"	HEA	2
VT-1	4"	KEB	2
VT-11	10"	FEA	2
VT-12	2-1/2"	KEB	2

All primary supports and snubbers for the above piping spools.

The following pressure seal and motor operated valves:

V-MS-10-3	2
V-MS-8-2	
V-MS-6-1	
V-VT-1-1	
MOV-1030	
MOV-1031	
MOV-1132	

Area 700 (PSS)

FIELD WELDS (GFE) 2

ALLOY LINES

8" & 10" Lines:	18 Welds Required MS-5 & MS-7 ST-18 & ST-19 VT-11
4" & 6" Lines:	61 Welds Required AS-7 MS-2, MS-3, MS-6, MS-8 & MS-9 ST-9 & ST-17 VT-1
2-1/2" & 3" Lines:	17 Welds Required CO-12 ST-13 VT-12

HEAVY WALL CARBON

4" Lines:	19 Welds Required FW-2
2-1/2" Lines:	4 Welds Required FW-9

Area 900 (EPGS)

RECEIVER FEED WATER PUMP AND DRIVE (P-917)

1. One (1) Receiver Feedwater Pump and Drive

   (a) Bingham-Willamette Model 4x6x9ECP 14 stage horizontal, double case, centrifugal pump and accessories. Weight of pump and accessories is 13,700 pounds.

   (b) One (1) American-Standard variable speed drive unit, Model No. 146CL6 Type VS and speed controller. Weight of drive is 4,000 pounds.

   (c) One (1) Reliance Electric E5010 or 5808, 800 horsepower, 4160 volt, 3 phase, 60 hertz electric drive motor. Weight of motor is 4,000 pounds.

   (d) One (1) structural base with a weight of 5,300 pounds.

   (e) One (1) spare rotating element and assorted spare parts.

2. The unit will be shipped with the pump, variable speed drive and motor assembled to the base plate. All half couplings will be installed on the shafts but not permanently connected. The assembled unit total weight is 27,000 pounds.

3. The spare parts will not be installed by the Contractor and will remain in the custody of the Construction Manager.

FORM NO. N-721A 12/71
BASED ON ISA S20

(7) LVDT POSITION TRANSMITTER MOUNTED ON VALVE REQUIRED
(6) VENDOR TO SUPPLY SIGNAL CONVERTER CAPABLE OF ACCEPTING A 4-20MA DC SIGNAL FOR CONVERSION TO 3-15 PSIG (TAG NO. PY-1001)
(5) ENCIRCLED NO. INDICATE DATA TO BE COMPLETED BY BIDDER

Stearns-Roger

CONTROL VALVES (SPECIAL)

DATA SHEET PV-1
PAGE 1
S-R PROJECT C-21700
ACCOUNT
DATE 1-3-80
BY C.A.M
BY 4 BY

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT SOLAR I
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 3-24-80 BY CAM 2 4-4-80 BY [illegible] 3
MANUFACTURER CONTROL COMPONENTS INTL SOURCE: QUOTE OF CONTROL COMPONENTS INTL

GENERAL	1	TAG NUMBER			PV-1001							
	2	SERVICE			CONDENSER DUMP PRESS.							
	3				REDUCING VALVE							
	4	LINE: SIZE, NUMBER			6"-MS-6-CE6							
BODY & TRIM	5	TYPE OF BODY			ANGLE							
	(6)	BODY SIZE	PORT SIZE		6 X 10	4"						
	(7)	GUIDING	NO. OF PORTS		DISK	1						
	8	END CONN & RATING		(4)	BUTTWELD 2500#							
	9	PIPE SCHEDULE OR BORE		(3)	INLET: 6" SCH. XXS, "C" BORE = 5.072"; OUTLET: 10" SCH. 40							
	(10)	BODY MATERIAL			ASTM A182-F22							
	(11)	PACKING MATERIAL			MFR STD							
	(12)	LUBRICATOR	ISO VALVE		NO	NO						
	(13)	BONNET TYPE	(HI TEMP)		BOLTED							
	(14)	TRIM FORM	(LOW NOISE)		LINEAR							
	(15)	TRIM MATERIAL			CA-MC & INCONEL							
	16	TIGHT SHUTOFF REQD			YES, CLASS I							
ACTUATOR	17	TYPE OF ACTUATOR		(2)	PNEUMATIC							
	(18)	MODEL NO. & SIZE			NO.1 & 200 SQ. IN							
	(19)	CLOSE AT	OPEN AT		3 PSIG	15 PSIG						
	(20)	PUSH DOWN TO	FLOW ACTION TO		CLOSE	OPEN						
	21	FAIL POSITION			CLOSED							
	22	HANDWHEEL & LOCATION			YES / SIDE							
	23	AIR SUPPLY PRESSURE			80 ~ 100 PSIG							
	24	TRAVEL INDICATOR			YES							
POSIT.	(25)	MODEL NO.		(6)	BAILEY AP-5							
	26	FILTER REG	GAUGES	BYPASS	YES	YES	YES					
	27	INPUT SIGNAL			4-20 MA							
	(28)	OUTPUT SIGNAL			3-15 PSIG							
~~PILOT~~	~~29~~	~~MODEL NO.~~	~~ACTION~~									
	~~30~~	~~CONTROL MODES~~										
	~~31~~	~~MOUNTING~~	~~OUTPUT~~									
	~~32~~	~~ELEMENT: TYPE~~	~~RANGE~~									
	~~33~~	~~MATERIAL~~										
ACCESS.	(34)	TOTAL VALVE WEIGHT			1800 #							
	35	SOLENOID	TAG NO./REF		SOV-1001	3-WAY	125 VDC	N.C.	ASCO			
	36	LIMIT SWITCHES	TAG NO./REF		ZS-1001	2-SPDT			NAMCO EA 6			
	37	MAX. DES. TEMP/PRESS			1010°F / 1780 PSIA							
FLUID DATA	38	FLUID (1)			STEAM							
	39	FLOW	MAX(1)	MAX(2) MIN	112,300	130,000	6500	#/HR				
	40	TEMP °F			950	650	440/950	°F				
	41	Δ PRESS			1350	1350	515/1458	PSI				
	42	INLET PRESS			1465	1465	380/1465	PSIA				
	43	MAXIMUM SHUTOFF ΔP			1780 PSI							
	44	CAL. CV	MAX(1)	MAX(2) MIN	52.5	50.5	9.4/3.0					
	(45)	VALVE CV	MAX	MIN	(LATER)							
	46	VALVE VEL.	MAX	MIN	386	297	23-36.9					
	(47)	NOISE LVL, dbA			85	@ 5	'					
	(48)	MODEL NUMBER			A2X613							

NOTES: (1) FLOW UNITS: LIQUID _____ STEAM #/HR GAS _____

(2) SPRING CLOSING & PROVIDE AIR VOLUME TANK (ROSS) TO STROKE OPEN IN 0.8 SECONDS ON TRIP SIGNAL TO VALVE (FULL STROKE).

(3) PIPE MATERIAL: INLET- 2500# ALLOY 2¼% CHROME 1% MOLY ASTM A335 GRADE P22
OUTLET- 300# ALLOY 1¼% CHROME ½% MOLY ASTM A335 GRADE P11

(4) VENDOR MUST SUPPLY REDUCERS IF REQUIRED TO MATCH VALVES TO PIPE SIZE & MATERIAL.

TAG NO. PV-1001

FORM NO. N-721A 12/71
BASED ON ISA S20

Stearns-Roger

CONTROL VALVES (SPECIAL)

DATA SHEET PV-2
PAGE 1
S-R PROJECT C-21700
ACCOUNT
DATE 1-3-80
BY C.A.M.

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS Co.
PROJECT SOLAR I
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 3-24-80 BY CAM 2 6-24-80 BY RGB 3 9-11-80 BY RGB 4 ____ BY ____
MANUFACTURER COPES VULCAN — SOURCE: QUOTE OF ____

Section	No.	Item	Data		
GENERAL	1	TAG NUMBER	PV-1003		
	2	SERVICE	MAIN STEAM TO		
	3		AUX STEAM - PRESS REDUCING		
	4	LINE: SIZE, NUMBER	2" - MS - 8 - QEB		
BODY & TRIM	5	TYPE OF BODY	GLOBE		
	(6)	BODY SIZE / PORT SIZE	2"		
	(7)	GUIDING / NO. OF PORTS	CAGE		
	8	END CONN & RATING (3)	BUTTWELD - 2500 #		
	9	PIPE SCHEDULE OR BORE (2)	INLET: 2" SCH 160 S.W.; OUTLET: 6" SCH XXS "C" BORE = 5.072		
	(10)	BODY MATERIAL	CHROME MOLY C9		
	(11)	PACKING MATERIAL	GRAPHITE ASB		
	(12)	LUBRICATOR / ISO VALVE	NO	NO	
	(13)	BONNET TYPE (HI TEMP)	COOLING EXT.		
	(14)	TRIM FORM (LOW NOISE)	CASCADE		
	(15)	TRIM MATERIAL	420 MALCOMIZED		
	16	TIGHT SHUTOFF REQD	YES CLASS IV		
ACTUATOR	17	TYPE OF ACTUATOR	PNEUMATIC		
	(18)	MODEL NO. & SIZE	D-100-60R		
	19	CLOSE AT / OPEN AT	3 PSIG	15 PSIG	
	(20)	PUSH DOWN TO / FLOW ACTION TO			
	21	FAIL POSITION	CLOSED		
	22	HANDWHEEL & LOCATION	YES / TOP		
	23	AIR SUPPLY PRESSURE	80 ~ 100 PSIG		
	24	TRAVEL INDICATOR	YES		
POSIT.	(25)	MODEL NO. (4)	BAILEY AP-5		
	26	FILTER REG / GAUGES / BYPASS	YES	YES	YES
	27	INPUT SIGNAL	3-15 PSIG		
	(28)	OUTPUT SIGNAL	13.5 - 80		
~~PILOT~~	~~29~~	~~MODEL NO. / ACTION~~			
	~~30~~	~~CONTROL MODES~~	REDUCER: OUTLET - 6" X 2" XXS CLASS 2500		
	~~31~~	~~MOUNTING / OUTPUT~~		A335 GR P22	[illegible]
	~~32~~	~~ELEMENT: TYPE / RANGE~~			
	~~33~~	~~MATERIAL~~			
	(34)	TOTAL VALVE WEIGHT	1345 #		
ACCESS.	35	SOLENOID / TAG NO./REF	—		
	(36)	POSITION INDICATOR / TAG NO./REF	YES	ZT-1003	[illegible] TYPE 2WIRE 24VDC 4-20ma OUTPUT (5)
	37	MAX. DESIGN TEMP/PRESS	1010°F / 1780 PSIA		

Section	No.	Item	MAX (1)	MAX (2)	MIN	Units
FLUID DATA	38	FLUID (1)	STEAM			
	39	FLOW	13554	9880	270	#/HR
	40	TEMP °F	650	950	950	°F
	41	Δ PRESS	1383	1383	1383	PSI
	42	INLET PRESS	1465	1465	1465	PSIA
	43	MAXIMUM SHUTOFF ΔP	1780 PSI			
	44	CAL. CV	5.28	4.63	0.11	
	(45)	VALVE CV	7.3			
	46	VALVE VEL.				
	(47)	NOISE LVL, dbA				
	(48)	MODEL NUMBER	D-100			

NOTES: (1) FLOW UNITS: LIQUID ____ STEAM #/HR GAS ____

(2) PIPE MATERIAL: INLET - 2500# ALLOY 2¼% CHROME 1% MOLY ASTM A335 GR P22
OUTLET - 2500 # ALLOY 2¼% CHROME 1% MOLY ASTM A335 GR P22

(3) VENDOR MUST SUPPLY REDUCERS [illegible] TO MATCH VALVE TO PIPE SIZE & MATERIAL

(4) VENDOR TO SUPPLY SIGNAL CONVERTER CAPABLE OF ACCEPTING A 4-20 MA DC SIGNAL FOR CONVERSION TO 3-15 PSIG (TAG NO. PY-1003)

(5) C-V MODEL VPT-IT MODIFIED FOR 2WIRE OPERATION ⚠3

TAG NO. PV-1003

(6) ENCIRCLED NOS INDICATE ITEM TO BE COMPLETED BY BIDDER

FORM NO. N-721A 12/71
BASED ON ISA S20

Sloans-Roger

CONTROL VALVES (SPECIAL)

DATA SHEET PV-3
PAGE 1
S-R PROJECT C-17200
ACCOUNT
DATE 1-3-80
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT SOLAR I
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 3-24-80 BY CAM 2 6-29-80 BY REB 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER COPES VULCAN
SOURCE: QUOTE OF

GENERAL	1	TAG NUMBER			PV-1005					
	2	SERVICE			ADMISSION STEAM					
	3				TO AUX. STEAM					
	4	LINE: SIZE, NUMBER			2½"-ST-6-FBA					
BODY & TRIM	5	TYPE OF BODY			GLOBE					
	(6)	BODY SIZE	PORT SIZE		2"					
	(7)	GUIDING	NO. OF PORTS		CAGE					
	8	END CONN & RATING (3)			BUTTWELD-300#					
	9	PIPE SCHEDULE OR BORE (2)			INLET: 2½" SCH 40		OUTLET: 4" SCH 40			
	10	BODY MATERIAL			CARBON STEEL					
	(11)	PACKING MATERIAL			GRAPHITE ASB					
	(12)	LUBRICATOR	ISO VALVE		NO	NO				
	(13)	BONNET TYPE			STD					
	(14)	TRIM FORM (LOW NOISE)			CASCADE					
	(15)	TRIM MATERIAL			410					
	16	TIGHT SHUTOFF REQD			YES, CLASS IV					
ACTUATOR	17	TYPE OF ACTUATOR			PNEUMATIC					
	(18)	MODEL NO. & SIZE			D-100-40R					
	19	CLOSE AT	OPEN AT		3 PSIG	15 PSIG				
	(20)	PUSH DOWN TO	FLOW ACTION TO							
	21	FAIL POSITION			CLOSED					
	22	HANDWHEEL & LOCATION			YES / TOP					
	23	AIR SUPPLY PRESSURE			80 – 100 PSIG					
	24	TRAVEL INDICATOR			YES					
POSIT.	(25)	MODEL NO. (4)			BAILEY AF-5					
	26	FILTER REG	GAUGES	BYPASS	YES	YES	YES			
	27	INPUT SIGNAL			3 – 15 PSIG					
	(28)	OUTPUT SIGNAL			22 – 80					
~~PILOT~~	~~29~~	~~MODEL NO.~~	~~ACTION~~							
	~~30~~	~~CONTROL MODES~~			REDUCERS: INLET - 2½"X2" SCH. 40 CLASS 300					
	~~31~~	~~MOUNTING~~	~~OUTPUT~~			OUTLET - 4 X 2 SCH 40 CLASS 300				
	~~32~~	~~ELEMENT, TYPE~~	~~RANGE~~			A105	GR II			
	~~33~~	~~MATERIAL~~								
	(34)	TOTAL VALVE WEIGHT			250#					
ACCESS.	35	SOLENOID	TAG NO./REF		—					
	36	POSITION INDICATOR	TAG NO./REF		YES	ZT-1005	LVDT TYPE 2-WIRE 24VDC 4-20MA OUTPUT (5)			
	37	MAX. DES TEMP/PRESS			580°F / 465 PSIA					
FLUID DATA	38	FLUID (1)			STEAM					
	39	FLOW	MAX	MIN	3765	270	#/HR			
	40	TEMP °F	MAX	MIN	525	525	°F			
	41	△PRESS	MAX	MIN	313	313	PSI			
	42	INLET PRESS	MAX	MIN	385	385	PSIA			
	43	MAXIMUM SHUTOFF △P			465 PSI					
	44	CAL. CV	MAX	MIN	5.35	0.38				
	(45)	VALVE CV	MAX	MIN	7.3					
	46	VALVE VEL.	MAX	MIN						
	(47)	NOISE LVL, dbA			72.5					
	(48)	MODEL NUMBER			D-100					

(6) ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY ____

NOTES: (1) FLOW UNITS: LIQUID ____, STEAM #/HR, GAS ____

(2) PIPE MATERIAL – CLASS 300 CARBON STEEL ASTM A106 GR. B

(3) VENDOR MUST SUPPLY REDUCERS IF REQUIRED TO MATCH VALVES TO PIPE SIZE & MATL.

(4) VENDOR TO SUPPLY SIGNAL CONVERTER CAPABLE OF ACCEPTING A 4-20 MA DC SIGNAL FOR CONVERSION TO 3-15 PSIG (TAG NO PY-1005)

(5) C-V MODEL VPT-T MODIFIED FOR 2WIRE OPERATION ②

TAG NO. PV-1005

Stearns-Roger

CONTROL VALVES (ON - OFF)

DATA SHEET: AOV
PAGE: 1
S-R PROJECT: C-21700
ACCOUNT:
DATE: 1-15-80
BY: CAM

CLIENT: McDONNELL DOUGLAS ASTRONAUTICS
PROJECT: SOLAR ONE
LOCATION: DAGGETT CALIFORNIA
REVISIONS: 1 5-13-80 BY CAM 2 7-15-80 BY CAM 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER: COPES VULCAN   SOURCE: QUOTE OF COPES-VULCAN

Section	No.	Item	Sub-item	AOV-1008		AOV-1009	
GENERAL	1	TAG NUMBER		AOV-1008		AOV-1009	
	2	SERVICE		ADMISSION STEAM		AUX. STEAM	
	3			TO DESUPERHEATER		TO BLANKET TS	
	4	FLOW SHEET		P3-1		P3-1	
	5	LINE: SIZE, NUMBER		4"-ST-9-FEA		1½"-AS-9-FBA	
BODY & TRIM	(6)	TYPE OF BODY		GLOBE		GLOBE	
	(7)	BODY SIZE	PORT SIZE	4"		1½"	
	(8)	GUIDING	NO. OF PORTS	CAGE	1	CAGE	1
	9	END CONN. & RATING (5)		BUTTWELD 300 #		SOCKETWELD 600#	
	10	PIPE SCHEDULE OR BORE		INLET/OUTLET 4" SCH. 40 (4)		1½"-SCH 80	
	(11)	BODY MATERIAL		CR-MO WC9		CARBON STEEL	
	(12)	PACKING MATERIAL		GRAPHITE ASBESTOS		GRAPHITE ASBESTOS	
	13	LUBRICATOR	ISO VALVE	NO	NO	NO	NO
	14	BONNET TYPE		(HI TEMP) STANDARD		STANDARD	
	15	TRIM FORM		QUICK OPENING		QUICK OPENING	
	(16)	TRIM MATERIAL		410 SS HARDENED		410 SS HARDENED	
	17	SEAT LEAKAGE CLASS (3)		CLASS IV		CLASS IV	
ACTUATOR	18	TYPE OF ACTUATOR		DIAPHRAGM		DIAPHRAGM	
	19	MODEL NO. & SIZE		D-100 & 100SQ.IN.		CV-600-4RA	
	(20)	CLOSE AT	OPEN AT	0 PSIG	68 PSIG	0 PSIG	35 PSIG
	(21)	PUSH DOWN TO	FLOW ACTION TO	OPEN	OPEN	OPEN	OPEN
	22	FAIL POSITION		CLOSED		CLOSED	
	23	HANDWHEEL & LOCATION		YES/TOP		YES/TOP	
	24	AIR SUPPLY PRESSURE		80 ~ 100 PSIG		80 ~ 100 PSIG	
	25	TRAVEL INDICATOR		YES		YES	
POSIT.	26	MODEL NO.		NO		NO	
	27	FILTER REQ / GAUGES / BYPASS		YES / YES / —		YES / YES / —	
	~~28~~	~~INPUT SIGNAL~~					
	~~29~~	~~OUTPUT SIGNAL~~					
~~PILOT~~	~~30~~	~~MODEL NO.~~	~~ACTION~~				
	~~31~~	~~CONTROL MODES~~					
	~~32~~	~~MOUNTING~~	~~OUTPUT~~				
	~~33~~	~~ELEMENT TYPE~~	~~RANGE~~				
	34	LVDT MODEL/TAG NO.		NONE REQUIRED		NONE REQUIRED	
	(35)	TOTAL VALVE WEIGHT		360 #		100 #	
ACC.	36	SOLENOID	TAG NO/REF	YES	3WAY 120 VAC N.C.	YES 3WAY	120VAC N.C.
	37	LIMIT SWITCHES	TAG NO/REF	ZS-1008	2 SPDT MICROSWITCH ICX-42	ZS-1009	2 SPDT
FLUID DATA	38	ON PROCESS INCREASE - VALVE TO		OPEN		OPEN	
	39	FLUID (1)		STEAM		STEAM	
	40	NORM FLOW (1)	P_{IN}, PSIA/TEMP °F / ΔP	3765	72/460°F 2 PSI	400	75/345°F ≈1 PSI
	41	MAX FLOW (1)	P_{IN}, PSIA/TEMP °F / ΔP	3765	72/460°F 2 PSI	400	75/345°F ≈1 PSI
	42	MIN FLOW (1)	P_{IN}, PSIA/TEMP °F / ΔP	0	72/460°F -	0	75/345°F -
	(43)	CALC CV (2)	VALVE CV	111	121	16.37	30
	44	MAXIMUM SHUTOFF ΔP		75 PSI		75 PSI	
	45	TEMP MAX DES.	PRESS MAX DES	860°F	90 PSIA	460°F / 90 PSIA	
	46	SP GR AT: 60 °F	O.T.				
	47	VISC. CP AT O.T.		0.018		0.016	
	48	IS FLASHING EXPECTED IN VALVE		NO		NO	
	(49)	SOUND LEVEL:dB ALLOW	PRED	90 dB	57 dBA	90 dB	50 dBA
	(50)	MODEL NUMBER		D-100		CV-600	

NOTES: (1) FLOW UNITS: LIQUID ____, STEAM #/HR, GAS ____
(2) CORRESPONDS TO NORMAL FLOW UNLESS OTHERWISE NOTED.
(3) IN ACCORDANCE WITH ANSI 316.104 - 1976
(4) PIPE MATERIAL: INLET: CLASS 300 CARBON STEEL ASTM A-106 GRADE B
OUTLET: CLASS 300 ALLOY STEEL 1¼% CR ½% MO ASTM A335 [illegible]

FORM NO. N-721 REV. 11/77
BASED ON ISA S20

(6) ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.
(5) VENDOR TO SUPPLY REDUCERS IF REQUIRED TO MATCH VALVES TO PIPE SIZE & MATERIAL

Stearns-Roger

CONTROL VALVES (ON - OFF)

DATA SHEET FV
PAGE 1
S-R PROJECT C-21700
ACCOUNT
DATE 1-23-80
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS Co
PROJECT SOLAR ONE
LOCATION DAGGETT CALIFORNIA

REVISIONS 1 5-13-80 BY CAM 2 9-16-80 BY RGP 3 11-14-80 BY RGP 4 ____ BY ____

MANUFACTURER COPES-VULCAN SOURCE: QUOTE OF COPES-VULCAN

GENERAL	1	TAG NUMBER			FV-1006					FV-1007			
	2	SERVICE			ATOMIZING STM TO					ATOMIZING STM TO			
	3				DESUPERHTR DS-901					DESUPERHTR DS-901			
	4	FLOW SHEET			P3-1					P3-1			
	5	LINE: SIZE, NUMBER			2"-MS-6-QEB					2"-VT-1-KEB			
BODY & TRIM	6	TYPE OF BODY			GLOBE					GLOBE			
	(7)	BODY SIZE	PORT SIZE		2"					1 1/2"			
	(8)	GUIDING	NO. OF PORTS		CAGE	1				CAGE	1		
	9	END CONN. & RATING		(5)	SOCKETWELD CLASS 2500# STANDARD					SOCKETWELD CLASS 1500			
	10	PIPE SCHEDULE OR BORE		(6)	INLET: 2" SCH-160; OUTLET: 3" SCH-160					INLET/OUTLET: 2" SCH 80			
	(11)	BODY MATERIAL			CR-MO WC9					CR-MO WC9			
	(12)	PACKING MATERIAL			GRAPHITE ASB					GRAPHITE ASB			
	13	LUBRICATOR	ISO VALVE		NO	NO				NO	NO		
	14	BONNET TYPE		(HI-TEMP)	COOLING EXT					COOLING EXT			
	15	TRIM FORM			CASCADE					CASCADE			
	(16)	TRIM MATERIAL			420 SS HARD MALC					420 SS HARD MALC			
	17	SEAT LEAKAGE CLASS (3)			CLASS IV					CLASS IV			
ACTUATOR	18	TYPE OF ACTUATOR			DIAPHRAGM					DIAPHRAGM			
	(19)	MODEL NO. & SIZE			D-100-40					D-100-40			
	(20)	CLOSE AT	OPEN AT		0 PSIG	38 PSIG				0 PSIG	35 PSIG		
	(21)	PUSH DOWN TO	FLOW ACTION TO		OPEN	OPEN				OPEN	OPEN		
	22	FAIL POSITION			CLOSED (4)					CLOSED			
	23	HANDWHEEL & LOCATION			YES / TOP					YES / TOP			
	24	AIR SUPPLY PRESSURE			80 ~ 100 PSIG					80 ~ 100 PSIG			
	~~25~~	TRAVEL INDICATOR			YES					YES			
POSIT.	26	MODEL NO.			NO					NO			
	27	FILTER REG	GAUGES	BYPASS	YES	YES	NO			YES	YES	NO	
	~~28~~	~~INPUT SIGNAL~~											
	~~29~~	~~OUTPUT SIGNAL~~											
PILOT	30	REDUCERS			OUTLET: 3"X2" SCH-160 w 3/4"		Soc-o-let			INLET & OUTLET: 2X1½"			
	31				ASTM A182-F11		(2)			SCH 80 ASTM A185-P22			
	~~32~~	~~MOUNTING~~	~~OUTPUT~~										
	~~33~~	~~ELEMENT TYPE~~	~~RANGE~~										
	34	LVDT MODEL / TAG NO.			NONE REQD					NONE REQD			
	(35)	TOTAL VALVE WEIGHT			545 #					310 #			
ACC.	36	SOLENOID	TAG NO/REF		SOV-1006	3 WAY	120VAC N.C.			SOV-1007	3 WAY	120VAC N.C.	
	37	LIMIT SWITCHES	TAG NO/REF		ZS-1006	ZSPDT	MICROSWITCH ICX-A2			ZS-1007	ZSPDT		
FLUID DATA	38	ON PROCESS INCREASE - VALVE TO			—					—			
	39	FLUID (1)			STEAM					STEAM			
	40	NORM FLOW (1).	P_{IN}, PSIA/TEMP°F	ΔP	—	—	—			—	—	—	
	41	MAX FLOW (1)	P_{IN}, PSIA/TEMP°F	ΔP	4040	465/950	1295 PSI			1300	380/954	290	
	42	MIN FLOW (1).	P_{IN}, PSIA/TEMP°F	ΔP	0	—	—			0	—	—	
	(43)	CALC CV (2)	VALVE CV		2.2	2.9				2.8	4.1		
	44	MAXIMUM SHUTOFF ΔP			1780 PSI					600 PSI			
	45	TEMP MAX DES	PRESS MAX DES		1010°F / 1750 PSIA					960°F / 600 PSIA			
	46	SP GR AT: 60 °F	O.T.										
	47	VISC. CP AT O.T.			0.030					0.028			
	48	PERCENT FLASH	PERCENT SOLIDS		NONE					NONE			
	(49)	SOUND LEVEL: dB ALLOW	PRED		90 dB	80 dBA				90 dB	72 dBA		
	(50)	MODEL NUMBER			D-100					D-100			

NOTES: (1) FLOW UNITS: LIQUID ____, STEAM #/HR, GAS ____
(2) CORRESPONDS TO NORMAL FLOW UNLESS OTHERWISE NOTED.
(3) IN ACCORDANCE WITH ANSI B16.104 - 1976
(4) SPRING CLOSING AND DEVICE VOLUME TANK TO STROKE OPEN IN 0.8 SECONDS OR LESS ON TRIP SIGNAL TO VALVE (FULL STROKE)

(5) VENDOR TO SUPPLY REDUCERS IF REQUIRED TO MATCH VALVES TO PIPE SIZE AND MATERIAL.
(6) PIPE MATERIAL: INLET & OUTLET - ALLOY STEEL 2¼% CHROME 1% MOLY ASTM A335 GRADE P22.
(7) ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

FORM NO. N-721 REV. 11/77
BASED ON ISA S20

Stearns-Roger CONTROL VALVES

DATA SHEET PV
PAGE 6
S-R PROJECT C-21700
ACCOUNT
DATE 1-11-80
BY C. M.

CLIENT McDONNEL DOUGLAS ASTRONAUTICS CO
PROJECT SOLAR I
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 5-13-80 BY CAM 2 7-15-80 BY CAM 3 9-10-80 BY RCG 4 ____ BY ____
MANUFACTURER COPES-VULCAN SOURCE: QUOTE OF COPES-VULCAN ⚠1

Section	No.	Item	Item	Entry	Entry	Rev.
GENERAL	1	TAG NUMBER		PV-1000		
	2	SERVICE		RS FLASH TK TO		
	3			COND. DUMP DESUPRHTR		
	4	FLOW SHEET		P3-1		
	5	LINE: SIZE, NUMBER		4" VT-1-KEE		
BODY & TRIM	6	TYPE OF BODY		GLOBE		
	(7)	BODY SIZE	PORT SIZE	8"		⚠1
	(8)	GUIDING	NO. OF PORTS	CAGE	1	⚠1
	9	END CONN. & RATING (7)		BUTTWELD 600# (RATED AT 710 PSI @ 960°F PER ANSI-B16.34)		⚠2
	10	PIPE SCHEDULE OR BORE (4)		INLET: 4" SCH 40; OUTLET: 10 SCH. 40		
	(11)	BODY MATERIAL		CR-MO WC9		⚠1
	(12)	PACKING MATERIAL		GRAPHITE ASB		⚠1
	13	LUBRICATOR	ISO VALVE	NO	NO	
	14	BONNET TYPE (HI TEMP)		COOLING EXTENSION		⚠1
	15	TRIM FORM (LOW NOISE)		HUSH TRIM		⚠1
	(16)	TRIM MATERIAL		420 SS HARDENED MALCOMIZED		⚠1
	17	SEAT LEAKAGE CLASS (3)		CLASS IV		
ACTUATOR	18	TYPE OF ACTUATOR		DIAPHRAGM		
	(19)	MODEL NO. & SIZE		D-100-160		⚠1
	(20)	CLOSE AT	OPEN AT	0 PSIG	60 PSIG	⚠1
	(21)	PUSH DOWN TO	FLOW ACTION TO	OPEN	OPEN	⚠1
	22	FAIL POSITION		CLOSED		
	23	HANDWHEEL & LOCATION		YES / TOP		
	24	AIR SUPPLY PRESSURE		80 ~ 100 PSIG		
	25	TRAVEL INDICATOR		YES		
POSIT.	(26)	MODEL NO. (5)		BAILEY AP-5		⚠1
	27	FILTER REQ / GAUGES / BYPASS		YES / YES / YES		
	28	INPUT SIGNAL		4-20 MA		
	(29)	OUTPUT SIGNAL				
~~PILOT~~	30	REDUCERS		INLET: 4"X8" SCH 40 ASTM A-182-F5 w/ 3/4 SOC-O-LET		⚠1 ⚠3
	31			OUTLET 8"X10 SCH 40 ASTM A-182-F5 w/ 3/4" SOC-O-LET		⚠1 ⚠3
	~~32~~	~~MOUNTING~~	~~OUTPUT~~			
	~~33~~	~~ELEMENT TYPE~~	~~RANGE~~			
	34	LVDT MODEL / TAG NO		VPT-T	ZT-1000	⚠1
	(35)	TOTAL VALVE WEIGHT		2090#		⚠1
ACC.	36	SOLENOID	TAG NO/REF	SOV-1000	3 WAY 120 VAC N.C	
	37	LIMIT SWITCHES	TAG NO/REF	LS-1000	2 SPDT MICROSWITCH 1CX-4	⚠1
FLUID DATA	38	ON PROCESS INCREASE - VALVE TO		OPEN		
	39	FLUID (1)		STEAM		
	40	NORM FLOW (1)	P_{IN}, PSIA/TEMP / ΔP	40000	380/567F 349 PSI	
	41	MAX FLOW (1)	P_{IN}, PSIA/TEMP / ΔP	40000	380/954°F 343 PSI	
	42	MIN FLOW (1)	P_{IN}, PSIA/TEMP / ΔP	4000	380/440°F 370 PSI	
	(43)	CALC CV (2) MAX/MIN	VALVE CV	91.3/5.8	121	⚠1
	44	MAXIMUM SHUTOFF ΔP		600		
	45	TEMP MAX DES	MAX: DES PRESS	960°F / 600 PSIG		
	46	SP GR AT 60 °F	O.T.			
	47	VISC. CP AT O.T.		0.020		
	48	PERCENT FLASH	PERCENT SOLIDS	NO		
	(49)	SOUND LEVEL: dB ALLOW	PRED	90 dB	<90 dBA	⚠1
	(50)	MODEL NUMBER		D-100		⚠1

NOTES: (1) FLOW UNITS: LIQUID ____ , STEAM #/HR , GAS ____
(2) CORRESPONDS TO NORMAL FLOW UNLESS OTHERWISE NOTED.
(3) IN ACCORDANCE WITH ANSI 316.104 - 1976
(4) PIPE MATERIAL: INLET - CLASS 900# ALLOY 2 1/4% CHROME 1% MOLY ASTM A335 GR P22
OUTLET - CLASS 300# ALLOY 1 1/4% CHROME 1/2% MOLY ASTM A 335 GR P11.
(5) VENDOR TO SUPPLY SIGNAL CONVERTER CAPABLE OF ACCEPTING A 4 20 MA DC SIGNAL FOR CONVERSION TO 3-15 PSIG BASED ON ISA S20 (TAG NO. PY-1000)
(6) ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.
(7) VENDOR TO SUPPLY [illegible] TO [illegible] AND MATERIAL

FORM NO. N-721 REV. 11/77

Stearns-Roger

CONTROL VALVES

DATA SHEET TV
PAGE 1
S-R PROJECT C-21700
ACCOUNT
DATE 2-5-80
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT SOLAR ONE
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 5-13-80 BY CAM 2 7-15-80 BY CAM 3 12-22-80 BY RWB 4 BY
MANUFACTURER COPES-VULCAN SOURCE: QUOTE OF COPES-VULCAN

GENERAL	1	TAG NUMBER			TV-1004				TV-1002	
	2	SERVICE			CONDENSATE CONTROL TO DESUPERHTR DS-902				CONDENSATE CONTROL TO DESUPERHTR DS-901	
	3									
	4	FLOW SHEET			P3-1				P3-1	
	5	LINE: SIZE, NUMBER			1½"-CO-8-BBA				2½"-CO-12-FEA	
BODY & TRIM	6	TYPE OF BODY			GLOBE				GLOBE	
	(7)	BODY SIZE	PORT SIZE		1½"				1½"	
	(8)	GUIDING	NO. OF PORTS		CAGE	1			CAGE	1
	9	END CONN. & RATING (4)			SOCKETWELD 150#				BUTTWELD - 300 #	
	10	PIPE SCHEDULE OR BORE			1½" SCH. 80			INLET:	2½"; OUTLET = 2" (9)	
	(11)	BODY MATERIAL			CARBON STEEL				CR-MO WC9	
	(12)	PACKING MATERIAL			GRAPHITE ASB				GRAPHITE ASB	
	13	LUBRICATOR	ISO VALVE		NO	NO			NO	NO
	14	BONNET TYPE			PLAIN				PLAIN	
	15	TRIM FORM			CASCADE				EQUAL PERCENTAGE	
	(16)	TRIM MATERIAL			410 SS HARDENED				410 SS HARDENED	
	17	SEAT LEAKAGE CLASS (3)			CLASS IV				CLASS IV	
ACTUATOR	18	TYPE OF ACTUATOR			DIAPHRAGM				DIAPHRAGM (10)	
	(19)	MODEL NO. & SIZE			CV-600-40				CV-600-40	
	(20)	CLOSE AT	OPEN AT		22 PSIG	0 PSIG			47 PSIG	0 PSIG
	(21)	PUSH DOWN TO	FLOW ACTION TO		CLOSE	OPEN			CLOSE	OPEN
	22	FAIL POSITION			OPEN				OPEN (7)	
	23	HANDWHEEL & LOCATION			YES / TOP				YES / TOP	
	24	AIR SUPPLY PRESSURE			80 ~ 100 PSIG				80 ~ 100 PSIG	
	25	TRAVEL INDICATOR			YES				YES	
POSIT.	(26)	MODEL NO. (I/P POSITIONER) (5)			BAILEY AP-5				BAILEY AP-5	
	27	FILTER REG	GAUGES	BYPASS	YES	YES	YES		YES	YES
	28	INPUT SIGNAL			4 - 20 MA				4 - 20 MA	
	(29)	OUTPUT SIGNAL								
PILOT	30	REDUCERS							INLET: 1½" X 2½"	
	31								OUTLET: 1½" X 2"	
	~~32~~	~~MOUNTING~~	~~OUTPUT~~							
	~~33~~	~~ELEMENT: TYPE~~	~~RANGE~~							
	34	LVCT MODEL / TAG NO			VPT-T / ZT-1004				VPT-T / ZT-1002	
	(35)	TOTAL VALVE WEIGHT			110#				110 #	
ACC.	36	SOLENOID	TAG NO/REF		—					
	37	LIMIT SWITCHES	TAG NO/REF		ZS-1004	2SPDT	MICRO SWITCH 1CX-A2		ZS-1002	2SPDT
FLUID DATA	38	ON PROCESS INCREASE - VALVE TO			OPEN				OPEN	
	39	FLUID (1)			CONDENSATE				CONDENSATE	
	40	NORM FLOW (1)	P_{IN}, PSIA/TEMP°	ΔP	-	-	-		27281	126/121°F 14 PSI
	41	MAX FLOW (1)	P_{IN}, PSIA/TEMP	ΔP	2292	107/121°F	17 PSI		27281	126/121°F 14 PSI
	42	MIN FLOW (1)	P_{IN}, PSIA/TEMP°	ΔP	62	147/109°F	112 PSI		17?	140/109°F 14 PSI
	(43)	CALC CV (2) MAX/MIN	VALVE CV		1.12/0.012	2.9			14.7/0.057	30
	44	MAXIMUM SHUTOFF ΔP			160 PSI				160 PSI	
	45	TEMP MAX DES	PRESS MAX DES		135°F / 160 PSIA				135°F / 160 PSIA	
	46	SP GR AT: 60 °F	O.T.							
	47	VISC, CP AT O.T.			0.6				0.6	
	48	PERCENT FLASH	PERCENT SOLIDS		NO				NO	
	(49)	SOUND LEVEL: dB ALLOW	PRED		90 dB	54 dBA			90 dB	53 dBA
	(50)	MODEL NUMBER			CV-600				CV-600	

NOTES: (1) FLOW UNITS: LIQUID #/HR, STEAM, GAS
(2) CORRESPONDS TO NORMAL FLOW UNLESS OTHERWISE NOTED.
(3) IN ACCORDANCE WITH ANSI B16.104 - 1976
(4) VENDOR TO SUPPLY REDUCERS IF REQUIRED TO MATCH VALVES TO PIPE SIZE AND MATERIAL.
(10) FURNISHED WITH STEEL ACTUATOR FRAME & YOKE

(5) VENDOR TO SUPPLY SIGNAL CONVERTER CAPABLE OF ACCEPTING A 4-20 MA DC SIGNAL FOR CONVERSION TO 3-15 PSIG (TAG 110 • TY-1002)
(6) ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY VENDOR
(7) VALVE TO STROKE OPEN TO CONTROL SIGNAL POSITION IN 0.8 SECONDS AND STROKE TO CLOSE SIGNAL POSITION IN 3.0 SEC.
(8) PILOT OPERATED: INLET/OUTLET — ALLOY STEEL 1¼% CHROME ½% MOLY ASTM A335 GRADE P11.
(9) PNEUMATIC BOOSTER RELAY

FORM NO. N-721 REV. 11/77 BASED ON ISA S20

5

TAG n	VALVE STD. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	CONTR. OR REQ. NO.	ROCKETDYNE DESIGNATION	REMARKS	REV. NO.
PSV-2021	SP42 -004	1½" x 3" 300#	ANGLE	1500	BW x RF	WCB	CROSBY	(1)	GFE	RPWRV-1	RELIEVES @ 2000 PSIG	
PSV-2022	SP42 -004	1½" x 3" 300#	ANGLE	1500	BW x RF	WCB	CROSBY	(1)	GFE	RPWRV-2	RELIEVES @ 2000 PSIG	
PSV-2023	SP42 -004	1½" x 3" 300#	ANGLE	1500	BW x RF	WCB	CROSBY	(1)	GFE	RPWRV-3	RELIEVES @ 2000 PSIG	
PSV-2909	SP42 -005	2" x 6" 300#	ANGLE	2500	BW x RF	WC9	CROSBY	(2)	GFE	RMSRV-1	RELIEVES @ 1765 PSIG	
PSV-2910	SP42 -005	2" x 6" 300#	ANGLE	2500	BW x RF	WC9	CROSBY	(2)	GFE	RMSRV-2	RELIEVES @ 1818 PSIG	
PSV-2912	SP42 -006	4" x 6" 300#	ANGLE	900	BW x RE	WC9	CROSBY	(2)	GFE	RFSRV	RELIEVES @ 600 PSIG	

(1) P&ID NO. 40P2005131763
(2) P&ID NO. 40P2005131767

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ROCKWELL INTERNATIONAL, ROCKETDYNE

RELIEF VALVE LIST 2

CUSTOMER DEPT. OF ENERGY

PROJECT 10 MW$_e$ SOLAR PILOT PLANT

LOCATION DAGGETT, CALIF

SYSTEM P24-7 RS

ORDER NO. PAGE OF

TAG NO.	VALVE STD. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	CONTR. OR REQ. NO.	ROCKETDYNE DESIGNATION	REMARKS	REV. NO
V-FW-2-201	SP42 -014	4"	ANGLE	1500	BW	WCB	VALTEK	(1)	GFE	RWIV	MANUAL	
V-FW-200-202	SP42 -058	4"	PISTON	1500	BW	WCB	ROCKWELL	(1)	GFE	RPWICK	CHECK	
Y-FW-228-203	SP42 -014	4"	ANGLE	1500	BW	WCB	VALTEK	(1)	GFE	RPWOV	MANUAL	
V-CO-201-201	SP42 -048	3"	GLOBE	1500	BW	WC9	ROCKWELL	(2)	GFE	RAWIV	MANUAL	3
V-TO-10-329	SP42 -076	10"	GATE	600	BW	WCB	ROCKWELL 1611Y	(3)	GFE	TUFIS	MANUAL	
V-TO-22-330	SP42 -077	4"	GLOBE	150	FL	WCB	VALTEK MARK I	(3)	GFE	TFAIS-1	MANUAL	
Y-TO-3-328	SP42 -076	10"	GATE	600	BW	WCB	ROCKWELL 1611Y	(3)	GFE	TUFEIS	MANUAL	
V-UG-1-401	SP42 -118	6"	GATE	150	FL	WCB	POWELL 150S N	(3)	GFE	UGIS-1	MANUAL	3

(1) P&ID NO. 40P2005131763
(2) P&ID NO. 40P2005131767
(3) P&ID NO. 40P3005132196.

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ROCKWELL INTERNATIONAL, ROCKETDYNE

VALVE LIST 2

CUSTOMER DEPT. OF ENERGY
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIF.
SYSTEM P 26-2 RS 1 TSS
ORDER NO. PAGE 01

TAG NO.	VALVE STD. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	CONTR. OR REQ. NO.	ROCKETDYNE DESIGNATION	REMARKS	REF. NO.
AOV-2007	SP42 -038	½"	ANGLE	1500	BW	WC9	VALTEK	(1)	GFE	RPWVV	AIR OPERATED	
AOV-2901	SP42 -039	1"	GLOBE	2500	BW	WC9	VALTEK	(1)	GFE	RAWDV	AIR OPERATED	
AOV-2911	SP42 -040	4"	GLOBE	2500	BW	WC9	VALTEK	(1)	GFE	RFSIV	AIR OPERATED	
AOV-2004	SP42 -044	4"	ANGLE	1500	BW	WCB	VALTEK	(2)	GFE	RPWIV	AIR OPERATED	
AOV-2902	SP42 -041	3"	ANGLE	2500	BW	WC9	VALTEK	(1)	GFE	RMSVV-1	AIR OPERATED	
AOV-2903	SP42 -042	½"	ANGLE	2500	BW	WC9	VALTEK	(1)	GFE	RMSVV-2	AIR OPERATED	
SOV-2019A	SP42 -043	1"	GLOBE	1000	NPT	WCB	ATKOMATIC	(1)	GFE	RNPV-1-1	SOLENOID OPERATED, N.C.	3
SOV-2016A	SP42 -043	1"	GLOBE	1000	NPT	WCB	ATKOMATIC	(1)	GFE	RNPV-2-1	SOLENOID OPERATED, N.C.	3
SOV-2019B	SP42 -043	1"	GLOBE	1000	NPT	WCB	ATKOMATIC	(1)	GFE	RNPV-1-2	SOLENOID OPERATED, N.O.	3
SOV-2016B	SP42 -043	1"	GLOBE	1000	NPT	WCB	ATKOMATIC	(1)	GFE	RNPV-2-2	SOLENOID OPERATED, N.O.	3
AOV-3001	SP42 -025	10"	BUTTERFLY	150	RF	WCB	VALTEK VALDISC	(3)	GFE	TUFBV-1	AIR OPERATED	
AOV-3002	SP42 -025	10"	BUTTERFLY	150	RF	WCB	VALTEK VALDISC	(3)	GFE	TUFCV	AIR OPERATED	
AOV-3003	SP42 -025	10"	BUTTERFLY	150	RF	WCB	VALTEK VALDISC	(3)	GFE	TUFBV-2	AIR OPERATED	
AOV-3004	SP42 -025	10"	BUTTERFLY	150	RF	WCB	VALTEK VALDISC	(3)	GFE	TUFEV	AIR OPERATED	
AOV-3005	SP42 -028	4"	GLOBE	150	BW	WCB	VALTEK MARK I	(3)	GFE	TFAIV-3	AIR OPERATED	
AOV-4014	SP42 -117	6"	GLOBE	150	FL	WCB	VALTEK MARK I	(3)	GFE	UGPCV	AIR OPERATED	

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ROCKWELL INTERNATIONAL, ROCKETDYNE

STOP CONTROL VALVES LIST 2

CUSTOMER DEPT. OF ENERGY
PROJECT 10MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIF.
SYSTEM F24-3 RS & TSS
ORDER NO. PAGE 01

TAG NO.	VALVE STD. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	CONTR. OR REQ. NO.	ROCKETDYNE DESIGNATION	REMARKS	REV. NO.
AOV-2914	SP42-122	1"	GLOBE	1500	BW	WC9	VALTEK	(1)	GFE	RFSOV	AIR OPERATED	3
AOV-2915	SP43-123	1"	GLOBE	2500	BW	WC9	VALTEK	(1)	GFE	RFSIS	AIR OPERATED	3

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ROCKWELL INTERNATIONAL
ROCKETDYNE

AOV VALVE LIST 4

CUSTOMER DEPT. OF ENERGY
PROJECT 10MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
SYSTEM P26-3 RS & TSS
ORDER NO. PAGE OF

FORM 67.238 REV. 2-76

TAG NO.	SPEC. NO.	SIZE	TYPE	PRESS RATE	TEMP °F max.	ENDS	BODY MTL	STRAINER MTL	% OPN	SIZE OPN	FLUID	ΔP PSID	MFG & NO.	REMARKS ROCKETDYNE DESIGNATION
PF-FW-2-201	SP42-045	4"	TEE	1500	600	BW	WCB	SST			WATER	3 MAX	WINTEC	RNF 3
PF-N-200-201	SP42-047	1"	TEE	900	113	NPT	WCB	SST			GN_2	3 MAX	WINTEC	RNF 3

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2		PERMANENT STRAINERS2
1		CUSTOMER DEPT. OF ENERGY
0	7-26-80	PROJECT 10 MWe SOLAR PILOT PLT
	5-2-80	LOCATION DAGGETT, CALIF
		ORDER NO. PAGE OF

TAG NO.	VALVE STD. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	CONTR. OR REQ. NO.	ROCKETDYNE DESIGNATION	REMARKS	
~~NONE~~	SP42 -016	~~1"~~	~~GLOBE~~	~~2500~~	~~BW~~	~~WC9~~	ROCKWELL	~~(1)~~	~~GFE~~	~~RFSEB~~	~~MANUAL~~	△1
~~NONE~~	SP42 -047	~~1"~~	~~GLOBE~~	~~1500~~	~~BW~~	~~WC9~~	ROCKWELL	~~(1)~~	~~GFE~~	~~RESOV~~	~~MANUAL~~	△1
NONE	SP42 -055	1"	OPT.	900	NPT	WCB	ROCKWELL	(1)	GFE	RNMV	MANUAL	
NONE	SP42 -059	1"	OPT.	2500	BW	WC9	ROCKWELL	(1)	GFE	RMNCK-1	CHECK	
NONE	SP42 -057	1"	OPT.	2500	BW	WC9	ROCKWELL	(1)	GFE	RMNCK-2	CHECK	
NONE	SP42 -060	1"	OPT.	1500	BW	WCB	ROCKWELL	(1)	GFE	RPNCK-1	CHECK	
NONE	SP42 -070	1"	OPT.	1500	BW	WCB	ROCKWELL	(1)	GFE	RPNCK-2	CHECK	
NONE	SP42 -055	1/2"	OPT.	2500	BW	WC9	CIRCLE SEAL	(1),(2),(3)	GFE	GIS	MANUAL	
NONE	SP42 -054	1/2"	2-VALVE MANIFOLD	1500	NPT	WCB	AGCO	(1),(2),(3)	GFE	GV	MANUAL	
NONE	SP42 -056	1/2"	5-VALVE MANIFOLD	1500	NPT	WCB	AGCO	(1),(2),(3)	GFE	DPGV.	MANUAL	
NONE	SP42 -016	1"	GLOBE	2500	BW	WC9	ROCKWELL	(1)	GFE	RMNIS	MANUAL	
NONE	SP42 -119	1"	GLOBE	1500	BW	WCB	ROCKWELL	(1)	GFE	RPNIS	MANUAL	
NONE	SP42 -116	3/4"	GLOBE	600	SW	WCB	ROCKWELL	(3)	GFE	TOVV	MANUAL	
NONE	NONE	1"	BALL	500 @ 100°F	NPT	BR	HILLS-McCANNA	(4)	GFE	TIAIS-10	MANUAL	△2
NONE	NONE	3/4"	BALL	500 @ 100°F	NPT	BR	HILLS-McCANNA	(4)	GFE	TIAIS-11	MANUAL	△2
NONE	NONE	1/2"	BALL	500 @ 100°F	NPT	BR	HILLS-McCANNA	(4)	GFE	TIAADV-10	MANUAL	△2

(1) P&ID NO. 40P2005131767
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(4) P&ID NO. 40P7005133147

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ROCKWELL INTERNATIONAL, ROCKETDYNE

VALVE LIST

CUSTOMER DEPT. OF ENERGY
PROJECT 10MW. SOLAR PILOT PLANT
LOCATION DAGGETT, CALIF.
SYSTEM P 26-12 RS & TSS
SPEC. NO. PAGE 1 OF 2

TAG NO.	VALVE SID. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	QUANTITY REQ. NO.	NUCLEAR DESIGNATION	REMARKS	REV. NO.
NONE	NONE	1/2"	BALL	500 @ 100°F	NPT	BR	HILLS-McCANNA	(4)	GFE	TIAADV-11	MANUAL	
NONE	SP42-127	1"	PISTON CHECK	600	SKW	A105	ROCKWELL-EDWARD	(3)	GFE	UNCK-2	CHECK	
NONE	SP42-128	1"	BALL	300 @ 100°F	NPT	C.S.	HILLS-McCANNA	(3)	GFE	UNIS-4	MANUAL	
NONE	SP42-129	1"	GLOBE	600	SKW	A105	ROCKWELL-EDWARD	(3)	GFE	UNIS-1	MANUAL	
NONE	SP42-129	1"	GLOBE	600	SKW	A105	ROCKWELL-EDWARD	(3)	GFE	UNIS-5	MANUAL	
NONE	SP42-130	1/2"	GLOBE	600	NPT	A105	ROCKWELL-EDWARD	(3)	GFE	UNIS-3	MANUAL	

REV.	DATE
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ROCKWELL INTERNATIONAL, ROCKETDYNE

VALVE LIST

CUSTOMER DEPT. OF ENERGY
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIF
SYSTEM P26-12 RS & TSS
ORDER NO. PAGE 2 OF 2

APPENDIX 2

DRAWING LIST

ROCKWELL INTERNATIONAL ROCKETDYNE DIVISION DRAWINGS

Drawing No.		Rev.	Title	
40I2002131	679	1	Press. Inst. Detail Process Conn.	4
	680		Deleted	4
	681	0	Press. Inst. Detail Process Conn.	
	682	0	Press. Inst. Detail Differential & Liquid Level PC	
40P2005131	763	3	P&ID RS Preheater Feedwater	1,3,6
	764 Sh. 1	2	P&ID RS Boiler RB204 - RB206	1,3,6
	764 Sh. 2	2	P&ID RS Boiler RB207 - RB209	1,3,6
	765 Sh. 1	2	P&ID RS Boiler RB210 - RB212	1,3,6
	765 Sh. 2	2	P&ID RS Boiler RB213 - RB215	1,3,6
	766 Sh. 1	2	P&ID RS Boiler RB216 - RB218	1,3,6
	766 Sh. 2	2	P&ID RS Boiler RB219 - RB221	1,3,6
	767	3	P&ID RS Main Steam Manifold, GN_2, & Drain	1,3,6
40M2005131	925	1	Core Piping Plan Elev. 379'0"	1
	926	1	Core Piping Plan Elev. 375'0"	1
	927	3	Core Piping Plan Elev. 372'6"	1,3,4
	928	1	Core Piping Plan Elev. 367'3"	1
	929	1	Core Piping Plan Elev. 364'0"	
	930	1	Core Piping Plan Elev. 363'0"	
	931	1	Core Piping Plan Elev. 350'0"	
	932	3	Core Piping Plan Elev. 347'6"/341'6"	1,3,4
	933	1	Core Piping Plan Elev. 337'0"	
	934	3	Core Piping Plan Elev. 331'0"	1,3,4
	935	1	Core Piping Plan Elev. 324'0"	1,3
	937	3	Core Piping Elev. Main Steam Header Lines & Vent Upper	1,3,4
	938	0	Core Piping Elev. Main Steam Header & Vent Lines Lower	
	939	1	Core Piping Elev. Start Sys. Steam Line Upper	1
	940	3	Core Piping Elev. Start Sys. Steam Line Lower	1,3,4
	941	1	Core Piping Elev. M.S. Line Anchor & Inst. Details	3
	942	2	Core Piping Elev. Condensate Line Upper	1,4
	943	2	Core Piping Elev. Condensate Line Lower	3,4
	944	2	Feed Water Elev. Upper	2,4
	945	3	Feed Water Elev. Lower	1,3,4
	946	1	Elevation, Boiler & Preheater Drains	1
	948	0	GN_2 Reducing Panel Assy	

ROCKWELL INTERNATIONAL ROCKETDYNE DIVISION DRAWINGS (CONTD)

Drawing No.	Rev.	Title	
958	1	GN_2 & Inst. Air Elevation	1,3
962	2	Pipe Support #1	1,3
963	1	Pipe Support #2	1
964	1	Pipe Support #3	1
965	0	Module Installation	
966	0	Module Installation Guide	
967	1	Module Installation Fixtures	1
968	1	Heat Shield - Level 16 to 17	1
969	1	Heat Shield Details	1
970	1	Pipe Support #4	1
971	3	Notes & Pipe Support Data	1,3,4
40M3005132 173	0	Interconnect Skid Piping	
40P3005132 192	3	P & ID TSS Charging Oil	2,3,6
193 SHT 1	3	P & ID TSS Charging Steam and Condensate	2,3,6
193 SHT 2	3	P & ID TSS Charging Steam and Condensate	2,3,6
194	3	P & ID TSS Extraction Oil	2,3,6
195	3	P & ID TSS Extraction Steam and Condensate	2,3,6
196	2	P & ID Thermal Storage Unit and Ullage Maintenance Unit	2,3,6

ROCKWELL INTERNATIONAL ROCKETDYNE DIVISION DRAWINGS (INFORMATION ONLY)

GA000-90907-M8	0	UMU Skid Assembly	1
-M30	4	Skid Assembly 301 - Piping Plan & Elev.	1,4
-M31	4	Skid Assembly 301 - Piping Sections & Elev.	4
-M35	0	Skid Assembly 302 & 303 - Piping Plan	1
-M36	1	Skid Assembly 302 & 303-Piping Elev.	1
-M40	1	Skid Assembly 304 - Piping Plan & Elev.	
-M50	0	Skid Assembly 305 & 306 - Piping Plan, Elev. & Sections	
-M55	1	Skid Assembly 307 & 308 - Piping Plan	1
-M56	1	Skid Assembly 307 & 308 - Side Elev.	1
-M57	1	Skid Assembly 307 & 308 - Front & End Elev.	1
-M60	1	Skid Assembly 309 - Piping Plan & Elev.	1
-M75	1	Skid Assemblies Typical Sling Assy.	1

ROCKWELL INTERNATIONAL ROCKETDYNE DIVISION DRAWINGS (CONTD)

TEMPORARY FLUSHING CONNECTIONS 6

NOTE: The following temporary flush drawings are original contract drawings marked-up to show temporary piping interfaces.

Drawing No.		Rev.	Title
40M2005131	925-B	0	Temp. Flush Conn., Core Piping Plan Elev. 379'-0"
	926-A	1	Temp. Flush Conn., Core Piping Plan Elev. 375'-0"
	927-A	3	Temp. Flush Conn., Core Piping Plan Elev. 372'-6"
	928-A	1	Temp. Flush Conn., Core Piping Plan Elev. 367'-3"
	929-A	1	Temp. Flush Conn., Core Piping Plan Elev. 364'-0"
	930-A	1	Temp. Flush Conn., Core Piping Plan Elev. 363'-0"
	931-A	1	Temp. Flush Conn., Core Piping Plan Elev. 350'-0"
	932-A	3	Temp. Flush Conn., Core Piping Plan Elev. 347'-6"/341'-6"
	933-B	1	Temp. Flush Conn., Core Piping Plan Elev. 337'-0"
	934-A	3	Temp. Flush Conn., Core Piping Plan Elev. 331'-0"
	940-A	3	Temp. Flush Conn., Core Piping Elev.
	944-A	2	Temp. Flush Conn., Feed Water Elev.
	945-B	3	Temp. Flush Conn., Feed Water Elev.
	658-A	4	Temp. Flush Conn., Preheater Module Assy.
	659-A	3	Temp. Flush Conn., Boiler Module Assy.
	660-A	4	Temp. Flush Conn., Preheater Feed Water and Drain System
GA000-90902	M130	4	Temp. Flush Conn., SA-301 Piping Plan & Elev.
	M135	3	Temp. Flush Conn., SA-302 & 303 Piping Plan
	M136	3	Temp. Flush Conn., SA-302 & 303 Piping Elev.
	M150	1	Temp. Piping Conn., SA-305 & 306 Piping Plan & Elev.
	M155	2	Temp. Flush Conn., SA-307 & 308 Piping Plan
	M156	2	Temp. Flush Conn., SA-307 & 308 Elev.
SKIE	M809	0	Flush Conn., SA-307 & 308

STEARNS-ROGER ENGINEERING CORPORATION DRAWINGS

Drawing No.	S-R Drawing No.	Sheet No.	Rev.	Title	
40A7005133101	XL22934	A5-1	0	Warehouse Plan & Elevations & Sections	
40A7005133081	XL22934	A6-3	1	Environmental Electronics Instrument Enclosures	4,5
40A7005133255	XL22934	A8-1	0	Raw Service Water Pump Bldg.	
40A7005133256	XL22934	A8-2	1	Secondary Fire Pump Bldg.	2
40A7005133105	XL22934	A8-3	0	Pump Buildings Sections & Details	
40A2005131600	XL22934	A12-1	0	Receiver Tower Electronic Room	
40A2005131601	XL22934	A12-2	0	Receiver Tower Electronic Room	
40C700S133116	XL22934	C17-2	3	Secondary Fire Pump Bldg. - Foundation	2,5
40C1005133900	XL22934	G1-1	6	General Arrangement - Site Plot Plan	2
40C1005133901	XL22934	G1-2	3	General Arrangement - Core Area	2,5
40P7005133103	XL22934	P1-1	2	Piping Symbols & Nomenclature	4,6
40P7002133104	9033/4	P1-2	4	Line Schedule	2,4,5,6
40P7005133140	XL22934	P3-1	4	P&ID - Main Steam EPGS Area	2,4,5,6
40P7005133141	XL22934	P3-2	4	P&ID -Condensate & Feedwater EPGS Area	2,4,5,6
40P7005133145	XL22934	P3-6	4	P&ID - Demineralized Water PSS Area	2,4,6
40P7005133147	XL22934	P3-8	4	P&ID - Instr. Air & Service Air PSS Area	2,4,5,6

STEARNS-ROGER ENGINEERING CORPORATION DRAWINGS (CONTD)

Drawing No.	S-R Drawing No.	Sheet No.	Rev.	Title	
40P7005133148	XL22934	P3-9	3	P&ID - Fire Protection PSS Area	2,4,6
40P7005133149	XL22934	P3-10	3	P&ID - Liquid Waste & Drains PSS Area	2,4,5
40P7005133150	XL22934	P3-11	4	P&ID - Service Water PSS Area	2,4,5,6
40P7005133151	XL22934	P3-12A	1	Cycle Flush and Steam Blow (PSS)	2,5,6
40P7005133151	XL22934	P3-12B	1	Cycle Flush and Steam Blow (PSS)	2,5,6
40P7005133151	XL22934	P3-12C	1	Cycle Flush and Steam Blow (PSS)	2,5,6
40P7005133152	XL22934	P3-13	2	P&ID - Inerting Gas & Misc. PSS Area	2,4
40P7005133153	XL22934	P3-14	0	P&ID - Water Conservation PSS Area	
40P7005133155	XL22934	P6-1	3	Raw/Service Water Pump Bldg - Plan & Sections	2,4,5
40P7005133246	XL22934	P6-2	3	Secondary Fire Pump Building Plan & Sections	2,4,6
40P7005133154	XL22934	P6-3	2	Pump Building Floor Drains	2
40P7005133247	XL22934	P7-1	1	Fire Protection System	2
40P7005133156	XL22934	P8-1	2	Underground Yard Piping Plot Plan - Core Area	2,4
40P7005133157	XL22934	P8-2	1	Underground Yard Piping Plot Plan - Souther Area	2
40P7005133158	XL22934	P8-3	1	Underground Yard Piping West Well A)	2

STEARNS-ROGER ENGINEERING CORPORATION DRAWINGS (CONTD)

Drawing No.	S-R Drawing No.	Sheet No.	Rev.	Title	
40P7005133159	XL22934	P8-4	7	Underground Yard TSS Drainage	2,4,5,6
40P7005133160	XL22934	P8-5	4	Underground Yard Piping Sections & Details	2,4,5
40P7005133161	XL22934	P8-6	5	Underground Yard Piping Misc Details	2,4,5
40P7005133165	XL22934	P9-1	2	Above Ground Yard Piping Key Plan	2,5
40P2005131901	XL22934	P9-2	1	Above Ground Yard Piping Receiver Twr Piping Plan & Section	2
40P2005131904	XL22934	P9-3	2	Above Ground Yard Piping Receiver Twr Piping Plans	2,5
40P2005131905	XL22934	P9-4	3	Above Ground Yard Piping RS Twr Piping Sect. & Details	2,4,6
40P3005132020	XL22934	P9-5	4	Above Ground Yard Piping Thermal Storage Unit Plan	2,4,5,6
40P3005132021	XL22934	P9-6	4	Above Ground Yard Piping Thermal Storage Unit Section & Elev.	2,4,5,6
40P7005133248	XL22934	P9-7	3	Above Ground Yard Piping Plan - North Half 110' Level	2,4,5
40P7005133249	XL22934	P9-8	4	Above Ground Yard Piping Plan - South Half 110' Level	2,4,5,6
40P7005133250	XL22934	P9-9	3	Above Ground Yard Piping Plan - North Half 115' Level	2,5,6
40P7005133251	XL22934	P9-10	4	Above Ground Yard Piping Plan - South Half 115' Level	2,4,5,6

STEARNS-ROGER ENGINEERING CORPORATION DRAWINGS (CONTD)

Drawing No.	S-R Drawing No.	Sheet No.	Rev.	Title	
40P7005133252	XL22934	P9-11	2	Above Ground Yard Piping Plan - North Half 120' Level	2,5
40P7005133253	XL22934	P9-12	1	Above Ground Yard Piping Plan - South Half 120' Level	2
40P7005133162	XL22934	P9-13	1	Above Ground Yard Piping - Pipe Rack Sections	2
40P7005133163	XL22934	P9-14	4	Above Ground Yard Piping Sections	2,4,5,6
40P7005133108	XL22934	P9-15	4	Above Ground Yard Piping EPGS Area Plans & Sections	2,4,5,6
40P7005133164	XL22934	P9-16	2	Above Ground Yard Piping Water Treatment Area Plan	4,5
40P7005132027	XL22934	P9-17	3	Above Ground Yard Piping Make-Up & UMU Area	2,5,6
40P7005133109	XL22934	P9-18	2	Above Ground Yard Piping Details	2,4
40P7005133180	XL22934	P9-19	4	Above Ground Piping Details	2,4,5,6
40P7005133065	XL22934	P9-20	2	Above Ground Piping Details	2,5
40P7005133185	XL22934	P9-21	0	Temp. Steam Blow, Velocity Flush and Chem. Piping-PSS Area	5,6
40P7005133197	XL22934	P9-22	0	Temp. Steam Blow, Velocity Flush and Chem. Piping-PSS Area	5,6
40P7004I	1165/8	P14-1	2	98 Secondary Pipe Supports Oil Lines	2,4
40P7004I	1165/8	P14-2	4	150 Secondary Pipe Supports 2-1/2" & Larger Hot Lines	2,4,5,6

STEARNS-ROGER ENGINEERING CORPORATION DRAWINGS (CONTD)

Drawing No.	S-R Drawing No.	Sheet No.	Rev.	Title	
40P7004I	1165/8	P14-3	3	65 Secondary Pipe Supports 2" & Smaller Hot Lines	2,3
40P7004I	1165/8	P14-4	4	115 Secondary Pipe Supports 2-1/2" & Larger Cold Lines	2,4,5,6
40P3002132009	9033/4	P25-5	0	TSS Blowdown Tank	
40P7005I	1165/8	P26-1	2	Nomenclature List	2,4
40P7006I	1165/8	P26-2	4	Valve List - 2-1/2 Inch and Larger	2,4,5,6
40P7007I	1165/8	P26-3	0	Motor Operated Valves	
40P7008I	1165/8	P26-4	1	Permanent Strainers	2
40P7009I	1165/8	P26-5	2	Temporary Strainers	2,4
40P70010I	1165/8	P26-6	0	Expansion Joints	
40P70011I	1165/8	P26-7	1	Pressure Relief Valves	5
40P70012I	1165/8	P26-8	0	Steam Traps	
40P70013I	1165/8	P26-9	1	Flow Restriction Orifices	2
40P70014I	1165/8	P26-10	0	Flex Hose List	
40P70015I	1165/8	P26-11	4	Interface List	2,4,5,6
40P70016I	1165/8	P60-1	7	144 Sheets PSS Area Primary Pipe Supports	2,6
40P70017I	1165/8	P60-2	1	66 Sheets PSS Area Snubbers	4
40C2005131812	XL22934	S32-10	2	BCS Target Support Framing	
40M6005132902	XL22934	M150-1	0	BCS Target Elevations, Sections & Details	
40M6005132903	XL22934	M150-2	0	BCS Target, Sections & Details	

STEARNS-ROGER ENGINEERING CORPORATION DRAWINGS (CONTD)

Drawing No.	S-R Drawing No.	Sheet No.	Rev.	Title	
40M60051 32904	XL22934	M150-3	2	BCS Target Sensor/ Shutter Locations and Details	2,5
40M60051 32905	XL22934	M150-4	0	BCS Target Shipping Crate Details	
40M70051 33123	XL22934	M4-1	2	HVAC Equipment Schedules, Symbols, Abbreviations & General Notes	4,5
40M70051 33124	XL22934	M4-2	1	Miscellaneous Structures and Plans	5
40M70051 33130	XL22934	M4-3	2	Sections, Details and Control Diagrams	4,5
40M70051 33254	XL22934	M4-4	1	HVAC - Environmental Electronics & Instrument Enclosure	4,5
40I70051 33201	XL22934	I3-1	2	PSS Instruments Locations	4
40I70021 33059	9033/4	I4-1 to 20	0	Instrument Installation Details	
		I4-4	1		4
		I4-5	1		4
		I4-12	1		4
40I700217I	PIT 1,4,5,6,7,9	I7 Series	0	PIT Instrument Data Sheet	2,4
	PIT-2		1		4
	PIT 3		1		4
	PIT-8		Void		4
40I700217I	TE 1A thru C and TE 2 thru A	I7 Series	1	TE Instrument Data Sheet	4 4
40I700217I	TT 1 - A	I7 Series	1	TT Instrument Data Sheet	4
	TT 1 - B		2		4
	TT 2 - A,B		Void		4
40I700217I	TS 1	I7 Series	0	TS Instrument Data Sheet	
40I700217I	LS 1 thru 3	I7 Series	1	LS Instrument Data Sheet	4
40I700217I	LV 4,5,6,8	I7 Series	0	LV Instrument Data Sheet	4
	LV 7		1		4

STEARNS-ROGER ENGINEERING CORPORATION DRAWINGS (CONTD)

Drawing No.	S-R Drawing No.	Sheet No.	Rev.	Title	
40I700217I	SOV 1 thru 3 SOV 7 thru 10	I7 Series	0	SOV Instrument Data Sheet	
40I700217I	TW 1A thru D,2	I7 Series	1	TW Instrument Data Sheet	2,4
40I700217I	PS 2	I7 Series	0	PS Instrument Data Sheet	
40I700217I	TI 1	I7 Series	0	TI Instrument Data Sheet	
40I700217I	PV 6 thru 10	I7 Series	0	PV Instrument Data Sheet	
40I700217I	LV 7	I7 Series	0	LV Instrument Data Sheet	
40I700217I	PI 1, 2, 3, 4	I7 Series	0	PI Instrument Data Sheet	2
40I700217I	TC 1	I7 Series	0	TC Instrument Data Sheet	
40I700217I	TV 1, 2	I7 Series	0	TV Instrument Data Sheet	
40I700217I	TV 3	I7 Series	1	TV Instrument Data Sheet	4,6
40I700217I	FE 1	I7 Series	1	FE Instrument Data Sheet	2,4,6
	FE 2		Void		4
40I700217I	FT 1	I7 Series	0	FT Instrument Data Sheet	
40I700217I	PV 1 thru 3	I7 Series	0	PV Instrument Data Sheet	
40I700217I	AOV 1	I7 Series	0	AOV Instrument Data Sheet	
40I700217I	FV 1	I7 Series	0	FV Instrument Data Sheet	
40I700217I	PSV 1	I7 Series	0	PSV Instrument Data Sheet	4

STEARNS-ROGER ENGINEERING CORPORATION DRAWINGS (CONTD)

Drawing No.	S-R Drawing No.	Sheet No.	Rev.	Title	
40I700217I	PI-BOB, BOC BOD, BOE	I7 Series	0	PI Instrument Data Sheet	5
40I700217I	SOV-11	I7 Series	0	SOV Instrument Data Sheet	6
40I700217I	TC-2	I7 Series	0	TC Instrument Data Sheet	6
40I700217I	TE-3	I7 Series	0	TE Instrument Data Sheet	6
40I700218I	11165/8	I11	4	PSS Instrument Index	2,4,6
40I700219I	11165/8	I11-T	0	PSS Temporary Instruments	5

STEARNS-ROGER ENGINEERING CORPORATION DRAWINGS (FOR INFORMATION ONLY)

Drawing No.	S-R Drawing No.	Sheet No.	Rev.	Title
40A3005132000	XL22934	A6-1	1	Thermal Storage Control Buildings
40A3005132004	XL22934	A6-2	1	Thermal Storage Electrical Equipment Building
40C1005133905	XL22934	C1-1	1	Settlement Record
40C1005133907	XL22934	C2-1	4	Core Area-Key Plan & Gen Notes
40C7005133110	XL22934	C11-1	2	Electrical Manholes and Misc. Foundations
40C7005133111	XL22934	C11-2	0	Electrical Manholes
40C3005132005	XL22934	C13-1	1	Thermal Storage Control Building & Electrical Building Foundations
40C7005133115	XL22934	C17-1	1	Raw/Service Water Pump Bldg. Foundation
40C7005133117	XL22934	C17-3	1	Covered Pipe Trench & Misc. Details
40C7005133118	XL22934	C17-4	0	Pump Bldgs. Sections & Details
40C7005133122	XL22934	C19-1	0	Warehouse Building Warehouse Fndn & Floor Slab
40C2005131801	XL22934	C37-1	0	Receiver Tower Foundation Plans, Sections & Details
40C3005132001	XL22934	C38-1	0	TSS Equipment Foundations
40C3005132002	XL22934	C38-2	1	TSS containment Foundation Plan Sections & Details

STEARNS-ROGER ENGINEERING CORPORATION DRAWINGS (FOR INFORMATION ONLY)

Drawing No.	S-R Drawing No.	Sheet No.	Rev.	Title
40C3005132003	XL22934	C38-3	0	TSS Tank Sections & Details
40C3005132022	XL22934	C38-4	1	TSS Misc. Foundations
40C7005133125	XL22934	C39-1	1	Pipe Rack Foundations
40C7005133126	XL22934	C39-2	1	Misc. Slabs & Foundations
40C1005133903	XL22934	G1-4	1	General Arrangement - Receiver Tower
40C7005133128	XL22934	S17-1	0	Raw/Service Water Pump Bldg.
40C7005133129	XL22934	S17-2	0	Secondary Fire Pump Building
40C3005132006	XL22934	S26-1	1	Thermal Storage Control Buildings
40C3005132007	XL22934	S26-2	1	Thermal Storage Electrical Building
40C2005131803	XL22934	S32-1	0	Exterior Elevations
40C2005131804	XL22934	S32-2	1	Framing Plans-Platform Levels 0, 1
40C2005131805	XL22934	S32-3	0	Framing Plans-Platform Levels 2,3,4,5,6
40C2005131806	XL22934	S32-4	1	Framing Plans-Platform Levels 7,8,9,10,11
40C2005131807	XL22934	S32-5	3	Framing Plans-Platform Levels 12,13,14,15
40C2005131808	XL22934	S32-6	0	Stair Sections & Details
40C2005131809	XL22934	S32-7	0	Stair Sections & Details

STEARNS-ROGER ENGINEERING CORPORATION DRAWINGS (FOR INFORMATION ONLY) (CONTD)

Drawing No.	S-R Drawing No.	Sheet No.	Rev.	Title
40C2005131810	XL22934	S32-8	0	Sections & Details
40C2005131811	XL22934	S32-9	3	Sections & Details
40C7005133131	XL22934	S33-1	1	Pipe Rack Plan at Elev. 120'-0"
40C7005133132	XL22934	S33-2	1	Pipe Rack Plan at Elev. 110'-0"
40C7005133133	XL22934	S33-3	1	Pipe Rack Elevations
40C7005133134	XL22934	S33-4	1	Pipe Rack Plans, Sections & Details
40C7005133135	XL22934	S33-5	0	Pipe Rack Sections & Details
40C1005133911	XL22934	Y1-1	0	Site Plot Plan
40C1005133921	XL22934	Y2-1	0	Initial Grading Plan
40C1005133922	XL22934	Y2-2	1	Grading Sections & Details
40C1005133923	XL22934	Y2-3	1	Core Area Layot & Grading Plan
40C1005133924	XL22934	Y2-4	0	Core Area Grading Sections & Details
40E7002133224	9033/4	E21	2	Heat Tracing List 5
40P7002133178	9033/4	P25-1	0	Demineralized Water Tank
40P7002133184	9033/4	P25-2	0	Raw Water Storage Tank
40P7002133186	9033/4	P25-4	0	Caloria Make-Up Tank

SHEETS	LINE NUMBER SERIES	SERVICE ABBREVIATIONS	SERVICE
1	300	AS	AUXILIARY STEAM
1	300	BD	BLOWDOWN
2	200, 300	CO	CONDENSATE
3	200, 300	FW	FEEDWATER
2	200, 300	MS	MAIN STEAM
1	200	N	NITROGEN
2	200, 300	ST	STEAM
2	300	TO	THERMAL OIL
2	200, 300	VT	VENTS

DRAWN		
CHECKED		6-29-83
APPROVED		
APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE INDEX

ORDER NO C-21345

DWG NO

SHEET NO FI-2

* LINE NO.	* LINE SIZE	* DESCRIPTION		OPERATING CONDITIONS			INSUL SCHED	DESIGN CONDITIONS		TEST PSIG	* REFERENCE DRAWINGS		* BY CONTRACTOR	REMARKS
		FROM	TO	FLOW	PSIG	°F		PSIG	°F		PIPING SYSTEM	DIAG. 1		
AS-301-KB-	1/2"	AOV-3218	6"-MS-4-KBA				6	1400	650	2133	M35	2193	GFE(1)	
AS-302-KB-	1/2"	AOV-3318	6"-MS-4-KBA				6	1400	650	2100	M35	2193	GFE(1)	
AS-303-FB-	1/2"	6"-ST-5-FBA	6"-ST-5-KBA				5	400	530	600	M35	2195	GFE(1)	
AS-304-FBA	1/2"	6"-ST-5-FBA	6"-ST-5-KBA				5	400	530	600	M35	2195	GFE(1)	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

		DRAWN	RBS	4-2-82	Stearns-Roger INCORPORATED
		CHECKED	DR	6-25-80	
1	9-10-80	APPROVED		7/22/80	LINE SCHEDULE
NO.	DATE	APPROVED			R AUX. STEAM (MS)

SPEC NO. C-21700

* LINE NO.	* LINE SIZE	* DESCRIPTION		OPERATING CONDITIONS			INSUL SCHED	DESIGN CONDITIONS		TEST PSIG	* REFERENCE DRAWINGS		* BY CONTRACTOR	REMARKS
		FROM	TO	FLOW	PSIG	°F		PSIG	°F		PIPING SYSTEM	DIAG		
BD-301-FB3	1"	E-305	AOV-3708				4	412	445	618	M55	2195	GFE (1)	
BD-302-FB3	1"	E-306	AOV-3808				4	412	445	618	M55	2195	GFE (1)	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV	DATE			
1	9-10-80	DRAWN	RRS	11-2-79
		CHECKED	RL	6-25-80
		APPROVED	[illegible]	6/25/80
		SUPERVISED		

Stearns-Roger INCORPORATED

LINE SCHEDULE
R BLOWDOWN (BD)

ORDER NO. 3-2700

* LINE NO.	* LINE SIZE	* DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	* REFERENCE DRAWINGS PIPING SYSTEM 40M4200531	DIAG ⚠	* BY CONTRACTOR	REMARKS
CO-201-QEX/KEX	3" 4"	3-CO-222-QEX	V-201				B	1775	1010	2662	929/934/943	1767	GFE	
CO-202-KEX	2"	V-201	2-CO-1-FBA				B	660	486	990	929	1767	CP9	
CO-203-MEX	3, 1½, 1, ¾	PANEL DRAINS VALVES	3-CO-6-BBA				B	200	400	300	946/935	1763 to 1766	GFE	
CO-204-RNX	1"	MS-204	2"-CO-205-RNX				B	1775	1010	2662	929	1764	GFE(1)/CP9	
CO-205-RNX	1", 2"	MS-205	3-CO-222-QEX				B	1775	1010	2662	929	1764 1767	GFE(1)/CP9	
CO-206-RNX	1"	MS-206	2"-CO-205-RNX				B	1775	1010	2662	929	1764	GFE(1)/CP9	
CO-207-RNX	1"	MS-207	2"-CO-208-RNX				B	1775	1010	2662	929	1764	GFE(1)/CP9	
CO-208-RNX	1", 2"	MS-208	3-CO-222-QEX				B	1775	1010	2662	929	1764 1767	GFE(1)/CP9	
CO-209-RNX	1"	MS-209	2"-CO-208-RNX				B	1775	1010	2662	929	1764	GFE(1)/CP9	
CO-210-RNX	1"	MS-210	2"-CO-211-RNX				B	1775	1010	2662	929	1765	GFE(1)/CP9	
CO-211-RNX	1", 2"	MS-211	3-CO-222-QEX				B	1775	1010	2662	929	1765 1767	GFE(1)/CP9	
CO-212-RNX	1"	MS-212	2"-CO-211-RNX				B	1775	1010	2662	929	1765	GFE(1)/CP9	
CO-213-RNX	1"	MS-213	2"-CO-214-RNX				B	1775	1010	2662	929	1765	GFE(1)/CP9	
CO-214-RNX	1", 2"	MS-214	3-CO-222-QEX				B	1775	1010	2662	929	1765 1767	GFE(1)/CP9	
CO-215-RNX	1"	MS-215	2"-CO-214-RNX				B	1775	1010	2662	929	1765	GFE(1)/CP9	
CO-216-RNX	1"	MS-216	2"-CO-217-RNX				B	1775	1010	2662	929	1766	GFE(1)/CP9	
CO-217-RNX	1", 2"	MS-217	3-CO-222-QEX				B	1775	1010	2662	929	1766 1767	GFE(1)/CP9	
CO-218-RNX	1"	MS-218	2"-CO-217-RNX				B	1775	1010	2662	929	1766	GFE(1)/CP9	
CO-219-RNX	1"	MS-219	2"-CO-220-RNX				B	1775	1010	2662	929	1766	GFE(1)/CP9	
CO-220-RNX	1", 2"	MS-220	3-CO-222-QEX				B	1775	1010	2662	929	1766 1767	GFE(1)/CP9	
CO-221-RNX	1"	MS-221	2"-CO-220-RNX				B	1775	1010	2662	929	1766	GFE(1)/CP9	
CO-222-QEX	3"	2-CO-205, 208, 211, 214, 217, 220-RNX	3-CO-201-QEX				B	1775	1010	2662	924/929	1767	GFE	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE				
		DRAWN	EV	[illegible]	
		CHECKED	RGL	6-25-80	
1	9-10-80	APPROVED	TL	[illegible]	
		APPROVED			

Stearns-Roger INCORPORATED

LINE SCHEDULE
R CONDENSATE (CO)

ORDER NO. C-21700
DWG. NO. 5053-[illegible]
SHEET NO. 1 of [illegible]

* LINE NO.	* LINE SIZE	* DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	* REFERENCE DRAWINGS PIPING SYSTEM	DIAG ⚠1	* BY CONTRACTOR	REMARKS
CO-301-KBA	4"	E-311	V-305				4	1350	435	2025	M35	2193	GFE (1)	
CO-302-KB	4"	E-312	V-306				4	1350	435	2025	M35	2193	GFE (1)	
CO-303-EE	4"	V-CO-303-305	V-304				6	165	535	247	M30	2193	GFE (1)	
CO-304-EE	4"	V-CO-304-306	V-304				6	165	525	247	M30	2193	GFE (1)	
		DELETED												
CO-306-KBA	6"	E-301	SURGE TANK (V-309)				4	1350	435	2025	M35	2193	GFE (1)	
CO-307-KBA	6"	SURGE TANK (V-309)	E-311				4	1350	435	2025	M35	2193	GFE (1)	
CO-308-KBA	6"	E-302	SURGE TANK (V-310)				4	1350	435	2025	M35	2193	GFE (1)	
CO-309-KBA	6"	SURGE TANK (V-310)	E-312				4	1350	435	2025	M35	2193	GFE (1)	
⚠1 CO-310-F1	1½"	TFWIS-3	V-304				4	165	525	247	M35	2193	CPD	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV	DATE			
		DRAWN	RHG	11-2-82
		CHECKED	DG	6-25-83
1	9-10-83	APPROVED	PL	6/21/83

Stearns-Roger INCORPORATED

LINE SCHEDULE

R CONDENSATE (CO)

ORDER NO. C-21700

LINE NO.	LINE SIZE	DESCRIPTION FROM	DESCRIPTION TO	OPERATING CONDITIONS FLOW	OPERATING CONDITIONS PSIG	OPERATING CONDITIONS °F	INSUL SCHED	DESIGN CONDITIONS PSIG	DESIGN CONDITIONS °F	TEST PSIG	REFERENCE DRAWINGS PIPING SYSTEM	REFERENCE DRAWINGS DIAG. ⚠1	BY CONTRACTOR	REMARKS
FW-200-MBX	4"	FW-2	FW-201, FW-202, FW-203				B	2000	440	3000	945	1763	GFE	
FW-201-MBX	2½"	FW-200	RP-201				B	2000	440	3000	945	1763	GFE	
FW-202-MBX	2½"	FW-200	RP-202				B	2000	440	2000	945	1763	GFE	
FW-203-MBX	2½"	FW-200	RP-203				B	2000	440	2000	945	1763	GFE	
FW-204-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-204				B	2000	440	3000	931	1763 1764	CF9	
FW-205-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-205				B	2000	440	3000	931	1763 1764	CF9	
FW-206-MBX	1"	3-FW 228-MBX	BOILER PANEL RB-206				B	2000	440	3000	931	1763 1764	CF9	
FW-207-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-207				B	2000	440	2000	931	1763 1764	CF9	
FW-208-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-208				B	2000	440	3000	931	1763 1764	CF9	
FW-209-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-209				B	2000	440	2000	931	1763 1764	CF9	
FW-210-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-210				B	2000	440	3000	931	1763 1764	CF9	
FW-211-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-211				B	2000	440	2000	931	1763 1765	CF9	
FW-212-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-212				B	2000	440	2000	931	1763 1765	CF9	
FW-213-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-213				B	2000	440	3000	931	1763 [illegible]	CF9	
FW-214-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-214				B	2000	440	3000	931	1763 [illegible]	CF9	
FW-215-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-215				B	2000	440	3000	931	1763 1765	CF9	
FW-216-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-216				B	2000	440	3000	931	1763 [illegible]	CF9	
FW-217-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-217				B	2000	440	3000	931	1763 1766	CF9	
FW-218-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-218				B	2000	440	3000	931	1763 1766	CF9	
FW-219-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-219				B	2000	440	2000	931	1763 1766	CF9	
FW-220-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-220				B	2000	440	3000	931	1763 1766	CF9	
FW-221-MBX	1"	3-FW-228-MBX	BOILER PANEL RB-221				B	2000	440	3000	931	1763 1766	CF9	
FW-222-RHX	3"	RP-201	FW-231				B	2000	440	3000	65B	1763	GFE(1)	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	PV	12-27-79
		CHECKED	DG	6-25-80
1	9-10-80	APPROVED	[illegible]	[illegible]
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE

R FEEDWATER (FW)

CONTRACT NO. C-21700

SHEET NO. 9033/4

* LINE NO.	* LINE SIZE	* DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	* REFERENCE DRAWINGS PIPING SYSTEM	DIAG. ⚠1	* BY CONTRACTOR	REMARKS
FW-223-RNX	3"	RP-202	FW-232				B	2000	440	3000	653	1763	GFE(1)	
FW-224-RNX	3"	RP-203	FW-233				B	2000	440	3000	653	1763	GFE(1)	
FW-225-RNX	3"	RP-222	FW-234				B	2000	440	3000	653	1763	GFE(1)	
FW-226-RNX	3"	RP-223	FW-235				B	2000	440	3000	653	1763	GFE(1)	
FW-227-RNX	3"	RP-224	FW-236				B	2000	440	3000	653	1763	GFE(1)	
FW-228-MBX	1", 3"	2½-FW-234,235,236-MBX	1-FW-204 THRU 221-MBX				B	2000	440	3000	944	1763	GFE	
FW-229-MBX	1"	4-FW-200-MBX	V-201				B	2000	440	3000	954 & 944	1763 1767	CP9	
		DELETED												
FW-231-MBX	2½"	FW-222	RP-222				B	2000	440	3000	944	1763	GFE	
FW-232-MBX	2½"	FW-223	RP-223				B	2000	440	3000	944	[illegible]	GFE	
FW-233-MBX	2½"	FW-224	RP-224				B	2000	440	3000	944	[illegible]	GFE	
FW-234-MBX	2½"	FW-225	FW-228				B	2000	440	3000	944	[illegible]	GFE	
FW-235-MBX	2½"	FW-226	FW-228				B	2000	440	3000	944	1763	GFE	
FW-236-MBX	2½"	FW-227	FW-228				B	2000	440	3000	944	1763	GFE	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	PV	12-27-79
		CHECKED	PGL	6-25-80
1	9-10-80	APPROVED	[illegible]	6/27/80
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE

R FEEDWATER (FW)

ORDER NO. [illegible]

[illegible] 5233/4

SHEET NO. [illegible]

* LINE NO.	* LINE SIZE	* DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	* REFERENCE DRAWINGS PIPING SYSTEM	DIAG.	* BY CONTRACTOR	REMARKS
FW-301-FE	2½"	E-303	E-305				6	475	460	713	[illegible]	2195	CF9	
FW-302-FE	2½"	E-304	E-306				6	475	460	713	[illegible]	2195	CF9	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	RBS	11-2-79
		CHECKED	DG	6-25-80
1	9-10-80	APPROVED	[illegible]	6/27/80

Stearns-Roger INCORPORATED

LINE SCHEDULE
R FEEDWATER (FW)

ORDER NO. C-21700

* LINE NO.	* LINE SIZE	* DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	REFERENCE DRAWINGS PIPING SYSTEM	DIAG (1)	BY CONTRACTOR	REMARKS
(1) MS-201-QEX	6",2",1"	1/2" VT-209-QEB	RDSIV & 4-ST-202-QEX				A	1775	1010	2662	928 & 937 & 939 & 943	1767	GFE/CP9	
MS-204-RNX	2",3"	RB-204	MS-205				A	1775	1010	2662	928 & 659	[illegible]	GFE(1)/CP9	
MS-205-RNX/QEX	2",3",4",6"	RB-205	6-MS-201-QEB				A	1775	1010	2662	928 & 659	1764 1767	GFE(1)/CP9	1/GFE
MS-206-RNX	2",3"	RB-206	MS-205				A	1775	1010	2662	928 & 659	1764	GFE(1)/CP9	
MS-207-RNX	2",3"	RB-207	MS-208				A	1775	1010	2662	928 & 659	1764	GFE(1)/CP9	
MS-208-RNX/QEX	2",3",4",6"	RB-208	6-MS-201-QEB				A	1775	1010	2662	928 & 659	1764 1767	GFE(1)/CP9	1/GFE
MS-209-RNX	2",3"	RB-209	MS-208				A	1775	1010	2662	928 & 659	1764	GFE(1)/CP9	
MS-210-RNX	2",3"	RB-210	MS-211				A	1775	1010	2662	928 & 659	[illegible]	GFE(1)/CP9	
MS-211-RNX/QEX	2",3",4",6"	RB-211	6-MS-201-QEB				A	1775	1010	2662	928 & 659	1765 1767	GFE(1)/CP9	1/GFE
MS-212-RNX	2",3"	RB-212	MS-211				A	1775	1010	2662	928 & 659	1765	GFE(1)/CP9	
MS-213-RNX	2",3"	RB-213	MS-214				A	1775	1010	2662	928 & 659	1765	GFE(1)/CP9	
MS-214-RNX/QEX	2",3",4",6"	RB-214	6-MS-201-QEB				A	1775	1010	2662	928 & 659	1765 1767	GFE(1)/CP9	1/GFE
MS-215-RNX	2",3"	RB-215	MS-214				A	1775	1010	2662	928 & 659	[illegible]	GFE(1)/CP9	
MS-216-RNX	2",3"	RB-216	MS-217				A	1775	1010	2662	928 & 659	[illegible]	GFE(1)/CP9	
MS-217-RNX/QEX	2",3",4",6"	RB-217	6-MS-201-QEB				A	1775	1010	2662	928 & 659	1766 1767	GFE(1)/CP9	1/GFE
MS-218-RNX	2",3"	RB-218	MS-217				A	1775	1010	2662	928 & 659	[illegible]	GFE(1)/CP9	
MS-219-RNX	2",3"	RB-219	MS-220				A	1775	1010	2662	928 & 659	[illegible]	GFE(1)/CP9	
MS-220-RNX/QEX	2",3",4",6"	RB-220	6-MS-201-QEB				A	1775	1010	2662	928 & 659	1766 1767	GFE(1)/CP9	GFE
MS-221-RNX	2",3"	RB-221	MS-220				A	1775	1010	2662	928 & 659	1766	GFE(1)/CP9	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	PV	11-27-73
		CHECKED	PG	1-25-73
1	9-10-80	APPROVED	[illegible]	1-27-[illegible]
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE

R MAIN STEAM (MS)

ORDER NO. C-21700

[illegible] NO. 5033/4

SHEET NO. [illegible]1-2

LINE NO.	LINE SIZE	DESCRIPTION		OPERATING CONDITIONS			INSUL SCHED	DESIGN CONDITIONS		TEST PSIG	REFERENCE DRAWINGS		BY CONTRACTOR	REMARKS
		FROM	TO	FLOW	PSIG	°F		PSIG	°F		PIPING SYSTEM	DIAG. 1		
MS-301-KBA	3/4"	6"-MS-4-KBA	V-309				6	1400	650	2100	MSS	2193	GFE(1)	
MS-302-KBA	3/4"	6"-MS-4-KBA	V-316				6	1400	650	2100	MSS	2193	GFE(1)	
MS-303-KBA	3/4"	3/4"-MS-301-KBA	THSVV-1 (VENT)				6	1400	650	2100	MSS	2193	GFE(1)	
MS-304-KBA	3/4"	3/4"-MS-302-KBA	THSVV-2 (VENT)				6	1400	650	2100	MSS	2193	GFE(1)	

GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
1	9-10-80	DRAWN	JHN	6-20-80
		CHECKED	PGL	6-25-80
		APPROVED		
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE
MAIN STEAM (MS)

CASER NO. C-21700
DWG. NO. 9033/4
SHEET NO. P1-2

LINE NO.	LINE SIZE	DESCRIPTION FROM	DESCRIPTION TO	OPERATING CONDITIONS FLOW	OPERATING CONDITIONS PSIG	OPERATING CONDITIONS °F	INSUL SCHED	DESIGN CONDITIONS PSIG	DESIGN CONDITIONS °F	TEST PSIG	REFERENCE DRAWINGS PIPING SYSTEM	REFERENCE DRAWINGS DIAG. △	BY CONTRACTOR	REMARKS
N-200-KBA	1"	N-1 @ RNMV	RMNIS & PCV 2013				N/A	600	113	900	918 & 955	1767	CPG	
N-201-QEX	1"	RMNIS	V-201				N/A	1775	1010	2662	955	1767	CPG	
N-202-KBA/MBX	1"	PCV-2013	½-VT-207-MBX				N/A	600/2650	113/610	900/3975	950	1763/1767	CPG	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	PV	12-23-79
		CHECKED	PG	6-25-80
1	2-10-80	APPROVED	JH	6/11/80
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE
R NITROGEN (U)

ORDER NO. C-21700
DWG. NO. 5033/4
SHEET NO. 1-2

* LINE NO.	* LINE SIZE	* DESCRIPTION		OPERATING CONDITIONS			INSUL SCHED	DESIGN CONDITIONS		TEST PSIG	* REFERENCE DRAWINGS		* BY CONTRACTOR	REMARKS
		FROM	TO	FLOW	PSIG	°F		PSIG	°F		PIPING SYSTEM	DIAG. ⚠1		
ST-202-QEX	4", 1"	6-MS-201-QEX	AOV-2911 & FO-ST-203-201				A	1775	1010	2662	940	1767	GFE/CPG	
⚠1 ST-203-KEX	4", 1"	AOV 2911 & FO-ST-203-201	4-CO-201-KEX				A	600	1010	900	940	1767	GFE/CPG	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV	DATE		
		DRAWN	PV 12-27-79
		CHECKED	DG 6-26-80
1	9-10-80	APPROVED	[illegible] 9-11-80

Stearns-Roger INCORPORATED

LINE SCHEDULE
R STEAM (ST)

SHEET NO. C-2700

* LINE NO.	* LINE SIZE	* DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	* REFERENCE DRAWINGS PIPING SYSTEM	DIAG. △1	* BY CONTRACTOR	REMARKS
ST-301-KBA	1"	E-301	FO-ST-301-301				6	1400	650	2100	M35	2193	GFE (1)	
ST-302-KBA	1"	E-302	FO-ST-302-302				6	1400	650	2100	M35	2193	GFE (1)	
ST-303-FBA	6"	E-305	E-307				6	475	600	713	M55	2195	GFE (1)	
ST-304-FBA	6"	E-306	E-308				6	475	600	713	M55	2195	GFE (1)	
ST 305-KBA	1"	E-302	FO-ST-305-303				6	1400	650	2100	M35	2193	GFE (1)	
ST-306-KBA	1"	E-301	FO-ST-306-304				6	1400	650	2100	M35	2193	GFE (1)	
ST-307-FBA	6"	PSV-3719	ATMOSPHERE				N/A	50	600	N/A	M55	2195	GFE (1)	
ST-308-FBA	6"	PSV-3819	ATMOSPHERE				N/A	50	600	N/A	M55	2195	GFE (1)	
ST-309-FBA	3"	E-305	PSV-3719				N/A	450	600	675	M55	2195	GFE (1)	
ST-310-FBA	4"	PSV-3115	ATMOSPHERE				N/A	50	372	N/A	M30	2193	GFE (1)	
ST-311-FBA	3"	E-306	PSV-3819				N/A	450	600	675	M55	2195	GFE (1)	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	JHN	6-20-80
		CHECKED	[illegible]	6-25-80
1	9-10-80	APPROVED	[illegible]	5-11-83
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE
R STEAM (ST)

ORDER NO. C-2-720
DWG. NO. [illegible]
SHEET NO. [illegible]

* LINE NO.	* LINE SIZE	* DESCRIPTION FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	* REFERENCE DRAWINGS PIPING SYSTEM	DIAG. ⚠1	* BY CONTRACTOR	REMARKS
TO-301-BBA	8"	8"-TO-4-BBA	8"-TO-5-BBA				4	150	425	225	M40	2192	GFE(1)	
TO-302-BBA	8"	AOV-3906	AOV-3905				5	150	575	225	M55	2194	GFE(1)	
TO-303-BBA	8"	E-307	8"-TO-25-BBA				4	150	425	225	M55	2194	GFE(1)	
TO-304-BBA	8"	E-308	8"-TO-26-BBA				4	150	425	225	M55	2194	GFE(1)	
TO-305-BBA	8"	E-305	E-303				6	150	600	225	10M3005132173	2194	CP9	
TO-306-BBA	8"	E-306	E-304				6	150	600	225	10M3005132173	2194	CP9	
TO-307-BBA	4"	P-305	8-TO-302-BBA				4	150	425	225	M60	2194	GFE(1)	
TO-308-BBA	3"	E-301	PSV-3222				N/A	150	580	225	M35	2192	GFE(1)	
TO-309-BBA	3"	E-302	PSV-3322				N/A	150	580	225	M35	2192	GFE(1)	
TO-310-BBA	4"	PSV-3222	8"-TO-31-BBA				N/A	150	580	N/A	M35	2192	GFE(1)	
TO-311-BBA	4"	PSV-3322	8"-TO-30-BBA				N/A	150	580	N/A	M35	2192	GFE(1)	
⚠1 TO-312-BBA	6"	E-301	8"-TO-31-BBA				N/A	150	580	225	M35	2192	GFE(1)	
⚠1 TO-313-BBA	6"	E-302	8"TO-30-BBA				N/A	150	580	225	M35	2192	GFE(1)	
⚠1 TO-314-BBA	4"	E-303	6"-TO-34-BBA				N/A	150	600	225	M50	2194	GFE(1)	
⚠1 TO-315-BBA	4"	E-304	6"-TO-35-BBA				N/A	150	600	225	M50	2194	GFE(1)	
⚠1 TO-316-BBA	4"	E-307	6-TO-32-BBA				N/A	150	125	225	M50	2194	GFE(1)	
⚠1 TO-317-BBA	4"	E-308	6-TO-33-BBA				N/A	150	125	225	M50	2194	GFE(1)	
TO-318-BBA	3"	E-303	PSV-3506				N/A	150	600	225	M50	2194	GFE(1)	
TO-319-BBA	3"	E-304	PSV-3606				N/A	150	600	225	M50	2194	GFE(1)	
TO-320-BBA	4"	PSV-3506	6"-TO-34-BBA				N/A	150	600	N/A	M50	2194	GFE(1)	
TO-321-BBA	4"	PSV-3606	6"-TO-35-BBA				N/A	150	600	N/A	M50	2194	GFE(1)	
TO-322-BBA	3"	E-307	PSV-3720				N/A	150	600	225	M50	2194	GFE(1)	
TO-323-BBA	3"	E-308	PSV-3820				N/A	150	600	225	M50	2194	GFE(1)	
TO-324-BBA	4"	PSV-3720	6-TO-32-BBA				N/A	150	600	N/A	M50	2194	GFE(1)	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
1	9-16-80	DRAWN	[illegible]	11-2-79
		CHECKED	DG	6-25-80
		APPROVED	[illegible]	6-27-80
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE
R THERMAL OIL (TO)

ORDER NO. [illegible]
DRAWING NO. [illegible]
SHEET NO. [illegible]

LINE NO.	LINE SIZE	DESCRIPTION		OPERATING CONDITIONS			INSUL SCHED	DESIGN CONDITIONS		TEST PSIG	REFERENCE DRAWINGS		BY CONTRACTOR	REMARKS
		FROM	TO	FLOW	PSIG	°F		PSIG	°F		PIPING SYSTEM	DWG. #		
TO-325-BP1	4"	PSV-3820	6-TO-33-B2A				N/A	150	661	N/A	M50	2197	GFE(1)	

GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	JHH	6-20-80
		CHECKED	DSL	6-25-80
1	9-10-80	APPROVED	JCL	6-27-80
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE
R THERMAL OIL (TO)

JOB NO. C-21700
DWG. NO. 1033/7
SHEET NO. P1-2

LINE NO. *	LINE SIZE *	DESCRIPTION * FROM	TO	OPERATING CONDITIONS FLOW	PSIG	°F	INSUL SCHED	DESIGN CONDITIONS PSIG	°F	TEST PSIG	* REFERENCE DRAWINGS PIPING SYSTEM	DIAG. △1	* BY CONTRACTOR	REMARKS
VT-201-KEX	4", 1"	V-201 (RS FLASH TK)	PV2906 & FO-VT-201-201				B	600	1010	900	943	1767	GFE/CP9	
VT-202-MBX	1/2"	3-FW-224-RNX	1/2-VT-207-MBX				B	600	1010	900	926	1763	CP9	
VT-203-MEX	1/2"	3-FW-223-RNX	1/2-VT-207-MBX				B	600	1010	900	926	176[illegible]	CP9	
VT-204-MEX	1/2"	3-FW-222-RNX	1/2-VT-207-MBX				B	600	1010	900	926	17[illegible]	CP9	
VT-205-MEX	1/2"	3-FW-227-RNX	1/2-VT-207-MBX				B	600	1010	900	926	17[illegible]	CP9	
VT-206-MEX	1/2"	3-FW-226-RNX	1/2-VT-207-MBX				B	600	1010	900	926	17[illegible]	CP9	
VT-207-MEX	1/2"	3-FW-225-RNX	AOV-2007 (RPWVV)				B	600	1010	900	926	17[illegible] 1767	CP9	
VT-208-QEX	3, 1	AOV-2007 & 2903, AOV-2902	ATMOSPHERE				B	600	1010	N/A	937 & 933	17[illegible]7	GFE/CP9	
△1 VT-209-QEX	1/2"	6"-MS-201-QEX	AOV-2903 (RMSVV-2)				B	1725	1010	2662	927	1767	CP9	
△1 VT-210		DELETED												
△1 VT-211		DELETED												
△1 VT-212		DELETED												
VT-213-6CH 20	12"	PSV-2909	ATMOSPHERE				N/A	100	1010	N/A	925 & 937	17[illegible]	CP9	
VT-214-5CH 20	12"	PSV-2910	ATMOSPHERE				N/A	100	1010	N/A	925 & 937	17[illegible]	CP9	
VT-215-BBA	6"	PSV-2912	ATMOSPHERE				N/A	100	1010	N/A	933 & 940	17[illegible]	CP9	
VT-216-BBA	6"	PSV-2021	ATMOSPHERE				N/A	100	600	N/A	925	17[illegible]	CP9	
VT-217-BBA	6"	PSV-2022	ATMOSPHERE				N/A	100	600	N/A	925	17[illegible]	CP9	
VT-218-BBA	6"	PSV-2023	ATMOSPHERE				N/A	100	600	N/A	925	17[illegible]	CP9	

*Information supplied by S-R, all other columns to be completed by Rocketdyne.
GFE(1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
		DRAWN	PV	12-22-79
		CHECKED	DG	1-25-80
1	9-10-80	APPROVED	[illegible]	[illegible]
		APPROVED		

Stearns-Roger INCORPORATED

LINE SCHEDULE

VENTS (VT)

ORDER NO. C-21700

DWG. NO. 703341

SHEET NO. [illegible]

LINE NO.	LINE SIZE	DESCRIPTION FROM	DESCRIPTION TO	OPERATING CONDITIONS FLOW	OPERATING CONDITIONS PSIG	OPERATING CONDITIONS °F	INSUL SCHED	DESIGN CONDITIONS PSIG	DESIGN CONDITIONS °F	TEST PSIG	REFERENCE DRAWINGS PIPING SYSTEM	REFERENCE DRAWINGS DIAG. 1	BY CONTRACTOR	REMARKS
VT-301-KBA	1"	V-305	FO-VT-301-301				5	1415	590	2140	M35	2193	GFE (1)	
VT-302-KBA	1"	V-306	FO-VT-302-302				5	1425	590	2140	M35	2193	GFE (1)	
VT-303-FBA	1"	FO-VT-301-301	1-ST-1-FBA				6	[illegible]	650	450	M35	2193	GFE (1)	
VT-304-FBA	1"	FO-VT-302-302	1-ST-1-FBA				6	[illegible]	650	450	M35	2193	GFE (1)	
VT-305-KBA	1"	V-309	1-VT-301-KBA				5	1425	590	2140	M35	2193	GFE (1)	
VT-306-KBA	1"	V-310	1-VT-302-KBA				5	1425	590	2140	M35	2193	GFE (1)	
VT-307-KBA	4"	PSV 5221	ATMOSPHERE				N/A	50	590	N/A	M35	2193	GFE (1)	
VT-306-KBA	4"	PSV 3321	ATMOSPHERE				N/A	50	590	N/A	M25	2193	GFE (1)	

*Information furnished by S-R, all other columns to be completed by Rocketdyne.
GFE (1) INDICATES LINES PROVIDED WITHIN GFE SKID/MODULE

REV.	DATE			
1	9-10-80	DRAWN	RBS	11-2-79
		CHECKED	DG	6-25-80
		APPROVED	[illegible]	6-27-80

Stearns-Roger INCORPORATED

LINE SCHEDULE
R VENTS (VT)

ORDER NO. C-21700
DWG. NO. [illegible]
SHEET NO. [illegible]

APPENDIX 3

D.O.E. NO. 4017002181
PSS INSTRUMENT INDEX
DWG. NO. 11165/8 SHEET 111
March 3, 1981, Rev. 4

△ = Line Changed this Revision

INST. NO.		P&ID NO.	LOCATION DWGS.	INSTALLER	FURNISHED BY	DATA SHEET NO./DETAIL DWG. NO.	SERVICE
LV	1	P3-2		SCE	#9	LV-8/None	P904 Crossover to 4" FW-10-FBA
SOV	1	P3-2		SCE	#9	SOV-1/None	LV-1 Control
PIT	34	P3-2		SCE	#9	PIT-9/None	1SS FW PP Discharge Pressure
FE	35B	DELETED ON PSS					
FC	37	P3-2		SCE	D46.1	None/None	FV-37 Control
FE	37	P3-2		SCE	D46.1	None/None	FV-37 Control
FIT	37	P3-2		SCE	D46.1	None/None	FV-37 Control
FV	37	P3-2		SCE	D46.1		FV-37 Control
FY	37	P3-2		SCE	D46.1	None/None	FV-37 Control
ZI	37	P3-2			SDPC		FV-37 Position Indication
ZS	37 A&B	P3-2		D46.1	D46.1	None	FV-37 Position Switches
JI	44			SCE	F235.1 40E70019S (Load Center A Spec.)		P917 (BKR A01-5)
JI	50			SCE	SCE		PPA
PI	55	P3-2		SCE	#9	PI-3/None	1SS FW PP Discharge Pressure - Local
TW	59	P3-2		SCE	#9	TW-2/None	1SS FW PP Discharge H_2O Temp.
△ PT	926	P3-1		#9	SCE	Furnished Later by SCE	RS Steam Discharge Pressure
△ PI	927	P3-1		#9	SCE	Furnished Later by SCE	RS Steam Discharge Pressure
PC	1000	P3-1			SDPC		PV-1000 Control
PI	1000	P3-1			SDPC		RS Flash TK Downcomer Pressure
PIT	1000	P3-1	I3-1/P9-4	#9	#9	PIT-1/14-12	PV-1000 Control
PV	1000	P3-1	I3-1	#9	E5	PV-6/None	RS Flash Tank Vent to Condenser
PY	1000	P3-1	I3-1	#9	E5	PV-6/None	I/P
SOV	1000	P3-1	I3-1	#9	E5	PV-6/None	PV-1000 Control
ZI	1000	P3-1			SDPC		PV-1000 Control
ZIX	1000	P3-1			DAS		PV-1000 Position to DAS
ZS	1000	P3-1	I3-1	#9	E5	PV-6/None	PV-1000 Control
ZT	1000	P3-1	I3-1	#9	E5	PV-6/None	PV-1000 Control
HS	1001	P3-1			SDPC Discrete		Deenergize PV-1001
PAH	1001	P3-1			SDPC		MS Steam Pressure Hi Alarm
PC	1001	P3-1			SDPC		PV - 1001 Control
PI	1001	P3-1			SDPC		Main Steam Pressure
PIT	1001	P3-1	I3-1	#9	#9	PIT-2/14-12	PV - 1001 Control
PV	1001	P3-1	I3-1	#9	E4	PV-1/None	MS Steam Bypass to Condenser
PY	1001	P3-1	I3-1	#9	E4	PV-1/None	I/P
SOV	1001	P3-1	I3-1	#9	E4	PV-1/None	PV - 1001 Control
TE	1001	P3-1	I3-1	#9	#9	TE-1A/14-5	Main Steam Temp
TI	1001	P3-1			SDPC		Main Steam Temp Indicator
TT	1001	P3-1		#9	#9	TT-1/None	Main Steam Temp
ZI	1001	P3-1			SDPC		PV - 1001 Control
ZIX	1001	P3-1			DAS		PV - 1001 Position to DAS
ZS	1001 A&B	P3-1	I3-1	#9	E4	PV-1/None	PV - 1001 Control
ZT	1001	P3-1	I3-1	#9	E4	PV-1/None	PV - 1001 Control

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PSS INSTRUMENT INDEX
DWG. NO. 11165/8 SHEET 111
March 3, 1981, Rev. 4

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INST. NO.		P&ID NO.	LOCATION DWGS.	INSTALLER	FURNISHED BY	DATA SHEET NO./DETAIL DWG. NO.	SERVICE
PAH	1002	P3-1			SDPC		DS-901 Outlet Pressure Hi Alarm
PI	1002	P3-1			SDPC		DS-9001 Outlet Pressure
PIT	1002	P3-1	P9-8	#9	#9	PIT-4/14-12	TV-1002 Control
SOV	1002	P3-1	I3-1	#9	E5	TV-1	TV-1002 Control
TAH	1002	P3-1			SDPC		DS-901 Outlet Temp. Hi Alarm
TC	1002	P3-1			SDPC		TV-1002 Control
TE	1002	P3-1		#9	#9	TE-1/14-5	TV-1002 Control
TI	1002	P3-1			SDPC		DS-901 Outlet Temp Indication
TS	1002	P3-1	P9-8	#9	#9	TS-1/None	TV-1002 Control
TT	1002	P3-1	P9-8	#9	#9	TT-1/None	TV-1002 Control
TV	1002	P3-1	I3-1	#9	E5	TV-1/None	Condensate to DS-901
TY	1002	P3-1	I3-1	#9	E5	TV-1/None	I/P
ZI	1002	P3-1			SDPC		TV-1002 Control
ZT	1002	P3-1	I3-1	#9	E5	TV-1/None	TV-1002 Control
PC	1003	P3-1			SDPC		PV-1003 Control
PI	1003	P3-1			SDPC		PV-1003 Control
PIT	1003	P3-1	I3-1/P9-4	#9	#9	PIT-5/14-12	PV-1003 Control
PV	1003	P3-1	I3-1	#9	E4	PV-2/None	MS to Aux. Steam Tie
PY	1003	P3-1	I3-1	#9	E4	PV-2/None	I/P
ZI	1003	P3-1			SDPC		PV-1003 Control
ZT	1003	P3-1	I3-1	#9	E4		PV-1003 Control
TC	1004	P3-1			SDPC		TV-1004 Control
TE	1004	P3-1	I3-1/P9-3	#9	#9	TE-2/14-5	TV-1004 Control
TI	1004	P3-1			SDPC		DS-902 Outlet Temp Indication
TT	1004	P3-1		#9	#9	TT-1/None	TV-1004 Control
TV	1004	P3-1	I3-1	#9	E5	TV-1/None	Condensate to DS-902
TY	1004	P3-1	I3-1	#9	E5	TV-1/None	I/P
ZI	1004	P3-1			SDPC		TV-1004 Control
ZT	1004	P3-1	I3-1	#9	E5	TV-1/None	TV-1004 Control
PC	1005	P3-1			SDPC		PV-1005 Control
PI	1005	P3-1			SDPC		PV-1005 Control
PIT	1005	P3-1	I3-1/P9-4	#9	#9	PIT-6/14-12	PV-1005 Control
PV	1005	P3-1	I3-1	#9	E4	PV-3/None	Auxiliary Steam Control
PY	1005	P3-1	I3-1	#9	E4	PV-3/None	I/P
ZI	1005	P3-1			SDPC		PV-1005 Control
ZT	1005	P3-1	I3-1	#9	E4		PV-1005 Control
FV	1006	P3-1	I3-1	#9	E5	FV-1/None	Atomizing Steam to DS-901
SOV	1006	P3-1	I3-1	#9	E5	FV-1/None	FV-1006 Control
ZI	1006	P3-1			SDPC		FV-1006 Control
ZS	1006 A & B	P3-1	I3-1	#9	E5	FV-1/None	FV-1006 Control

△ = Line Changed this Revision

INST. NO.		P&ID NO.	LOCATION DWGS.	INSTALLER	FURNISHED BY	DATA SHEET NO./DETAIL DWG. NO.	SERVICE
FV	1007	P3-1	I3-1	#9	E5	FV-1/None	Atomizing Steam to DS-901
SOV	1007	P3-1	I3-1	#9	E5	FV-1/None	FV-1007 Control
ZI	1007	P3-1			SDPC		FV-1007 Control
ZS	1007 A & B	P3-1	I3-1	#9	E5	FV-1/None	FV-1007 Control
AOV	1008	P3-1	I3-1	#9	E5	AOV-1/None	
HS	1008	P3-1			SDPC		
SOV	1008	P3-1	I3-1	#9	E5	AOV-1/None	
ZI	1008	P3-1			SDPC	AOV-1/None	
ZS	1008 A & B	P3-1	I3-1	#9	E5	AOV-1/None	
AOV	1009	P3-1	I3-1	#9	E5	AOV-1/None	
SOV	1009	P3-1	I3-1	#9	E5	AOV-1/None	
ZI	1009	P3-1			SDPC		
ZS	1009 A & B	P3-1	I3-1	#9	E5	AOV-1/None	
HS	1010	P3-1			SDPC		LV-1010 Control
LAH	1010	P3-1			SDPC		LV-1010 Control
LS	1010	P3-1	I3-1	#9	#9	LS-1/14-15	LV-1010 Control
LV	1010	P3-1	I3-1	#9	#9	LV-4/14-8	4"-V1-1 - KEB Drain Pot Level Control
SOV	1010	P3-1	I3-1	#9	#9	SOV-1/14-8	LV-1010 Control
ZI	1010	P3-1			SDPC		LV-1010 Control
ZS	1010 A & B	P3-1	I3-1	#9	#9	LV-4/14-8	LV-1010 Control
HS	1011	P3-1			SDPC		LV-1011 Control
LAH	1011	P3-1		#9	SDPC		LV-1011 Control
LS	1011	P3-1	I3-1	#9	#9	LS-1/14-15	LV-1011 Control
LV	1011	P3-1	I3-1	#9	#9	LV-4/14-8	6"MS-6-QEB Drain Pot Level Control
SOV	1011	P3-1	I3-1	#9	#9	SOV-1/14-8	LV-1011 Control
ZI	1011	P3-1			SDPC		LV-1011 Control
ZS	1011 A&B	P3-1	I3-1	#9	#9	LV-4/14-8	LV-1011 Control
HS	1012	P3-1			SDPC		LV-1012 Control
LAH	1012	P3-1			SDPC		LV-1012 Control
LS	1012	P3-1	I3-1	#9	#9	LS-1/14-15	LV-1012 Control
LV	1012	P3-1	I3-1	#9	#9	LV-5/14-8	10"-MS-7-FEA Drain Pot Level Control
SOV	1012	P3-1	I3-1	#9	#9	SOV-2/14-8	LV-1012 Control
ZI	1012	P3-1			SDPC		LV-1012 Control
ZS	1012 A & B	P3-1	I3-1	#9	#9	LV-5/14-8	LV-1012 Control
HS	1013	P3-1			SDPC		LV-1013 Control
LAH	1013	P3-1			SDPC		LV-1013 Control
LS	1013	P3-1	I3-1	#9	#9	LS-2/14-15	LV-1013 Control
LV	1013	P3-1	I3-1	#9	#9	LV-5/14-8	6"-MS-3-QEB Drain Pot Level Control
SOV	1013	P3-1	I3-1	#9	#9	SOV-2/14-8	LV-1013 Control
ZI	1013	P3-1			SDPC		LV-1013 Control
ZS	1013 A&B	P3-1	I3-1	#9	#9	LV-5/14-8	LV-1013 Control

△ = Line Changed this Revision

INST. NO.		P&ID NO.	LOCATION DWGS.	INSTALLER	FURNISHED BY	DATA SHEET NO./DETAIL DWG. NO.	SERVICE
HS	1015	P3-1			SDPC		LV-1015 Control
LAH	1015	P3-1			SDPC		LV-1015 Control
LS	1015	P3-1	13-1	#9	#9	LS-2/14-15	LV-1015 Control
LV	1015	P3-1	13-1	#9	#9	LV-6/14-8	2"-MS-8-QEB Drain Pot Level Control
SOV	1015	P3-1	13-1	#9	#9	SOV-3/14-8	LV-1015 Control
ZI	1015	P3-1			SDPC		LV-1015 Control
ZS	1015 A&B	P3-1	13-1	#9	#9	LV-6/14-8	LV-1015 Control
HS	1016	P3-1			SDPC		LV-1016 Control
LAH	1016	P3-1			SDPC		LV-1016 Control
LS	1016 A	P3-1	13-1	#9	#9	LS-3/14-15	LV-1016 Control
LS	1016 B	P3-1	13-1	#9	#9	LS-3/14-15	LV-1016 Control
LV	1016	P3-1	13-1	#9	#9	LV-6/14-8	6"-MS-2-QEB Drain Pot Level Control
SOV	1016	P3-1	13-1	#9	#9	SOV-3/14-8	LV-1016 Control
ZI	1016	P3-1			SDPC		LV-1016 Control
ZS	1016 A & B	P3-1	13-1	#9	#9	LV-6/14-8	LV-1016 Control
PI	1020	P3-1	P9-4		SDPC		DS-902 Outlet Pressue Indication Remote
PIT	1020	P3-1	13-1	#9	#9	PI1-7/14-12	DS-902 Outlet Pressure Transmitter
TE	1022	P3-1		#9	#9	TE-1/14-5	MS to Turbine Temp.
TI	1022	P3-1			SDPC		MS to Turbine Temp Indication Remote
TT	1022	P3-1		#9	#9	TT-1/None	MS to Turbine Temp.
TW	1022	P3-1	P9-10	#9	#9	TW-1/None	MS to Turbine Temp. Well
PS	1024	P3-1	P9-10	#9	#9	PS-2/14-9	TSS Steam to Turbine Press
TE	1025	P3-1	P9-10	#9	#9	TE-2/14-5	TSS Steam to Turbine Temp.
TI	1025	P3-1			SDPC		TSS Steam to Turbine Temp. Remote
TT	1025	P3-1		#9	#9	TT-1/None	TSS Steam to Turbine Temp.
TW	1026	P3-1	P9-10	#9	#9	TW-1/None	TSS Steam to Turbine Temp. Well
HS	1030	P3-1			SDPC		MOV-1030 Control
ZI	1030	P3-1			SDPC		MOV-1030 Control
ZS	1030 A & B	P3-1	13-1		E3		MOV-1030 Control
HS	1031	P3-1			SDPC		MOV-1031 Control
ZI	1031	P3-1			SDPC		MOV-1031 Control
ZS	1031 A & B	P3-1	13-1		E3		MOV-1031 Control
PI	1102	P3-2	P9-15	#9	#9	PI-2/14-14	FW Pressure After 1st PI HTR Indication
PP	1102	P3-2	P9-15	#9	#9	None/14-14	FW Pressure After 1st PI HTR
TEX	1102	P3-2	P9-15	#9	#9	TE-1A/14-5	FW Pressure After 1st PI HTR Temp. (DAS)
TI	1102	P3-2	P9-15	#9	#9	TI-1/14-6	FW Pressure After 1st PI HTR Temp.
TT	1102			SCE	#9	TI-1/None	TEX 1102 Transmitter

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INST. NO.		P&ID NO.	LOCATION DWGS.	INSTALLER	FURNISHED BY	DATA SHEET NO./DETAIL DWG. NO.	SERVICE
FS	1105			D46.1	D46.1	Hold for Vendor Info.	P917 Seal Water Flow
PC	1105	P3-2		#11	D46.1(F.W. Pump Spec)		P917 Control
PI	1105			46.1	D46.1		P917 Lube Oil Pressure
PS	1105-1			D46.1	D46.1	Hold for Vendor Info.	P917 Main Lube Oil Pressure
PS	1105-2			D46.1	D46.1	Hold for Vendor Info.	P917 Aux. Lube Oil Pressure
PS	1105-3			D46.1	D46.1	Hold for Vendor Info.	P917 Lube Oil Pressure Alarm
PV	1105	P3-2		SCE	#9	PV-7/None	Seal Water to RFP Control
SI	1105	P3-2			SDPC		P917 Speed Indication
ST	1105	P3-2		#11	D46.1		P917 Speed Transmitter
TC	1105A			D46.1	D46.1	Hold for Vendor Info.	TV-1105A Control
TC	1105B			D46.1	D46.1	Hold for Vendor Info.	TV-1105B Control
TE	1105A			D46.1	D46.1	Hold for Vendor Info.	P917 Thrust Brg. Temp.
TE	1105B			D46.1	D46.1	Hold for Vendor Info.	P917 Thrust Brg. Temp.
TE	1105C			D46.1	D46.1	Hold for Vendor Info.	P917 Drive Brg. Temp.
TE	1105D			D46.1	D46.1	Hold for Vendor Info.	P917 Casing Temp.
TE	1105E			D46.1	D46.1	Hold for Vendor Info.	Hydraulic Cplg. Oil Temp.
TE	1105F			D46.1	D46.1	Hold for Vendor Info.	P917 Motor Radial Brg. Temp.
TE	1105G			D46.1	D46.1	Hold for Vendor Info.	P917 Motor Thrust Brg. Temp.
TI	1105			D46.1	D46.1	Hold for Vendor Info.	P917 Lube Oil Temp. Local Indication
TI	1105A				SDPC		P917 Thrust Brg. Temp.
TI	1105B				SDPC		P917 Thrust Brg. Temp.
TI	1105C				SDPC		P917 Drive Brg. Temp.
TI	1105D				SDPC		P917 Casing Temp.
TI	1105E				SDPC		Hydraulic Cplg. Oil Temp. Indication
TI	1105F				SDPC		Motor Radial Brg. Temp Indication
TI	1105G				SDPC		Motor Thrust Brg. Temp Indication
TS	1105			D46.1	D46.1	Hold for Vendor Info.	Hydraulic Cplg. Oil Temp Switch
TV	1105A			D46.1	D46.1	Hold for Vendor Info.	P917 Injection Water Temp. Control
TV	1105B			D46.1	D46.1	Hold for Vendor Info.	P917 Injection Water Temp. Control
XAH	1105A				SDPC		P197 Hi Vibration Alarm
XAH	1105B				SDPC		P197 Hi Vibration Alarm
XI	1105			D46.1	D46.1	Hold for Vendor Info.	P917 Vibration Indicator
XT	1105A			D46.1	D46.1	Hold for Vendor Info.	P917 Vibration Detector
XT	1105B			D46.1	D46.1	Hold for Vendor Info.	P917 Vibration Detector
HS	1132	P3-2			SDPC		MOV 1132 Control
ZI	1132	P3-2			SDPC		MOV-1132 Position Indication
ZS	1132A&B	P3-2			E3		MOV-1132 Position Switch
PI	1201	P3-6	P6-1	#9	#9	P1-1/14-7	P-710 Discharge Pressure Indicator
HS	1202	P3-6			#11		P-710 Control

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INST. NO.	P&ID NO.	LOCATION DWGS.	INSTALLER	FURNISHED BY	DATA SHEET NO./DETAIL DWG. NO.	SERVICE
LAHL 1203	P3-6			SDPC		1K-702 Level Control
LS 1203	P3-6	P9-16	40M700-75	40M700-75	(Hold for Vendor Info)	1K-702 Level Control
LV 1203	P3-6	P9-16	#9	#9	LV-7/14-8	1K 702 Level Control
SOV 1203	P3-6		#9	#9	SOV-3/14-8	1K 702 Level Control
LI 1204	P3-6	P9-16	40M700-75	40M700-75	(Hold for Vendor Info)	1K 702 Local Level Indication
CAH 1205	P3-6			SDPC		Hi Conductivity to 1K-702 Alarm
CE 1205	P3-6	P9-16		40M70033S	(Hold for Vendor Info)	Condensate Conductivity to 1K-702 Element
CI 1205	P3-6			SDPC		Condensate Conductivity to 1K-702 Indicator
CIT 1205	P3-6			40M70033S	(Hold for Vendor Info)	Hi Conductivity Analyzer
CY 1205	P3-6			40M70033S	(Hold for Vendor Info)	Hi Conductivity Interlock to SOV-1203
FQI 1205	P3-6			40M70033S	(Hold for Vendor Info)	Total Flow From Demineralizer
CAH 1206	P3-6			SPDC		Polishing Demin. Conductivity Hi Alarm
CE 1206	P3-6			40M70033S	(Hold for Vendor Info)	CIT 1206 Flow Element
CI 1206	P3-6			SDPC		Polishing Demin Conductivity Indicator
CIT 1206	P3-6			40M70033S	(Hold for Vendor Info)	Polishing Demin Conductivity Analyzer
CY 1206	P3-6			40M70033S	(Hold for Vendor Info)	Polishing Demin Hi Conductivity Interlock
FI 1206	P3-6			40M70033S	(Hold for Vendor Info)	Polishing Demin. Flow
QAH 1206	P3-6			SDPC		Polishing Demin. Excessive Rinse Alarm
PV 1409	P3-8		#9	#9	PV-8/None	Air Supply to BCS Shutters
SOV 1410	P3-8		#9	#9	SOV-7/None	South Target Shutter
SOV 1411	P3-8		#9	#9	SOV-7/None	West Target Shutter
SOV 1412	P3-8		#9	#9	SOV-8/None	North Target Shutter
SOV 1413	P3-8		#9	#9	SOV-8/None	East Target Shutter
YT 1414 ABCD			#9	BCS		South Target Flux Sensor
YT 1415 ABCD			#9	BCS		West Target Flux Sensor
YT 1416 ABCD			#9	BCS		North Target Flux Sensor
YT 1417 ABCD			#9	BCS		East Target Flux Sensor
HS 1418	P3-13		#9	#9		P-201 Control
TAH 1418	P3-13		SDPC	SDPC	None/None	Flux Sensor Hi Temp Alarm
△TE 1418	P3-13		#9	#9	TE-3/None	TV 1418 Control
△TC 1418	P3-13		#9	#9	TC-2/None	TV 1418 Control
△TV 1418	P3-13		#9	#9	TV-3/None	Flux Sensor Cooling
△SOV 1418	P3-13		#9	#9	SOV-11/None	TV 1418 Control
TC 1420	40P3005132195	P9-19	#9	#9	TC-1/14-10	TV-1420 Control
TV 1420	40P3005132195	P9-19	#9	#9	TV-2/14-11	V-308 Outlet Temperature Control
JT 1451X			#11A	#11A		— Heliostat #0116 —
JTX 1452			#11A	#11A		— Heliostat #0128 —
JTX 1453			#11A	#11A		— Heliostat #1052 —

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INST.	NO.	P&ID NO.	LOCATION DWGS.	INSTALLER	FURNISHED BY	DATA SHEET NO./DETAIL DWG. NO.	SERVICE
JT	1454X			#11A	#11A		Heliostat #1638
JT	1455X			#11A	#11A		Heliostat #1638
JTX	1456			#11A	#11A		Power Center #2
JT	1457X			#11A	#11A		Power Center #6
JT	1468			SCE	F235.1 40E700195	(Load Center A Spec.)	Aux. Transformer Pwr Out. (BKR A01-2)
JT	1469			SCE	F235.1 40E700195	(Load Center A Spec.)	Solar Unit Main Transformer Output
JTX	1470			SCE	F235.1 40E700195	(Load Center A Spec.)	Solar Unit Main Transformer Output
TAH	1480				SDPC		13th Lvel T House #1 Tem Alarm Hi/Lo
TAH	1481				SDPC		14th Level T House #1 Temp Alarm Hi/Lo
TAH	1482				SDPC		T House #2 Temp Alarm Hi/Lo
TAH	1483				SDPC		T House #3 Temp Alarm Hi/Lo
TS	1480			#11	#11	TS-2/None	13th Level T House #1 Temp Alarm Switch
TS	1481			#11	#11	TS-2/None	14th Level T House #1 Temp Alarm Switch
TS	1482			#11	#11	TS-2/None	T House #2 Temp Alarm Switch
TS	1483			#11	#11	TS-2/None	T House #3 Temp Alarm Switch
ZS	1490			#11	40E700195		LC "A" Feeder Breaker
ZS	1491			#11	40E700195		MCC "B" Feeder Breaker
ZS	1492			#11	40E700195		LC "A" Undervoltage
ZS	1493			#11	40E700195		LC "A" Overvoltage
TS	1494			#11	40E700195		LC "A" Transformer Hi Temp
TS	1495			#11	40E700195		LC "A" Sudden Pressure Trip
PS	1495A			#11	40E700195		LC "A" Sudden Pressure Alarm
JS	1496			#11			Aircraft Warning Lite Off
LG	1501	P3-9	P6-2	#9	D46.8	(Hold for Vendor Information)	Diesel F.O. Day TK Level Local
LS	1501	P3-9	P6-2	#9	D46.8	(Hold for Vendor Information)	P-706 Control
FE	1502	P3-9	P6-2	#9	D46.8	(Hold for Vendor Information)	P-706 Flow Element
FI	1502	P3-9	P6-2	#9	D46.8	(Hold for Vendor Information)	P-706 Flow Indication Local
FS	1502	P3-9		#9	D46.8	(Hold for Vendor Information)	P-706 Control
HS	1502	P3-9		#9	SCE	(Hold for Vendor Information)	P-706 Control Remote
PI	1502	P3-9	P6-2	#9	D46.8	(Hold for Vendor Information)	P-706 Recir. Pressure
PS	1502	P3-9	P6-2	#9	D46.8	(Hold for Vendor Information)	P-706 Control
PSV	1502	P3-9		#9	D46.8	(Hold for Vendor Information)	P-706 Relief Valve
SOV	1502	P3-9		#9	D46.8	(Hold for Vendor Information)	P-706 Heat Exchange Control
PI	1510	P3-9	P6-2	#9	D46.8	(Hold for Vendor Information)	P-705 Suction Pressure
FE	1511	P3-9	P6-2	#9	D46.8	(Hold for Vendor Information)	P-705 Flow Element
FI	1511	P3-9	P6-2	#9	D46.8	(Hold for Vendor Information)	P-705 Flow Indication Local
HS	1511	P3-9		#9	SCE	(Hold for Vendor Information)	P-705 Control
PI	1511	P3-9	P6-1	#9	D46.8	(Hold for Vendor Information)	P-705 Discharge Pressure
PS	1511	P3-9		#9	D46.8	(Hold for Vendor Information)	P-705 Control
PSV	1511	P3-9	P6-1	#9	D46.8	(Hold for Vendor Information)	P-705 Relief Valve

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	INST. NO.	P&ID NO.	LOCATION DWGS.	INSTALLER	FURNISHED BY	DATA SHEET NO./DETAIL DWG. NO.	SERVICE
	PI 1513	P3-9	P6-1	#9	D46.8 (Hold for Vendor Information)		P-707 Discharge Pressure
	PS 1513	P3-9		#9	D46.8 (Hold for Vendor Information)		P-707 Control
	PSV 1513	P3-9	P6-1	#9	D46.8 (Hold for Vendor Information)		P-707 Relief Valve
	PI 1514	P3-9	P6-1	#9	D46.8 (Hold for Vendor Information)		Fire Water Pressure
	FE 1601	P3-10		#9	#9	FE-1/14-13	SE-701 Discharge Flow Element
	FR 1601	P3-10			SDPC		SE-701 Discharge Flow Recorder
	FT 1601	P3-10		#9	#9	FT-1/14-13	SE-701 Discharge Flow Transmitter
	SOV 1602	P3-10		#9	#9	SOV-9/None	Bearing Flush H_2O for P711 & P712
	LS 1602	P3-10		#9	#9	By #9 Contractor	SE-701 Level Control
	LAH 1602	P3-10			SDPC		
	HS 1602A	P3-10		#9	#9		P-711 Control
	HS 1602B	P3-10		#9	#9		P-712 Control
△	LS 1603	P3-10		#9	#9	By #9 Contractor	P-714 Control
△	LLH 1603	P3-10		#9	#9	By #9 Contractor	P-714 Control
	LS 1605	P3-10		#9	#9	By #9 Contractor	P-715 Control
	LS 1606	P3-10		#9	#9		P717 Control
	LI 1701	P3-11		40M700-75	40M700-75		1K-701 Local Level Indication
	LS 1702	P3-11	P9-16	40M700-75	40M700-75		1K-701 Level Control
	LV 1702	P3-11	P9-16	#9	#9	LV-7/14-8	1K-701 Level Control
	SOV 1702	P3-11		#9	#9	SOV-10/14-8	1K-701 Level Control
	HS 1703A	P3-11			#11		P-703 & P-704 Control
	HS 1703B	P3-11			#11		P-703 & P-704 Control
	LAH 1703	P3-11			SDPC		1K-701 Level Hi Alarm
	LS 1703	P3-11	P9-16	40M700-75	40M700-75		P-703 & P-704 Control
	PS 1703A	P3-11	P6-1	#9	#9	PS-1/14-16	P-703 & P-704 Recirc Control
	PS 1703B	P3-11	P6-1	#9	#9	PS-1/14-16	P-703 & P-704 Recirc. Control
	PV 1703	P3-11	P6-1	#9	#9	PV-9/14-8	P-703 & P-704 Recirc Control
	SOV 1703	P3-11		#9	#9	SOV-10/14-8	PV 1703 Control
	PI 1703A	P3-11		#9	#9	PI-4/None	P-703 Discharge Pressure Indication
	PI 1703B	P3-11		#9	#9	PI-4/None	P-704 Discharge Pressure Indication
	PV 1704	P3-11	P6-1	#9	#9	PV-10/None	Stm to Package Make-up Demineralizer
	SIX 1801		Later	#11	#11		Cup Anemometer (South Station)
	SIX 1802		Later	#11	#11		Wind Vane (South Station)
	TIX 1803		Later	#11	#11		Air Temperature (South Station)
	PIX 1804		Later	#11	#11		Pressure Transducer (Barometric Pressure)
	MIX 1805		Later	#11	#11		Dewpoint (South Station)
	LIX 1805		Later	#11	#11		Rainfall Gage (Tipping Bucket)
	AIX 1807		Later	#11	GFE		Circumsolar Telescope
	AIX 1808		Later	#11	#11		Pyranometer (South Station)
	AIX 1809		Later	#11	#11		Pyranometer (South Spoke Road)

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INST. NO.	P&ID NO.	LOCATION DWGS.	INSTALLER	FURNISHED BY	DATA SHEET NO./DETAIL DWG. NO.	SERVICE
STX 1810		Later	#11	#11		Cup Anemometer (West Station)
OTX 1811		Later	#11	#11		Wind Vane (West Station)
ATX 1812		Later	#11	#11		Pyranometer (West Station)
ATX 1813		Later	#11	#11		Pyranometer (West Spoke Road - Outer)
ATX 1814		Later	#11	#11		Pyranometer (West Spoke Road - Inner)
STX 1815		Later	#11	#11		Cup Anemometer (North Station)
OTX 1816		Later	#11	#11		Wind Vane (North Station
ATX 1817		Later	#11	#11		Normal Incidence Pyrheliometer (NIP) North Station
ATX 1818		Later	#11	#11		Active Cavity Radiometer (ACR)-North Station
ATX 1819		Later	#11	#11		Pyranometer (North Station)
ATX 1820		Later	#11	#11		Pyranometer (North Spoke Road -Outer)
ATX 1821		Later	#11	#11		Pyranometer (North Spoke Road - Inner)
STX 1822		Later	#11	#11		Cup Anemometer (East Station)
OTX 1823		Later	#11	#11		Wind Vane (East Station)
ATX 1824		Later	#11	#11		Pyranometer (East Station)
ATX 1825		Later	#11	#11		Pyranometer (East Spoke Road - Outer)
ATX 1826		Later	#11	#11		Pyranometer (East Spoke Road - Inner)
STX 1827		Later	#11	#11		Cup Anemometer #1 (Receiver Tower) - Level 7
OTX 1828		Later	#11	#11		Wind Vane #1 (Receiver Tower) - Level 7
STX 1829		Later	#11	#11		Cup Anemometer #2 (Receiver Tower) - Level 7
OTX 1830		Later	#11	#11		Wind Vane #2 (Receiver Tower) - Level 7
TTX 1831		Later	#11	#11		Air Temperature (Receiver Tower) - Level 7
MTX 1832		Later	#11	#11		Dewpoint (Receiver Tower) - Level 7
ATX 1833		Later	#11	#11		Nephelometer (Receiver Tower) Level 7
ATX 1834		Later	#11	#11		Pyranometer (Control Room Roof)
ST 1835		Later	#11	#11		Cup Anemometer (Control Room Roof)
OT 1836		Later	#11	#11		Wind Vane (Control Room Roof)
AT 1837		Later	#11	#11		Normal Incidence Pyrheliometer (NIP) Control Rm Roof
ATX 1838		Later	#11	#11		Precision Spectral Pyranometer (PSP)-Portable
STX 1839		Later	#11	#11		Cup Anemometer (Wind Tower 1, 32.2 Ft. Level)
STX 1840		Later	#11	#11		Cup Anemometer (Wind Tower 1, 20 ft. level)
STX 1841		Later	#11	#11		Cup Anemometer (Wind Tower 1, 10 ft. Level)
STX 1842		Later	#11	#11		Wind Vane (Wind Tower 1)
STX 1843		Later	#11	#11		Cup Anemometer (Wind Tower 2, 32.2 ft. Level)
STX 1844		Later	#11	#11		Cup Anemometer (Wind Tower 2, 20 ft. level)
STX 1845		Later	#11	#11		Cup Anemometer (Wind Tower 2, 10 ft. Level)
OTX 1846		Later	#11	#11		Wind Vane (Wind Tower 2)
STX 1847		Later	#11	#11		Cup Anemometer (Wind Tower 3, 32.2 Ft. Level)

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INST. NO.	P&ID NO.	LOCATION DWGS.	INSTALLER	FURNISHED BY	DATA SHEET NO./DETAIL DWG. NO.	SERVICE
STX 1848		Later	#11	#11		Cup Anemometer (Wind lower 3, 20 ft. Level)
STX 1849		Later	#11	#11		Cup Anemometer (Wind lower 3, 10 ft. level)
OTX 1850		Later	#11	#11		Wind Vane (Wind lower 3)
STX 1851		Later	#11	#11		Cup Anemometer (Wind lower 4, 32.2 Ft. Level)
STX 1852		Later	#11	#11		Cup Anemometer (Wind lower 4, 20 Ft. Level)
STX 1853		Later	#11	#11		Cup Anemometer (Wind lower 4, 10 Ft. Level)
OTX 1854		Later	#11	#11		Wind Vane (Wind lower 4)
STX 1855		Later	#11	#11		Cup Anemometer (Wind lower 5, 32.2 Ft. Level)
STX 1856		Later	#11	#11		Cup Anemometer (Wind lower 5, 20 Ft. Level)
STX 1857		Later	#11	#11		Cup Anemometer (Wind lower 5, 10 ft. level)
OTX 1858		Later	#11	#11		Wind Vane (Wind lower 5)
STX 1859		Later	#11	#11		Cup Anemometer (Wind lower 6, 32.2 Ft. Level)
STX 1860		Later	#11	#11		Cup Anemometer (Wind lower 6, 20 ft. level)
STX 1861		Later	#11	#11		Cup Anemometer (Wind lower 6, 10 ft. level)
OTX 1862		Later	#11	#11		Wind Vane (Wind lower 5)
HS 1901	P3-13			#11		P-306 Control
LI 1903	P3-13	P9-17	40M700-315	40M700-315		1K-301 Level Indication Local
ZS 3413A			#11	40E70019S		P-301 Feeder Bkr Trip
ZS 3414A			#11	40E70019S		P-302 Feeder Bkr Trip
ZS 3903A			#11	40E70019S		P-303 Feeder Bkr Trip
ZS 3904A			#11	40E70019S		P-304 Feeder Bkr Trip
△ J1 5001 ✓			SCE	~~F235.1 40E70019S~~ SCE ✓		1SS FW Pump
J1 5003			SCE	F235.1 40E70019S (Load Center A Spec.)		Station Service Substation
J1 5004 ✓			SCE	F235.1 40E70019S (Load Center A Spec.)		1SS Substation (BKR A01-4)
J1 5006 ✓			SCE	F235.1 40E70019S (Load Center A Spec.)		Cooling Tower Substation (480V) (BKR A01-3)
J1 5007 ✓			SCE F230.6	40E5006S Heliostat Power Centers		Heliostat Feeder #1 (BKR A01-8)
J1 5009 ✓			SCE F230.6	40E5006S Heliostat Power Centers		Heliostat Feeder #2 (BKR A01-7)
J1 5021 ✓			SCE	SCE		MCC "A"
J1 5022 ✓			SCE	SCE		MCC "C"

AREAS 200 (RS) & 300 (TSS)

GOVERNMENT FURNISHED EQUIPMENT - INSTRUMENTATION

TAG NO.	SERVICE/DESCRIPTION	TYPE	MFG/MOD. NO.	INSTALLATION DWG.	
PT-2002	Receiver Water Inlet Pressure	Pressure Transmitter	Rosemount 1151GP9E12B2	40I2002131679	
PDT-2003	Deleted				3
PTX-2052	Deleted				3
PT-2006	Receiver Preheater Water Outlet Pressure	Pressure Transmitter	Rosemount 1151GP9E12B2	40I2002131679	
PT-2902	Receiver Steam Outlet Pressure	Pressure Transmitter	Rosemount 1151GP9E12B2	40I2002131681	
PT-2906A	Receiver Flashtank Steam Outlet Pressure	Pressure Transmitter	Rosemount 1151GP8E12B2	40I2002131681	
PT-2906B	Receiver Flashtank Steam Outlet Pressure	Pressure Transmitter	Rosemount 1151GP8E12B2	40I2002131681	
PDTX-2952	Receiver Flashtank Pressure Valve P	Pressure Transmitter	Viatran Corp. 502-24-2000	40I2002131682	
PDT-2008	Receiver Differential Pressure	Pressure Transmitter	Rosemount 1151DP8E12B2	40I2002131682	
PDTX-2949	Receiver Downcomer Steam Valve Differential Pressure	Pressure Transmitter	Viatran Corp. 502-24-2000	40I2002131682	
TE-2001	Receiver Water Inlet Temperature T-1	Thermocouple	Hy-Cal Engrg. TC-623-K-C-7 3/4-F48X-H7	40M2005131945	
TEX-2050	Receiver Water Inlet Temperature T-2	Thermocouple	Hy-Cal Engrg. TC-623-K-C-7 3/4-F48X-H7	40M2005131945	
TEX-2051	Receiver Water Inlet Temperature T-3	Thermocouple	Hy-Cal Engrg. TC-623-K-C-7 3/4-F48X-H7	40M2005131932 40M2005131945	

TAG NO.	SERVICE/DESCRIPTION	TYPE	MFG/MOD. NO.	INSTALLATION DWG.	
TE 2005	Receiver Preheater Water Outlet Temp.	Thermocouple	Hy-Cal Engrg. TC-623-K-C-7 3/4-F4BX-H7	40M2005131931	
TEX-2930	Deleted				4
TEX-2939	Deleted				3
TEX-2940	Receiver Boiler No. 8 4 In. Cross Skin Temp.	Thermocouple	Hy-Cal Engrg. TC-2265-EX-K-8-600	40M2005131928 40M2005131937	
TEX-2941	Receiver Boiler No. 11 4 In. Cross Skin Temp.	Thermocouple	Hy-Cal Engrg. TC-2265-EX-K-8-600	40M2005131928 40M2005131937	
TEX-2942	Receiver Boiler No. 14 4 In. Cross Skin Temp.	Thermocouple	Hy-Cal Engrg. RC-2265-EX-K-8-600	40M2005131928 40M2005131937	
TEX-2943	Receiver Boiler No. 17 4 In. Cross Skin Temp.	Thermocouple	Hy-Cal Engrg. TC-2265-EX-K-8-600	40M2005131928 40M2005131937	
TEX-2944	Deleted				3
TEX-2936	Deleted				3
TEX-2937	Deleted				3
TEX-2938	Deleted				3
TEX-2945	Deleted				3
TEX-2946	Receiver Boiler No. 8 6 In. Cross Temp.	Thermocouple	Hy-Cal Engrg TC-2265-EX-K-8-600	40M2005131937	
TEX-2947	Receiver Boiler No. 11 6 In. Cross Temp.	Thermocouple	Hy-Cal Engrg. TC-2265-EX-K-8 600	40M2005131937	
TE-2903	Receiver Downcomer Steam Outlet Temp.	Thermocouple	Hy-Cal Engrg. TC-623-K-C-8 3/4-H7	40M2005131941 Detail A	
TT-2904	Receiver Downcomer Steam Outlet Temp.	Resistance Temp. Detector	Rosemount 78G23N01N055	40M2005131941 Detail A	3

TAG NO.	SERVICE/DESCRIPTION	TYPE	MFG/MOD. NO.	INSTALLATION DWG.	
TE-2005	Receiver Preheater Water Outlet Temp.	Thermocouple	Hy-Cal Engrg. TC-623-K-C-7 3/4-F4BX-H7	40M2005131931	
TEX-2030	Deleted				4
TEX-2939	Deleted				3
TEX-2940	Receiver Boiler No. 8 4 In. Cross Skin Temp.	Thermocouple	Hy-Cal Engrg. TC-2265-EX-K-8-600	40M2005131928 40M2005131937	
TEX-2941	Receiver Boiler No. 11 4 In. Cross Skin Temp.	Thermocouple	Hy-Cal Engrg. TC-2265-EX-K-8-600	40M2005131928 40M2005131937	
TEX-2942	Receiver Boiler No. 14 4 In. Cross Skin Temp.	Thermocouple	Hy-Cal Engrg. RC-2265-EX-K-8-600	40M2005131928 40M2005131937	
TEX-2943	Receiver Boiler No. 17 4 In. Cross Skin Temp.	Thermocouple	Hy-Cal Engrg. TC-2265-EX-K-8-600	40M2005131928 40M2005131937	
TEX-2944	Deleted				3
TEX-2936	Deleted				3
TEX-2937	Deleted				3
TEX-2938	Deleted				3
TEX-2945	Deleted				3
TEX-2946	Receiver Boiler No. 8 6 In. Cross Temp.	Thermocouple	Hy-Cal Engrg. TC-2265-EX-K-8-600	40M2005131937	
TEX-2947	Receiver Boiler No. 11 6 In. Cross Temp.	Thermocouple	Hy-Cal Engrg. TC-2265-EX-K-8-600	40M2005131937	
TE-2903	Receiver Downcomer Steam Outlet Temp.	Thermocouple	Hy-Cal Engrg. TC-623-K-C-8 3/4-H7	40M2005131941 Detail A	
TT-2904	Receiver Downcomer Steam Outlet Temp.	Resistance Temp. Detector	Rosemount 78G23N01N055	40M2005131941 Detail A	3

2

TAG NO.	SERVICE/DESCRIPTION	TYPE	MFG/MOD. NO.	INSTALLATION DWG.	
FT-2303	Receiver Boiler No. 6 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2401	Receiver Boiler No. 7 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2402	Receiver Boiler No. 8 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2403	Receiver Boiler No. 9 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2501	Receiver Boiler No. 10 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2502	Receiver Boiler No. 11 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2503	Receiver Boiler No. 12 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2601	Receiver Boiler No. 13 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
T-2602	Receiver Boiler No. 14 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2603	Receiver Boiler No. 15 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2701	Receiver Boiler No. 16 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2702	Receiver Boiler No. 17 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3

TAG NO.	SERVICE/DESCRIPTION	TYPE	MFG/MOD. NO.	INSTALLATION DWG.	
FT-2703	Receiver Boiler No. 18 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 8FES-1	40M2005131931	3
FT-2801	Receiver Boiler No. 19 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 8FES-1	40M2005131931	3
FT-2802	Receiver Boiler No. 20 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 8FES-1	40M2005131931	3
FT-2803	Receiver Boiler No. 21 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 8FES-1	40M2005131931	3

Area 200 (RS)

GOVERNMENT FURNISHED EQUIPMENT

Modulating Control Valve List	(1 page)
Pressure Switch List	(1 page)
Pressure Regulator List	(1 page)
Flow Orifice Instrument Data Sheet	(1 page)
Pressure Gauge List	(1 page)

TAG NO.	SERVICE/DESCRIPTION	TYPE	MFG/MOD. NO.	INSTALLATION DWG.	
FT-2703	Receiver Boiler No. 18 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2801	Receiver Boiler No. 19 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2802	Receiver Boiler No. 20 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3
FT-2803	Receiver Boiler No. 21 Flow	Flow Meter & Transmitter	RAMAPO MK V-1-CFT7D SG-8401 BFES-1	40M2005131931	3

Area 200 (RS)

GOVERNMENT FURNISHED EQUIPMENT

Modulating Control Valve List	(1 page)
Pressure Switch List	(1 page)
Pressure Regulator List	(1 page)
Flow Orifice Instrument Data Sheet	(1 page)
Pressure Gauge List	(1 page)

TAG NO.		PANEL NO.	MFG	MODEL NO.	
YT 2210	A	RP 201	Medtherm Corp.	8-15-20456	4
	B		Medtherm Corp.	8-15-20456	
	C		Medtherm Corp.	8-15-20456	
YT 2211	A	RP 202	Medtherm Corp.	8-15-20456	4
	B		Medtherm Corp.	8-15-20456	
	C		Medtherm Corp.	8-15-20456	
YT 2212	A	RP 203	Medtherm Corp.	8-15-20456	4
	B		Medtherm Corp.	8-15-20456	
	C		Medtherm Corp.	8-15-20456	

TAG NO.		PANEL NO.	MFG	MODEL NO.	
YT 2110	A	RP 222	Medtherm Corp.	8-15-20456	4
	B		Medtherm Corp.	8-15-20456	
	C		Medtherm Corp.	8-15-20456	
YT 2111	A	RP 223	Medtherm Corp.	8-15-20456	4
	B		Medtherm Corp.	8-15-20456	
	C		Medtherm Corp.	8-15-20456	
YT 2112	A	RP 224	Medtherm Corp.	8-15-20456	4
	B		Medtherm Corp.	8-15-20456	
	C		Medtherm Corp.	8-15-20456	
YT 2307	A	RB 204	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2308	A	RB 205	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2309	A	RB 206	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2407	A	RB 207	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2408	A	RB 208	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2409	A	RB 209	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2507	A	RB 210	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2508	A	RB 211	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	

TAG NO.		PANEL NO.	MFG	MODEL NO.	
YT 2509	A	RB 212	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2607	A	RB 213	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2608	A	RB 214	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2609	A	RB 215	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2707	A	RB 216	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2708	A	RB 217	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2709	A	RB 218	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2807	A	RB 219	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2808	A	RB 220	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	
YT 2809	A	RB 221	Medtherm Corp.	8-43-20456	4
	B		Medtherm Corp.	8-43-20456	
	C		Medtherm Corp.	8-43-20456	

TAG NO.	SERVICE/DESCRIPTION	TYPE	MFG/MOD. NO.	INSTALLATION DWG.	5
FE-2301	Receiver Boiler No. 4 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2302	Receiver Boiler No. 5 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2303	Receiver Boiler No. 6 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2401	Receiver Boiler No. 7 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2402	Receiver Boiler No. 8 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2403	Receiver Boiler No. 9 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2501	Receiver Boiler No. 10 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2502	Receiver Boiler No. 11 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2503	Receiver Boiler No. 12 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2601	Receiver Boiler No. 13 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2602	Receiver Boiler No. 14 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	

TAG NO.	SERVICE/DESCRIPTION	TYPE	MFG/MOD. NO.	INSTALLATION DWG.	5
FE-2603	Receiver Boiler No. 15 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2701	Receiver Boiler No. 16 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2702	Receiver Boiler No. 17 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2703	Receiver Boiler No. 18 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2801	Receiver Boiler No. 19 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2802	Receiver Boiler No. 20 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	
FE-2803	Receiver Boiler No. 21 Flow		Ramapo MK V-1-CFR7D Flowmeter	40M2005131931	

ROCKWELL INTERNATIONAL, ROCKETDYNE

PRESSURE GAUGES

DATA SHEET _____
PAGE _____
S-R PROJECT _____
ACCOUNT _____
DATE 12/13/80
BY _____

CLIENT DEPT. OF ENERGY
PROJECT 10 MW SOLAR PILOT PLANT
LOCATION DAGGETT, CALIF.

REVISIONS 1 _____ BY _____ 2 _____ BY _____ 3 _____ BY _____ 4 _____ BY _____

MANUFACTURER _____ SOURCE: QUOTE OF _____

FORM NO. N-7186 REV. 11/77
BASED ON ISA S20

GENERAL

1 TYPE: [X] DIRECT ROG [ ] 3-15# RECEIVER
OTHER _____

2 MTG: [X] SURFACE [ ] LOCAL [ ] FLUSH

3 DIAL: DIAMETER 4 1/2 COLOR BLACK

4 CASE: [ ] CAST IRON [ ] ALUMINUM [ ] PHENOL
OTHER _____

5 RING: [X] SCREWED [ ] HINGED [ ] SLIP
[ ] SNAP OTHER _____

6 BLOW-OUT: [X] NONE [ ] BACK [ ] DISC
OTHER _____

7 LIQ.FIL: [ ] GLYCERINE [ ] SILICONE
OTHER NONE

8 WINDOW: [ ] GLASS [X] PLASTIC
OTHER _____

9 MODEL NUMBER 86

ELEMENT

10 PRESS ELEMENT: [ ] BOURDON [ ] BELLOWS
OTHER DIAPHRAGM

11 ELEM MTL: [X] BRONZE [ ] STEEL _____ SS
OTHER

12 SOCK MTL: [X] BRASS [ ] STEEL _____ SS
OTHER _____

13 CONN: NPT [X] 1/4" [ ] 1/2" OTHER _____
[X] BOTTOM [ ] BACK

14 MOVEMENT: [X] BRONZE [ ] SS [ ] NYLON
OTHER _____

15 ZERO ADJUSTMENT NO

16 ACCURACY: [ ] 1/4% [ ] 1/2%
[X] 1% [ ] 2%

REV	TAG NO	NO REQD	ACCT NO	RANGE PSIG	OP PRES PSIG	SERVICE	ROCKETDYNE DESIGNATION	NOTE
	PI4007	1		0 - 30" W. C.	4" WC	ULLAGE GAS	UNPR-5	

NOTES:

TAG NO.	VALVE STD. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	CONTR. OR REQ. NO.	ROCKETDYNE DESIGNATION	REMARKS	REV. NO.
PV-2002	SP42 -003	1"	GLOBE	1500	BW	WCB	VALTEK	(1)	GFE	RWBV	LVDT, I/P TRANS., SOL VALVE, REGULATOR, POSITIONER, FILTER	
UV-2905	SP42 -013	6"	GLOBE	2500	BW	WC9	VALTEK	(1)	GFE	RDSIV	SAME AS ABOVE PLUS MICRO SWITCH	
PV-2906	SP42 -012	4"	GLOBE	900	BW	WC9	VALTEK	(1)	GFE	RFSPCV	LVDT, I/P TRANS, SOL.VALVE REGULATOR, POSITIONER, FILTER	

(1) P&ID NO. 40P200513767

REV	DATE
△	
△	
△	
△	
△	
△	
△	
△	

ROCKWELL INTERNATIONAL, ROCKETDYNE

MODULATING CONTROL VALVE LIST

CUSTOMER DEPT. OF ENERGY

PROJECT 10MWe SOLAR PILOT PLANT

LOCATION DAGGETT, CALIF.

SYSTEM RS

ORDER NO. PAGE OF

TAG NO.	VALVE STD. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	CONTR. OR REQ. NO.	ROCKETDYNE DESIGNATION	REMARKS	REV. NO.
PS-2018	SP42 -023	1/4"	BOURDON TUBE		NPT		BARKSDALE	(1)	GFE	RNPS-1	SET PRESSURE: 300 PSIG ON DECREASING AND 500 PSIG ON INCREASING	
PS-2015A	SP42 -024	1/4"	BELLEVILLE		NPT		NEO-DYN	(1)	GFE	RNPS-2-1	SET PRESSURE: 5 PSIG ON DECREASING	
PS-2015B	SP42 -024	1/4"	BELLEVILLE		NPT		NEO-DYN	(1)	GFE	RNPS-2-2	SET PRESSURE: 30 PSIG ON INCREASING	

(1) P&ID NO. 40P200513767

REV	DATE
△	
△	
△	
△	
△	
△	
△	
△	

ROCKWELL INTERNATIONAL ROCKETDYNE

PRESSURE SWITCH LIST

CUSTOMER DEPT. OF ENERGY

PROJECT 10MW SOLAR PILOT PLANT

LOCATION DAGGETT, CALIF.

SYSTEM RS

ORDER NO. PAGE OF

Appendix 3

TAG NO.	VALVE STD. NO.	SIZE	TYPE	RATE	ENDS	MAT'L	MANUFACTURER & FIGURE NO.	FLOW DIAG.	CONTR. OR RLQ. NO.	ROCKETDYNE DESIGNATION	REMARKS	REV. NO.
PCV-2009	SP42 -009	1"	PRESS REDUCE	900	NPT	WCB	FISHER	(1)	GFE	RNPR-1	SET @ 400 PSIG	
PCV-2013	SP42 -010	1"	PRESS REDUCE	300	NPT	WCB	FISHER	(1)	GFE	RNPR-2	SET @ 10 PSIG	
PCV-4006	SP42 -125	1"	PRESS REG	150 & 100F	NPT	C.S	FISHER	(3)	GFE	UNPR-3	SET @ -4" H_2O	1

(1) P&ID NO. 40P2005131767

REV	DATE
1	12/10/80
0	5/2/80

ROCKWELL INTERNATIONAL, ROCKETDYNE

PRESSURE REGULATOR LIST

CUSTOMER DEPT OF ENERGY

PROJECT 10MWe SOLAR PILOT PLANT

LOCATION DAGGETT, CALIF.

SYSTEM RS

ORDER NO. PAGE OF

DOE NO. 401700219I
PSS TEMPORARY INSTRUMENT INDEX
DWG. NO. 11165/8 SHEET 111-T
JANUARY 12, 1981, REV. 0

INST. NO.	P&ID NO.	LOCATION DWGS.	INSTALLER	FURNISHED BY	DATA SHEET NO./DETAIL DWG. NO.	SERVICE
PI B0B	P3-12C	P9-22	#9	#9	PI-1T	Steam Blowing
PI B0C	P3-12C	P9-22	#9	#9	PI-1T	Steam Blowing
PI B0D	P3-12C	P9-22	#9	#9	PI-1T	Steam Blowing
PI B0E	P3-12C	P9-22	#9	#9	PI-1T	Steam Blowing
PSV B0A	P3-12C	P9-21	#9	#9	PSV-1T	Steam Blowing

Rev. 1 July 16, 1980
Rev. 2 September 12, 1980
Rev. 3 October 17, 1980
Rev. 4 December 5, 1980
Rev. 5 January 30, 1981
Rev. 6 March 20, 1981

TECHNICAL SPECIFICATION
D.O.E. NO. 40 M 700 - 6S

for

PIPING AND MECHANICAL EQUIPMENT

VOLUME II - SUPPLEMENTS & APPENDICES

CONSTRUCTION PACKAGE #9

Prepared by:

Stearns-Roger
ENGINEERING CORP.

PROJECT NO. C-21700

Revisions	ROCKWELL INTERNATIONAL, ROCKETDYNE — Engineering Standard	Page OF
X		
Project 10 MWe SOLAR PILOT PLANT	FLOW ORIFICE (RESTRICTION) INSTRUMENT DATA SHEET	ISSUED / REVISED

Tag No	FO-CO-201-201	FO-ST-203-201
Service	DRAIN	BYPASS
Location	3"-CO-201-QEX	1"-ST-203-QEX
Type	PADDLE	PADDLE
Fluid	CONDENSATE	BLANKET STEAM
Flow, LB/HR	1500	334
Temp. MAX	1010 °F	1010 °F
Inlet Press. MAX	1780 PSIA	1780 PSIA
Diff Press		
Orifice Size	0.100 ± .005 IN. DIA	0.097 ± 0.005 IN. DIA.
System Des. Press		
End Conn-Size/Type	1"-2500 LB WN-RF FLANGE	1"-2500 LB WN-RF FLANGE
Pipe Schedule	80	80
Remarks		
ROCKETDYNE DESIGNATION	RAWO	RFSO-1
Supplied By		
Manufacturer		
Model No		
[illegible] Dwg.	40P200513767	40P200513767
[illegible] Spec.	SP42-050	SP42-051

Tag No	FO-VT-1-201
Service	BYPASS
Location	1"-VT-1-KEX
Type	PADDLE
Fluid	BLANKET STEAM
Flow, LB/HR	334
Temp. MAX	960 °F
Inlet Press. MAX	615 PSIA
Diff Press	
Orifice Size	0.208 ± 0.005 IN. DIA
System Des. Press	
End Conn-Size/Type	1"-900 LB WN-RF FLANGE
Pipe Schedule	80
Remarks	
ROCKETDYNE DESIGNATION	RFSO-2
Supplied By	
Manufacturer	
Model No	
[illegible] Dwg.	40P200513767
RD Spec.	SP42-052

PRESSURE GAGE LIST

DATA SHEET ____ PAGE ____ S-R PROJECT ____ ACCOUNT ____ DATE ____ BY ____

CLIENT DEPT. OF ENERGY
PROJECT 10 MW Solar Pilot Plant
LOCATION DAGGETT, CALIF.
REVISIONS 1 ____ BY ____ 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

GENERAL

1 TYPE: [X] DIRECT ROG [ ] 3-15# RECEIVER [ ] OTHER ____
2 MTG: [X] SURFACE [ ] LOCAL [ ] FLUSH
3 DIAL: DIAMETER 4½" COLOR BLACK
4 CASE: [ ] CAST IRON [ ] ALUMINUM [X] PHENOL [ ] OTHER ____
5 RING: [X] SCREWED [ ] HINGED [ ] CLIP [ ] SNAP [ ] OTHER ____
6 BLOW-OUT: [ ] NONE [ ] JACK [X] DISC [ ] OTHER ____
7 LIQUID: [ ] GLYCERINE [ ] SILICONE [ ] OTHER NONE
8 WINDOW: [ ] GLASS [X] PLASTIC [ ] OTHER ____
9 MODEL NUMBER ____

ELEMENT

10 PRESS ELEMENT: [X] BOURDON [ ] BELLOWS [ ] OTHER ____
11 ELEM MTL: [X] BRONZE [ ] STEEL ____ [ ] OTHER
12 SOCK MTL: [X] BRASS [ ] STEEL ____ [ ] OTHER ____
13 CONN: NPT [ ] 1/4" [X] 1/2" OTHER ____ [ ] BOTTOM [ ] BACK
14 MOVEMENT: [ ] BRONZE [X] [ ] NYLON [ ] OTHER ____
15 ZERO ADJUSTMENT YES
16 ACCURACY: [ ] 1/4% [ ] 1/2% [ ] 1% [ ] 2% [X] 5%

REV	TAG NO	NO REQD	ACCT NO	RANGE PSIG	OP PRESS PSIG	SERVICE	ROCKETDYNE DESIGNATION	NOTES
	PI-2011	1		0 TO 600	400	GN_2	RNPG-1	
	PI-2014	1		0 TO 60	10	GN_2	RNPG-2	
	PI-2020	1		0 TO 2000	1500	GN_2 AND WATER	RMSPG	
	PI-2017	1		0 TO 3000	2000	GN_2 AND WATER	RPSPG	

NOTES:

APPENDIX 4

1. CONTRACTOR-FURNISHED EQUIPMENT

2. CONTRACTOR-FURNISHED EQUIPMENT (TEMPORARY) 5

Area 300 (TSS) 5

THERMAL STORAGE BLOW DOWN TANK (V-308)

The Contractor will be responsible for procuring a Thermal Storage Blowdown Tank V-308. The location of this tank can be found on Drawing 40P3005132195. The purpose of this tank is to receive the boiler to blowdown flow from the TSS Boilers E-305 and 306.

The vaporized portion of the boiler blowdown will be exhausted through a vent pipe and an exhaust hood. The condensate portion of the boiler blowdown will be mixed with service water to a temperature controlled by TC 1420 and returned to the drain system.

The Contractor is responsible for the procurement and installation of all of the components associated with this blowdown tank.

Details of the blowdown tank are shown on drawing 40P3002132009, P25-5.

Area 700 (PSS)

OIL WATER SEPARATOR (SE-701)

The general requirements for the oil water separator are as follows:

PERFORMANCE

The separator shall be rated for a flow of 350 GPM to separate free oil and non-permanent mechanically-emulsified oil with a specific gravity of 0.86 from water at an operating temperature of 50°F. When the representative oil globule diameter is 20 MICRONS. The effluent from the separator shall contain no more than 10 PPM of free oil.

GENERAL DESCRIPTION

1. A flow diverter at the inlet to reduce the horizontal velocity of the incoming flow.

2. An inlet chamber with pitched bottom to disperse flow and collected solids.

3. A separation chamber consisting of vertically-positioned, perforated, oleophilic tubes. This chamber is to contain a minimum of 150 cubic feet of coalescing media.

4. The coalescing media shall be put together in packs of 1' x 1', light enough to facilitate removal from separator for inspection and/or cleaning.

5. An oil retention baffle placed at the end of the separation chamber.

6. The oil reservoir shall be furnished with an adjustable weir for skimming oil under spill conditions. Oil collected in the reservoir shall flow by gravity to an integral storage tank where it will be reclaimed by a pump-out system provided by the separator manufacturer.

7. Oil storage tank to have minimum 700 gallon capacity.

8. A high level alarm to indicate high oil level.

9. A manually operated oil pump out package.

10. A sludge collection trough in the separation chamber. Each of the first 2 compartments of the separator shall have a sludge removal pipe with flanged connection easily accessible beneath manway covers.

11. Manually operated sludge pump out package.

12. An outlet chamber with an adjustable weir. A sheen baffle shall be provided ahead of the weir to stop and residual oil from flowing over the weir.

13. A primary clear-well chamber at the end of the separator fitted with an outlet arrangement which shall allow discharge from the bottom of the chamber only. This chamber shall contain an oil stop valve to prevent the discharge of discrete amounts of oil to the secondary clear-well.

14. A totally segregated secondary clear-well of minimum 800 gallons capacity.

15. An effluent pump out system consisting of two 175 GPM vertical sump pumps controlled by a 3-stage level switch.

16. A closed top with vent connections.

17. Manways providing access to all chambers of the separator. Manways shall be sufficiently large enough to allow removal of coalescing packs from the separator.

18. Lifting lugs to facilitate lifting and removal of the separator.

19. Flexible couplings between separator and customer's connecting pipes to eliminate excessive loading on separator flanges.

CONSTRUCTION AND MATERIAL

1. The separator shall be designed for installation flush with ground and shall have the structural strength to withstand the associated hydraulic loading.

2. The separator walls shall be a sandwich type construction with seamless outer skins of 30 percent chopped glass reinforced polyester resin laminates produced by "spray-up" method. The core of the sandwich construction shall consist of exterior grade plywood stress-skin panels with longitudinal framing members of treated lumber.

3. Steel tanks are not acceptable unless coated to give equivalent corroision resistance.

4. The entire separator shall be corrosion-resistant inside and out. 4

5. The separator shall be able to withstand attack from a sustained chemical activity of the influent within a pH range of 4 to 9 and at temperatures not to exceed 130°F.

6. The heat transfer through the separator envelope shall be kept to a minimum, and the overall coefficient of heat transfer (U-Factor) for the entire separator shall not exceed 1.0 Btu/Hr/Ft2/°F.

7. All the pipes and fittings in the separator shall be of a PVC compound meeting the requirements of type 1, grade 1, Polyvinyl Chloride as outlined in ASTM-D-1784, unless specified otherwise in the contract purchase order.

ELECTRICAL REQUIREMENTS

1. All electrical equipment shall be suitable for hazardous area class I, Division II, group D for operation outdoors as defined by the National Electrical Code. The installation shall conform to all applicable provisions of the National Electrical Code.

2. A single, 480 volt, three (3) phase, 60 Hertz, power source will be provided by others.

3. The motors shall be rated 460 volts, three (3) phase, and 60 Hertz. The motor circuits shall be protected against short circuits and overloads.

4. Motor starters shall be provided and wired to the control system by the separator manufacturer.

5. Control systems shall be operated on 120 volts, 60 Hertz supplied by the separator manufacturer. When possible, all control devices shall be mounted in a common enclosure and wired with #14 AWG, 600 volt, copper wire. Identified terminal blocks shall be provided in the common enclosure for all external wiring. Conduit seals shall be provided when required. All wires shall be identified on each by wire numbers using wire markers. All control devices shall be labeled.

6. Schematic, wiring, and plan drawings shall be submitted for purchaser's approval within 6 weeks after receipt of order. Certified drawings shall be submitted to the purchaser within 2 weeks after return of approval drawings.

   The piping design shown on the enclosed drawings is based on the equipment as described herein. If the Contractor chooses to purchase equipment other than as described it will be his responsibility and at his cost to charge the existing Engineering. He will also be responsible to provide for the successful operation of the system.

   One (1) AFL Industries Inc.,* Custom Vertical Tube Coalescing Separator, the function of which is to remove free oil and settleable solids from oil/water mixture. The description of the unit and accessories together with preliminary drawings are as follows:

   Materials of Construction: Fiberglass utilizing isophthalic resin with PVC piping and fittings, and including a matrix of oleophilic VTC tubes.
   Series/Model No.: VTC-400F2
   Separator Installation: Top flush with grade
   Maximum Flow Rate: 400 gpm, based on minimum specific gravity differential of .15 and minimum operating temperature of 40°F.

*AFL Industries Inc., 1149 Howard Drive/West Chicago Illinois, 60185

Overall Outside Dimensions: 18'0"L x 11'9-1/2" W x 9'0"H. Width dimension includes an 1'6" wide integral oil storage tank.
Approximate separator temporary stopping capacity should an oil spill occur: 1200 gallons
Approx. Integral Oil Storage Tank Capacity: 820 gallons gravity filled.
Approx. Separator Operating Capacity: 3770 gallons
Approx. Separator Operating Weight: 36,800 lbs.
Approx. Separator Shipping Weight: 6500 lbs.
Separator includes the following standard components/features:

1. Two 6"Ø inlet flanges to pitched bottom inlet chamber for sludge removal.

2. One 8"Ø water outlet flange from OSV-8 to integral effluent clearwell.

3. One 6"Ø oil outlet flange to integral oil storage tank.

4. Two 2"Ø sludge drawoff flanges.

5. One AFL diffusion baffle to create laminar flow.

6. One AFL VTC tube pack to accomplish separation process.

7. One adjustable spill-over weir for surface oil removal.

8. Four access hatches, one sized 4' x 5' 6", two sized 2' x 4', one sized 2' x 2'.

9. Two 2"Ø vent provisions.

10. One AFL/Clark Oil Stop Valve Factory Installed in primary clearwell.

11. One AFL Manual Sludge Pumpout Package to consist of the following components or equal:

    a. Gorman Rupp Diaphragm Pump Model No. 2Dx3/4-3P with a 3/4 HP, 460V/3Ø/60Hz motor capable of 15 GPM at 25 TDH. 4

    b. Sludge suction manifold complete with two butterfly valves and one Flex joint and all other necessary pipe and fittings to connect to the two existing sludge drawoffs in separator.

    c. One 2"Ø NPT sludge discharge, complete with 10' of heavy fabric hose for truck filling.

12. One AFL Manual Oil Pumpout Package to consist of the following components or equal:

    a. Gorman Rupp Centrifugal Pump Model No. 81 1/4 A3-x1/2 with a 4,5 4,5

       1/2 HP460V/3Ø/60 Hz, motor capable of 20 GPM at 25 TDH.

    b. 1-1/4"Ø oil suction line from integral oil storage tank.

    c. 1-1/4" NPT oil discharge, complete with 10' of heavy fabric hose for truck filling.

    d. One stage level switch to sense high level in integral oil storage tank complete with;

       1. Indicating lights at main control panel.

       2. Dry, normally open contacts for remote signal for customer use.

13. One AFL Automatic Alternation Duplex Effluent Pumpout Package to consist of the following components or equal:

    a. Two Gould 3171 Vertical Sump Pumps model No. 2-1/2 x 3-13 complete with Cutlass Rubber bearings and a 20HP 460V/3Ø/60Hz non-overloading explosion proof motor each capable of 175 GPM at 150' TDH.

    b. Three stage level switch to automatically start pump one at a set level, start pump two with pump one on at the next level and sense high level at the next stage with both pumps running to be complete with;

       1. Indicating lights at main control panel.

       2. High level, dry, normally open contacts for remote signal for customer use.

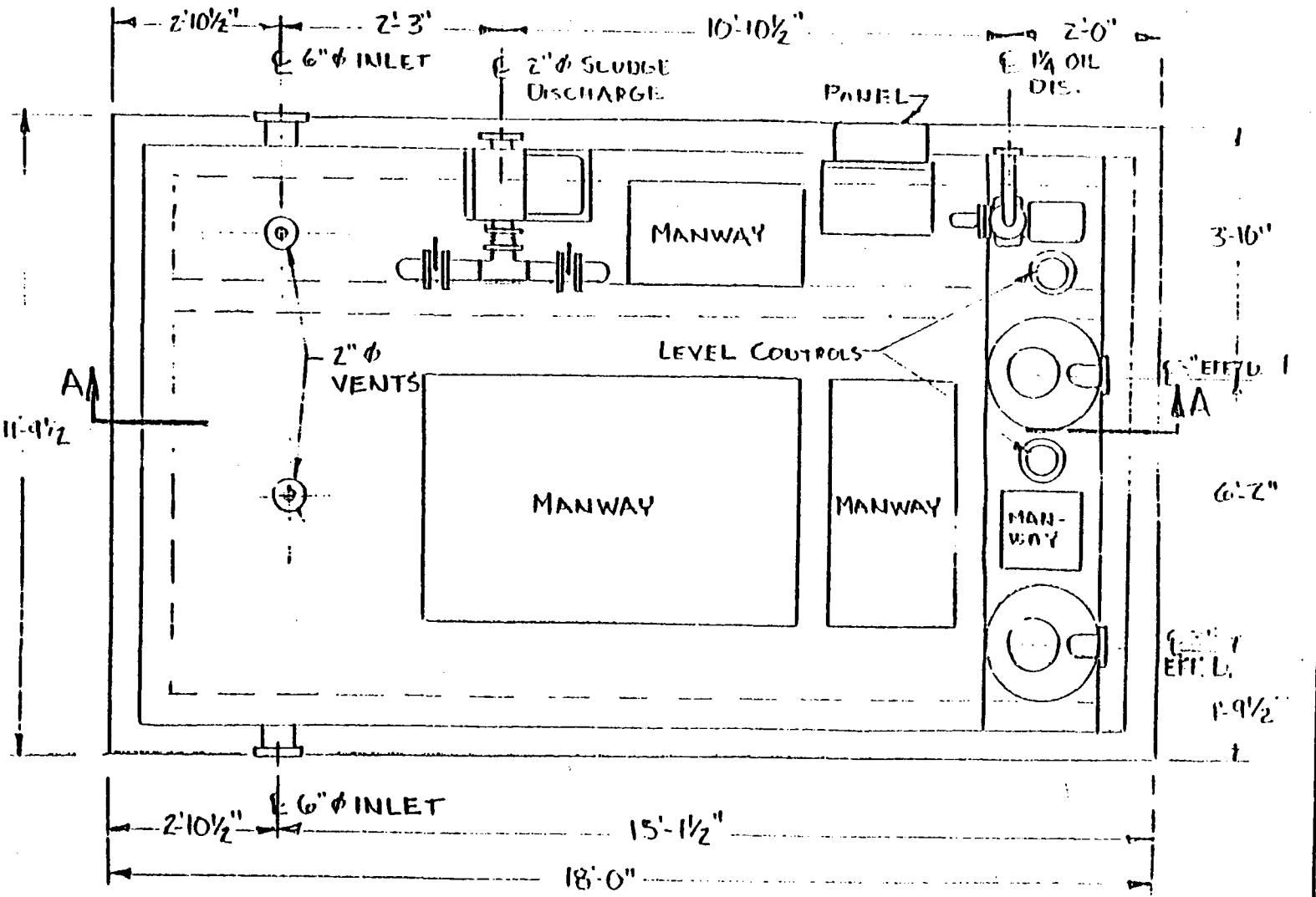
14. Control panel complete with all necessary indicating lights, relays, starters, etc. to coordinate above system, including a 120 volt, 60 hertz output to operate a service water inlet solenoid valve specified elsewhere. The output shall be interlocked to deenergize the solenoid valve when the separator waste water pumps are running and shall energize the solenoid valve when the separator waste water pumps are not running.

CUSTOM VTC-400=1.5

PRELIMINARY DRWG. (NOT FOR CONST.)

PAGE 1/2

DATE 11/27



PLAN VIEW

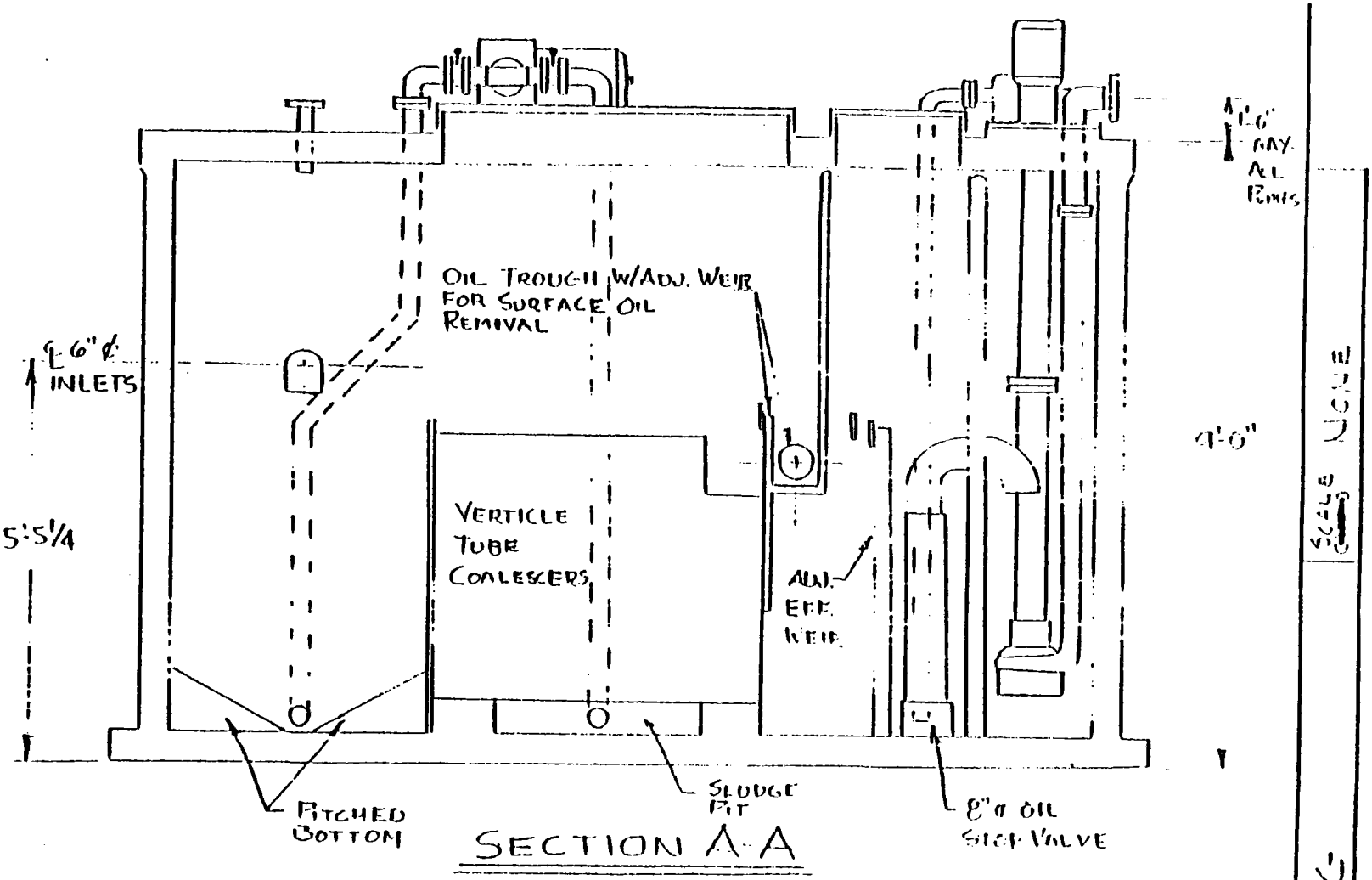
SCALE NONE

BY PLG

CUSTOM VTC-400 FILES

PRELIMINARY DRWG. (NOT FOR CONST.) 11/27

SHT 2/2



SECTION A-A

SCALE: NONE

Area 700 (PSS)

RAW/SERVICE WATER PUMPS (P-703, 704)

1. Two (2), horizontal centrifugal pumps as specified on the JD40.4.10-1 Design Data Sheet, Pg. 1 with its nozzles conforming to ANSI flange requirements for the specified conditions of service. The pump design shall comply with the requirements as specified in the Stearns-Roger, "Specification for Horizontal Centrifugal Pumps" Standard Number JD40.4.10. The pump selected shall accommodate the piping arrangement as indicated on S-R Drawing XL-22934, Sheet P6-1.

2. Two (2) electric drive motors as specified in the Stearns-Roger, "NEMA Frame Induction Motor" Standard JF16.02.02, and Motor Data Sheets, 8 pages, Standard No. JF16.02.02-1.

3. Each pump and drive motor shall be mounted on a common baseplate and provided with a suitable coupling.

4. The pumps and motors shall be purchased with a two year supply of manufacturers recommended spare parts.

5. The pump nameplate shall include; Model, Serial No., Total Head, capacity and speed.

DIVISION USAGE						**Stearns-Roger** INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
WM	P	PP	SH	FI	SP		JD40.4.10-1
	X						
APPROVALS							PAGE 1 OF 2
Des. Sect.						DESIGN DATA SHEET	
Sect. Supv.						HORIZONTAL CENTRIFUGAL PUMPS	ISSUED 11/1/73
Div.							REVISED 11/3/78

1	Job No. C-21700 Customer MDAC		
2	Project Solar One By HCW Date		
3	Equipment Nomenclature Raw/Service Water Pumps (P-703, 704)		
4	No. of Pumps 2 Driver by Vendor: X Yes ☐ No		
5	CONDITIONS OF SERVICE (EACH)		
6	Fluid Pumped (Characteristics, if known, are specified elsewhere)		Water
7	Flow Design/Normal Operating	USGPM	350/175
8	Operating Range Minimum to Maximum (If required)	USGPM	N/A / N/A
9	Design Temperature	°F	60
10	Discharge Pressure @ Design Flow	PSIG	108
11	Suction Pressure	PSIG	7.6
12	Specific Gravity @ Design Temp, (Ref. 60 °F)		1.0
13	Required Total Head @ Design Flow	Ft.	234
14	Available NPSH	Ft.	49
15	Barometric Pressure	PSIA	13.72
16	Vapor Pressure @ Design Temp.	PSIA	0.2563
17	Viscosity @ Design Temp.	SSU (or Cp)	
18	Max. Allowable Shut Off Head	Ft.	-
19	Cooling Water (If Required) Max. Temp.	°F	-
20	Installation Indoors or Outdoors		Indoors
21			
22	DESIGN REQUIREMENTS		
23	Pump Type	X Single Stage ☐ Multi-Stage	
24	Casing Split	X Axial ☐ Radial ☐ Back Pull ☐ Front Pull	
25	Drive Arrangement	X Coupled* ☐ Close Coupled ☐ V-Belt	
26	Base Type	☐ Cast Iron X Fab. Steel X Drain Rim	
27	Mount. Arrangement	X Common ☐ Separate ☐ Vertical In-Line	
28	Rotation (From Colg. End)	☐ Clockwise ☐ Counter Clockwise	
29	Pumps Identical?	X Yes ☐ No RPM Maximum	
30	Impeller Type	X Enclosed ☐ Semi-Enclosed ☐ Open ☐ Non-Clog	
31	Type of Operation	X Parallel ☐ Series ☐ Single	
32	Nozzle Detail	Required Min. Press Rating: Suction Cl.150 Discharge Cl.150	
33	Suction Location	X Side ☐ End ☐ Bottom	
34	Suction Type	X Flanged ☐ Screwed ☐ Welded	
35	Discharge Location	X Side ☐ Top X Tangential ☐ Centerline	
36	Discharge Type	X Flanged ☐ Screwed ☐ Welded	
37	Bearing Detail (810 Life 17500 hrs.)	Lube Medium: X Oil ☐ Grease	
38	Radial	X Ball ☐ Split Sleeve	
39	Radial Lube./w/Oil Level Indicator	☐ Ring X Flood ☐ Pressure ☐ Sealed ☐ Watercooled	
40		X Ball ☐ Spherical Roller ☐ Kingsbury	
41	Thrust Lube/Cooling	☐ Ring X Flood ☐ Pressure ☐ Sealed ☐ Watercooled	
42	Sealing Detail	X Packed Box ☐ Mech. Seal ☐ Injection Seal	
43	Sealing Cooling	X None ☐ Water Jacketed ☐ Heat Exchanger	
44	Driver Type	X Motor ☐ Turbine ☐ Engine ☐ Other	
45	Driver Enclosure (Specify)		
46	Factory Tests	Certified curves X Yes ☐ No	
47	Performance	☐ None X Non-Witnessed ☐ Witnessed	
48	Hydrostatic	☐ None X Non-Witnessed ☐ Witnessed	
49	NPSH	☐ None X Non-Witnessed ☐ Witnessed	
50	Max. Shaft deflection 0.002 in.		
51	*With Coupling Guard		

FORM 02 224 REV 11 76

DIVISION USAGE						**Stearns-Roger** INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
MM	P	PP	SH	FI	SP		JD40.4.10-1
	X						
APPROVALS Des. Sect. [signature] Sect. Supv. [signature] Div. [signature]						DESIGN DATA SHEET HORIZONTAL CENTRIFUGAL PUMPS TO BE COMPLETED BY MANUFACTURER	PAGE 2 OF 2 ISSUED 11/1/73 REVISED 11/3/78

1	Job No. C-21700		Customer MDAC			
2	Project Solar One			Manufacturer:		
3	Equipment Nomenclature Raw/Service Water Pumps (P-703, 704)					
4	PART	MATERIAL	ASTM NO.	PART	MATERIAL	ASTM NO.
5	Case			Shaft Sleeve		
6	Impeller			Bearing Lube		
7	Imp.Wrg.Ring			Baseplate		
8	Case Wrg.Ring					
9	Shaft					
10						

11	GENERAL DESCRIPTION AND CONSTRUCTION		PERFORMANCE
12	Size	52	Performance Curve No.
13	Manufacturer's Catalog No.	53	NPSH Required, Feet
14	Type	54	Design
15	No. of Stages	55	Runout (1 Pump Oper.)
16	Casing: Single Volute; Double Volute; Diffuser	56	Pump Efficiency, %
17	Max. Hydro., PSIG	57	Design
18	Bn. Hardness	58	Runout
19	Wrg. Ring, Bn. Hard	59	Pump Speed, RPM
20		60	Operating
21	Impeller, Enclosed; Open; Semi Open	61	First Critical
22	Bn. Hardness	62	Brake Horsepower, BHP
23	Wrg. Ring Bn. Hard	63	Design Point
24	Diameter, Bid, Inches	64	Runout
25	Diameter, Max/Min, Inches /	65	Max. at any Point
26	Thrust Bal. Method	66	Min. Recommended Flow, GPM
27	Shaft	67	Cooling Water (If Req'd)
28	Sleeve Bn. Hard	68	GPM
29	Diameter, Inches	69	Temp. Rise, °F
30	@ Coupling/Stuff. Box /	70	Sealing Water (If Req'd)
31	Bearings	71	GPM
32	Type, Radial/Thrust /	72	Temp., °F
33	Lube (Flood, Press or Seal)	73	PSIG
34	Radial, Mfgr./Model /	74	WK^2 (Wec) Lb.-Ft.^{2}
35	Thrust, Mfgr./Model /	75	Max. Allowable X, Y, Z
36	Stuffing Box, Packing Material	76	Forces, Lbs. (If Req'd)
37	Length/No. Rings /	77	Suction
38	Mechanical Seal	78	Discharge
39	Manufacturer	79	Max. Dia. Solids, In.
40	A.P.I. No./Model /	80	Recommended Spare Parts:
41	Coupling Size, Inches	81	
42	Manufacturer/Model /	82	
43	Suction Size, Inches	83	
44	Rating/Type/Face / /	84	
45	Discharge, Size, Inches	85	
46	Rating/Type/Face / /	86	
47	Outline & Dimension Dwg. No.	87	
48	Assembled Weight with	88	
49	Base. Colg. (No Driver), Lbs.	89	
50		90	
51		91	

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X				

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER JF16.02.02-1

APPROVALS
Des. Sec.
Sect. Supv.
Div.

MOTOR DATA SHEETS

ISSUED 7/7/76
REVISED 3/27/79

NAME OF BIDDER _____

1. GENERAL	No. 1	No. 2	No. 3
*A. Application	Raw/Service Water Pumps		
*B. Location (outdoors/indoors)	Indoors		
*C. Quantity	2		
**D. Manufacturer			
***E. Frame size			
***F. Motor Type			
a. Horizontal	☐	☐	☐
b. Vertical, solid shaft	☐	☐	☐
c. Vertical, hollow shaft	☐	☐	☐
d. Squirrel cage	☐	☐	☐
e. Wound rotor	☐	☐	☐
f. Synchronous	☐	☐	☐
g. Capacitor start	☐	☐	☐
h. Split phase	☐	☐	☐
i. Shaded pole	☐	☐	☐
j. Repulsion start	☐	☐	☐
k. Repulsion induction	☐	☐	☐
l. DC	☐	☐	☐
m. Other			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

2. PERFORMANCE	No. 1	No. 2	No. 3
**A. Rated output, horsepower			
**B. Load brake horsepower			
**C. Service factor			
*D. Rated voltage, volts	460		
**E. Field voltage, dc volts			
*F. Phase	3		
*G. Frequency, hertz	60		
**H. Rated Speed, rpm			
a. Synchronous			
b. Actual full load			
c. Base speed - DC			
*I. Minimum motor starting voltage, percent of rated	80		
**J. Full load current, amperes			
**K. Field current at base speed, dc amperes			
**L. Locked rotor current at rated voltage, amperes			
**M. Starting torque at rated voltage, percent of full load torque			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**N.	Breakdown torque at rated voltage, percent of full load torque			
***O.	Accelerating time at starting voltage specified above, seconds			
***P.	Successive starting limitations			
***Q.	"Safe" locked rotor time "cold" at rated voltage, seconds			
***R.	"Safe" locked rotor time "hot" at rated voltage, seconds			
**S.	Efficiency, Percent			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			
**T.	Power Factor			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**U. Losses, kW			
a. Service factor load	N/A		
b. Full load	N/A		
c. 75 percent load	N/A		
d. 50 percent load	N/A		
V. WK^2, $lb\text{-}ft^2$			
**a. Of load			
**b. Of motor			
**c. Load capability of motor			
3. CONSTRUCTION			
*A. Enclosure			
a. Open Dripproof	☒	☐	☐
b. TEFC	☐	☐	☐
c. TENV	☐	☐	☐
d. Dust-ignition proof	☐	☐	☐
e. Weather-protected	☐ I ☐ II	☐ I ☐ II	☐ I ☐ II
f. Other			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**B.	Bearings			
	a. Antifriction	☐	☐	☐
	b. Split-sleeve	☐	☐	☐
	c. Other			
	d. Type lubrication			
	e. Minimum AFBMA (L-10) antifriction bearing life rating (belt or chain drive motors only), hours			
**C.	Insulation			
	a. Class			
	b. Maximum design total temperature rating for insulation, degrees C			
	c. Maximum service ambient temperature, degrees C			
	d. Temperature rise (by resistance) at service elevation and at service factor rating, degrees C			
	e. Total hot-spot temperature at service factor rating, degrees C			
**D.	NEMA Code letter (If applicable)			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**E. NEMA Design letter (If applicable)			
***F. Net weight, pounds			
***G. Dimensions, inches			
a. Length			
b. Width			
c. Height			
**H. Rotor bar and end ring material (4kV and above)			

4. ACCESSORIES

**A. Baseplate	☐	☐	☐
**B. Soleplate	☐	☐	☐
**C. Space heater	☐	☐	☐
**D. Space heater demand, watts			
*E. Stator thermocouples or RTD's	☐	☐	☐
*F. Stator thermostatic-type protection	☐	☐	☐
*G. Bearing thermocouples or thermostats	☐	☐	☐
*H. Bearing oil sump heaters	☐	☐	☐

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No.3
*I. Differential protection current transformers	☐	☐	☐
*J. Surge capacitor	☐	☐	☐
*K. Motor controller by motor supplier	☐ Yes ☒ No	☐ Yes ☐ No	☐ Yes ☐ No

5. DRIVE COMPATIBILITY

**A. Gear	☐	☐	☐
**B. Belt	☐	☐	☐
**C. Chain	☐	☐	☐
*D. Direct coupled	☒	☐	☐
*E. Half coupling to be pressed on by motor supplier	☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
*F. Sheave to be pressed on by motor supplier	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

***6. TERMINAL BOXES AND GROUND CONNECTORS

A. Terminal boxes (inside dimensions), inches			
a. Height	_____	_____	_____
b. Width	_____	_____	_____
c. Depth	_____	_____	_____
B. Ground connector size, AWG	_____	_____	_____

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

**7. OTHER INFORMATION

(Special Starting, Etc.)

*8. ACCEPTABLE MANUFACTURERS

N/A

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

Area 300 (TSS) 5

CALORIA MAKE UP PUMP (P-306)

1. One (1) rotary pump as specified on the Design Data Sheet, pg. 1 of 2, Standard No. 40.4.14-1, with its nozzles conforming to ANSI B16.5 flange requirements for the specified conditions of service. The pump design shall comply with the requirements as specified in the Stearns-Roger "Specification for Rotary Pumps," Standard No. JD40.4.14.

2. One (1) electric drive motor suitable for hazardous area Class I, Division II, Group D suitable for operation outdoors as defined by the National Electrical Code as specified in the Stearns-Roger "NEMA Frame Induction Motor," Standard JF16.02.02, and Motor Data Sheets, 8 pages, Standard No. JF16.02.02-1.

3. The pump and drive motor shall be mounted on a common base plate and provided with a suitable coupling.

4. The pump shall be furnished with a suitable integral or separate safety relief valve.

5. The pump and motor shall be purchased with a two year supply of manufacturer's recommended spare parts.

6. The pump nameplate shall include; Model, Serial No., Total Head, Capacity and Speed.

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
MMI	P	PP	SH	FI	SP		JD40.4.14-1
	X						
APPROVALS Des. Sect. BCK Sect. Supv. [illegible] Div. [illegible]						DESIGN DATA SHEET ROTARY PUMPS	PAGE 1 OF 2 ISSUED 4/8/75 REVISED 4/26/77

1	Job No. C-21700	Customer MDAC		
2	Project Solar One	By JEG	Date	
3	Equipment Nomenclature Caloria Make Up Pump			
4	No. of Pumps ONE	Driver by Vendor: [X] Yes [ ] No		
5	CONDITIONS OF SERVICE (EACH)			
6	Fluid Pumped (Characteristics, if known, are specified elsewhere)			Exxon Caloria HT43
7	Flow, Normal/Design		USGPM	100 / 100
8	Design Temperature		°F	60
9	Discharge Pressure		PSIG	30
10	Suction Pressure		PSIG	0
11	Net Pressure		PSI	30
12	Specific Gravity @ Design Temp. (Ref. 60°F)			0.8587
13	Barometric Pressure		PSIA	13.7
14	Vapor Pressure @ Design Temp.		PSIA	Nil
15	Maximum System Design Pressure		PSIG	250
16	Viscosity @ Design Temp.		Cp	500
17	Viscosity Range, Minimum/Maximum		Cp	25 / 1000
18	Installation Indoors or Outdoors			Outdoors
19				
20	DESIGN REQUIREMENTS			
21	Pump Type [ ] Internal Gear [ ] External Gear [ ] Screw [ ] Lobe [ ] Vane [X] Vendor Option			
22	[ ] Other Specify			
23	Drive Arrangement [X] Direct Coupled [ ] Coupled through Reduction Gear [ ] V-Belt			
24	Base Type [ ] Cast Iron [ ] Fab. Steel [X] Driplip			
25	Rotation (From Cplg. End) [ ] Clockwise [ ] Counter Clockwise			
26	Pumps Identical? [ ] Yes [ ] No RPM Maximum			
27	Type of Operation [ ] Parallel [ ] Series [X] Single			
28	Nozzle Detail Required Min. Press. Rating: Suction Cl.150 Discharge Cl.150			
29	Suction Type [X] Flanged [ ] Screwed			
30	Discharge Type [X] Flanged [ ] Screwed			
31	Bearing Detail Lube Medium: [ ] Oil [ ] Grease [X] Pumped Medium (10 Life 17500 hrs)			
32	Bearing Location [X] Internal [ ] External			
33	Sealing Detail [ ] Packed Box [X] Mech. Seal			
34	Sealing Heating/Cooling [X] None [ ] Steam Jacketed [ ] Heat Exchanger			
35	Driver Type [X] Motor [ ] Turbine [ ] Engine [ ] Other			
36	Motor Enclosure (Specify) TEFC			
37	Strainer [X] Yes [ ] No			
38				
39				
40				
41				
42				
43				
44				
45				
46	Factory Tests Certified Curves [X] Yes [ ] No			
47	Performance [ ] None [X] Non-Witnessed [ ] Witnessed			
48	Hydrostatic [ ] None [X] Non-Witnessed [ ] Witnessed			
49				
50				
51				

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
MM	P	PP	SH	FI	SP		JD40.4.14-1
	X						
APPROVALS Des. Sect. BCK Sect. Supv. [illegible] Div. [illegible]						DESIGN DATA SHEET ROTARY PUMPS TO BE COMPLETED BY MANUFACTURER	PAGE 2 OF 2 ISSUED 4/8/75 REVISED 4/26/77

1	Job No. C-21700			Customer MDAC			
2	Project Solar One			Manufacturer			
3	Equipment Nomenclature Caloria Make Up Pump						
	PART	MATERIAL	ASTM NO.		PART	MATERIAL	ASTM NO.
4	Case			10	Shaft Sleeve		
5	Rotor			11	Bearing Lube		
6	Shaft			12	Stuffing Box		
7				13	Baseplate		
8				14			
9				15			

	GENERAL DESCRIPTION AND CONSTRUCTION		PERFORMANCE
16	Size	56	Capacity, GPM
17	Manufacturer's Catalog No.	57	NPSH Required, Feet
18	Type	58	Pump Efficiency, %
19	Casing	59	Pump Speed, RPM
20	Max. Hydro., PSIG	60	Brake Horsepower, BHP
21	Bn. Hardness	61	Net Pressure, PSI
22	Rotor, Type	62	Cooling Water, GPM
23	Bn. Hardness	63	Temp. Rise, °F
24	Shaft	64	WK^2 (Wet) Lb.-Ft.^{2}
25	Sleeve Bn. Hard	65	Max. Allowable X, Y, Z
26	Diameter, Inches	66	Forces, Lbs. (If Req'd)
27	@ Coupling/Stuff. Box /	67	Suction
28	Bearings	68	Discharge
29	Type, Radial/Thrust /	69	Performance Curve No.
30	Lube Type	70	Recommended Spare Parts:
31	Radial, Mfr./Model /	71	
32	Thrust, Mfr./Model /	72	
33	Stuffing Box, Packing Material	73	
34	Length/No. Rings /	74	
35	Mechanical Seal	75	
36	Manufacturer	76	
37	Type/Model /	77	
38	Coupling Size, Inches	78	
39	Manufacturer/Model /	79	
40	Suction Size, Inches	80	
41	Rating/Type/Face / /	81	
42	Discharge, Size, Inches	82	
43	Rating/Type/Face / /	83	
44	Outline & Dimension Dwg. No.	84	
45	Assembled Weight with	85	
46	Base, Cplg. (No Driver), Lbs.	86	
47	Relief Valve Capacity/Set Point /	87	
48	Mfr./Size, Inches /	88	
49		89	
50		90	
51		91	
52		92	
53		93	
54		94	
55		95	

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	Y				

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JF16.02.02-1

APPROVALS
Des. Se
Sect. Supv
Div.

MOTOR DATA SHEETS

ISSUED 7/7/76
REVISED 3/27/79

NAME OF BIDDER _____

1. GENERAL	No. 1	No. 2	No. 3
*A. Application	Caloria Make-up Pump		
*B. Location (outdoors/indoors)	Outdoors		
*C. Quantity	1		
**D. Manufacturer			
***E. Frame size			
***F. Motor Type			
a. Horizontal	☐	☐	☐
b. Vertical, solid shaft	☐	☐	☐
c. Vertical, hollow shaft	☐	☐	☐
d. Squirrel cage	☐	☐	☐
e. Wound rotor	☐	☐	☐
f. Synchronous	☐	☐	☐
g. Capacitor start	☐	☐	☐
h. Split phase	☐	☐	☐
i. Shaded pole	☐	☐	☐
j. Repulsion start	☐	☐	☐
k. Repulsion induction	☐	☐	☐
l. DC	☐	☐	☐
m. Other			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM 02 224 REV 11-76

NAME OF BIDDER _____

2. PERFORMANCE	No. 1	No. 2	No. 3
**A. Rated output, horsepower			
**B. Load brake horsepower			
**C. Service factor			
*D. Rated voltage, volts	460		
**E. Field voltage, dc volts			
*F. Phase	3		
*G. Frequency, hertz	60		
**H. Rated Speed, rpm			
a. Synchronous			
b. Actual full load			
c. Base speed - DC			
*I. Minimum motor starting voltage, percent of rated	80		
**J. Full load current, amperes			
**K. Field current at base speed, dc amperes			
**L. Locked rotor current at rated voltage, amperes			
**M. Starting torque at rated voltage, percent of full load torque			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**N.	Breakdown torque at rated voltage, percent of full load torque			
***O.	Accelerating time at starting voltage specified above, seconds			
***P.	Successive starting limitations			
***Q.	"Safe" locked rotor time "cold" at rated voltage, seconds			
***R.	"Safe" locked rotor time "hot" at rated voltage, seconds			
**S.	Efficiency, Percent			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			
**T.	Power Factor			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			

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**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**U. Losses, kW			
a. Service factor load	N/A		
b. Full load	N/A		
c. 75 percent load	N/A		
d. 50 percent load	N/A		
V. WK^2, $lb\text{-}ft^2$			
**a. Of load			
**b. Of motor			
**c. Load capability of motor			

3. CONSTRUCTION

*A. Enclosure			
a. Open Dripproof	☐	☐	☐
b. TEFC	☐	☐	☐
c. TENV	☐	☐	☐
d. Dust-ignition proof	☐	☐	☐
e. Weather-protected	☐I ☐II	☐I ☐II	☐I ☐II
f. Other	Enclosure shall be suitable for hazardous areas Class I, Division II, Group D suitable for operation outdoors.		

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**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**B. Bearings			
a. Antifriction	☐	☐	☐
b. Split-sleeve	☐	☐	☐
c. Other			
d. Type lubrication			
e. Minimum AFBMA (L-10) antifriction bearing life rating (belt or chain drive motors only), hours			
**C. Insulation			
a. Class			
b. Maximum design total temperature rating for insulation, degrees C			
c. Maximum service ambient temperature, degrees C			
d. Temperature rise (by resistance) at service elevation and at service factor rating, degrees C			
e. Total hot-spot temperature at service factor rating, degrees C			
**D. NEMA Code letter (If applicable)			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

Form 02 224 REV 11-76

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**E. NEMA Design letter (If applicable)			
***F. Net weight, pounds			
***G. Dimensions, inches			
a. Length			
b. Width			
c. Height			
**H. Rotor bar and end ring material (4kV and above)			

4. ACCESSORIES

**A. Baseplate	☐	☐	☐
**B. Soleplate	☐	☐	☐
**C. Space heater	☐	☐	☐
**D. Space heater demand, watts			
*E. Stator thermocouples or RTD's	☐	☐	☐
*F. Stator thermostatic-type protection	☐	☐	☐
*G. Bearing thermocouples or thermostats	☐	☐	☐
*H. Bearing oil sump heaters	☐	☐	☐

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
*I. Differential protection current transformers	☐	☐	☐
*J. Surge capacitor	☐	☐	☐
*K. Motor controller by motor supplier	☐ Yes ☒ No	☐ Yes ☐ No	☐ Yes ☐ No

5. DRIVE COMPATIBILITY

**A. Gear	☐	☐	☐
**B. Belt	☐	☐	☐
**C. Chain	☐	☐	☐
*D. Direct coupled	☒	☐	☐
*E. Half coupling to be pressed on by motor supplier	☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
*F. Sheave to be pressed on by motor supplier	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

***6. TERMINAL BOXES AND GROUND CONNECTORS

A. Terminal boxes (inside dimensions), inches			
a. Height	_____	_____	_____
b. Width	_____	_____	_____
c. Depth	_____	_____	_____
B. Ground connector size, AWG	_____	_____	_____

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

**7. OTHER INFORMATION

(Special Starting, Etc.)

*8. ACCEPTABLE MANUFACTURERS

N/A

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM 02 224 REV 11-76

Area 700 (PSS)

DEMINERALIZED WATER TRANSFER PUMP (P-710)

1. One (1) Demineralized Water Transfer Pump and Driver in accordance with Engineering Standard JD40.4.10 and to these specifications and design data sheets.

   (a) One (1) horizontal centrifugal pump and accessories.

   (b) One (1) 5 horsepower 480 volt, 3 phase, 60 hertz electric drive motor.

   (c) One set recommended spare parts.

2. The pump nameplate shall include; Model, Serial No., Total Head, Capacity and Speed.

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
WM	P	PP	SH	FI	SP		JD40.4.10-1
	X						
APPROVALS							PAGE 1 OF 2
Des. Sect. JHMount						DESIGN DATA SHEET	
Sect. Supv.						HORIZONTAL CENTRIFUGAL PUMPS	ISSUED 11/1/73
Div. WHZ							REVISED 11/3/78

1	Job No. C-21700 Customer DOE and Associates		
2	Project 10MWe Solar Pilot Plant By JRB Date		
3	Equipment Nomenclature Demineralized Wtr. Transfer Pump - (P-710)		
4	No. of Pumps One Driver by Vendor: [X] Yes [ ] No		
5	CONDITIONS OF SERVICE (EACH)		
6	Fluid Pumped (Characteristics, if known, are specified elsewhere)		Demin. Wtr.
7	Flow Design	USGPM	75
8	Operating Range Minimum to Maximum (If required)	USGPM	-/-
9	Design Temperature	°F	60
10	Discharge Pressure	PSIG	49
11	Suction Pressure	PSIG	6
12	Specific Gravity @ Design Temp, (Ref. 60 °F)		1.0
13	Required Total Head	Ft.	100
14	Available NPSH	Ft.	2
15	Barometric Pressure	PSIA	13.72
16	Vapor Pressure @ Design Temp.	PSIA	0.256
17	Viscosity @ Design Temp.	Cp	1.1
18	Max. Allowable Shut Off Head	Ft.	
19	Cooling Water (If Required) Max. Temp.	°F	-
20	Installation Indoors or Outdoors		Indoor
21			
22	DESIGN REQUIREMENTS		
23	Pump Type	[X] Single Stage	[ ] Multi-Stage
24	Casing Split	[ ] Axial [X] Radial	[ ] Back Pull [ ] Front Pull
25	Drive Arrangement	[X] Coupled [ ] Close Coupled	[ ] V-Belt
26	Base Type	[ ] Cast Iron [X] Fab. Steel	[X] Drain Rim
27	Mount. Arrangement	[X] Common [ ] Separate	[ ] Vertical In-Line
28	Rotation (From Colg. End)	[ ] Clockwise	[ ] Counter Clockwise
29	Pumps Identical?	[ ] Yes [ ] No	RPM Maximum
30	Impeller Type	[X] Enclosed [ ] Semi-Enclosed	[ ] Open [ ] Non-Clog
31	Type of Operation	[ ] Parallel [ ] Series	[X] Single
32	Nozzle Detail	Required Min. Press Rating: Suction Cl.150	Discharge Cl.150
33	Suction Location	[ ] Side [X] End	[ ] Bottom
34	Suction Type	[X] Flanged [ ] Screwed	[ ] Welded
35	Discharge Location	[ ] Side [X] Top [ ] Tangential	[ ] Centerline
36	Discharge Type	[X] Flanged [ ] Screwed	[ ] Welded
37	Bearing Detail (B10 Life 17500 hrs.)	Lube Medium: [X] Oil	[ ] Grease
38	Radial	[X] Ball	[ ] Split Sleeve
39	Radial Lube. w/Oil Level Indicator	[ ] Ring [X] Flood [ ] Pressure [ ] Sealed	[ ] Watercooled
40	Thrust	[X] Ball [ ] Spherical Roller	[ ] Kingsbury
41	Thrust Lube/Cooling	[ ] Ring [X] Flood [ ] Pressure [ ] Sealed	[ ] Watercooled
42	Sealing Detail	[X] Packed Box [ ] Mech. Seal	[ ] Injection Seal
43	Sealing Cooling	[X] None [ ] Water Jacketed	[ ] Heat Exchanger
44	Driver Type	[X] Motor [ ] Turbine [ ] Engine	[ ] Other
45	Driver Enclosure (Specify)	Open (Drip Proof)	
46	Factory Tests	Certified curves [X] Yes	[ ] No
47	Performance	[ ] None [X] Non-Witnessed	[ ] Witnessed
48	Hydrostatic	[ ] None [X] Non-Witnessed	[ ] Witnessed
49	NPSH	[ ] None [X] Non-Witnessed	[ ] Witnessed
50	Max. Shaft Deflection	0.002 in.	
51			

DIVISION USAGE						**Stearns-Roger** INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
MM	P	PP	SH	FI	SP		JD40.4.10-1
	X						
APPROVALS Des. Sect. Sect. Supv. Div.						DESIGN DATA SHEET HORIZONTAL CENTRIFUGAL PUMPS TO BE COMPLETED BY MANUFACTURER	PAGE 2 OF 2 ISSUED 11/1/73 REVISED 11/3/78

1	Job No. C-21700			Customer DOE and Associates		
2	Project 10MWe Solar Pilot Plant			Manufacturer:		
3	Equipment Nomenclature Demineralized Wtr. Transfer Pump - (P-710)					
4	PART	MATERIAL	ASTM NO.	PART	MATERIAL	ASTM NO.
5	Case			Shaft Sleeve		
6	Impeller			Bearing Lube		
7	Imp.Wrg.Ring			Baseplate		
8	Case Wrg.Ring					
9	Shaft					
10						

11	GENERAL DESCRIPTION AND CONSTRUCTION		PERFORMANCE
12	Size	52	Performance Curve No.
13	Manufacturer's Catalog No.	53	NPSH Required, Feet
14	Type	54	Design
15	No. of Stages	55	Runout (1 Pump Oper.)
16	Casing ☐ Single Volute ☐ Double Volute ☐ Diffuser	56	Pump Efficiency, %
17	Max. Hydro., PSIG	57	Design
18	Bn. Hardness	58	Runout
19	Wrg. Ring, Bn. Hard	59	Pump Speed, RPM
20		60	Operating
21	Impeller, ☐ Enclosed ☐ Open ☐ Semi Open	61	First Critical
22	Bn. Hardness	62	Brake Horsepower, BHP
23	Wrg. Ring Bn. Hard	63	Design Point
24	Diameter, Dia, Inches	64	Runout
25	Diameter, Max/Min, Inches /	65	Max. at any Point
26	Thrust Bal. Method	66	Min. Recommended Flow, GPM
27	Shaft	67	Cooling Water (If Req'd)
28	Sleeve Bn. Hard	68	GPM
29	Diameter, Inches	69	Temp. Rise, °F
30	@ Coupling/Stuff. Box /	70	Sealing Water (If Req'd)
31	Bearings	71	GPM
32	Type, Radial/Thrust /	72	Temp., °F
33	Lube (Flood, Press or Seal)	73	PSIG
34	Radial, Mfgr./Model /	74	WK² (Wet) Lb.-Ft.²
35	Thrust, Mfgr./Model /	75	Max. Allowable X, Y, Z
36	Stuffing Box, Packing Material	76	Forces, Lbs. (If Req'd)
37	Length/No. Rings /	77	Suction
38	Mechanical Seal	78	Discharge
39	Manufacturer	79	Max. Dia. Solids, In.
40	A.P.I. No./Model /	80	Recommended Spare Parts:
41	Coupling Size, Inches	81	
42	Manufacturer/Model /	82	
43	Suction Size, Inches	83	
44	Rating/Type/Face / /	84	
45	Discharge, Size, Inches	85	
46	Rating/Type/Face / /	86	
47	Outline & Dimension Dwg. No.	87	
48	Assembled Weight with	88	
49	Base. Colg. (No Driver), Lbs.	89	
50		90	
51		91	

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DIVISION USAGE					
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	Y				

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JF16.02.02-1

APPROVALS
Des. Sec.
Sect. Supv.
Div.

MOTOR DATA SHEETS

ISSUED 7/7/76
REVISED 3/27/79

NAME OF BIDDER _____

1. GENERAL	No. 1	No. 2	No. 3
*A. Application	Demineralized Water Transfer Pump		
*B. Location (outdoors/indoors)	Outdoors		
*C. Quantity	1		
**D. Manufacturer			
***E. Frame size			
***F. Motor Type			
a. Horizontal	☐	☐	☐
b. Vertical, solid shaft	☐	☐	☐
c. Vertical, hollow shaft	☐	☐	☐
d. Squirrel cage	☐	☐	☐
e. Wound rotor	☐	☐	☐
f. Synchronous	☐	☐	☐
g. Capacitor start	☐	☐	☐
h. Split phase	☐	☐	☐
i. Shaded pole	☐	☐	☐
j. Repulsion start	☐	☐	☐
k. Repulsion induction	☐	☐	☐
l. DC	☐	☐	☐
m. Other			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM JF 224 REV 11-76

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X				

APPROVALS
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ENGINEERING STANDARD

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PAGE 2 OF 3

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MOTOR DATA SHEETS (CONTD)

NAME OF BIDDER _____

2. PERFORMANCE	No. 1	No. 2	No. 3
**A. Rated output, horsepower			
**B. Load brake horsepower			
**C. Service factor			
*D. Rated voltage, volts	460		
**E. Field voltage, dc volts			
*F. Phase	3		
*G. Frequency, hertz	60		
**H. Rated Speed, rpm			
a. Synchronous			
b. Actual full load			
c. Base speed - DC			
*I. Minimum motor starting voltage, percent of rated	80		
**J. Full load current, amperes			
**K. Field current at base speed, dc amperes			
**L. Locked rotor current at rated voltage, amperes			
**M. Starting torque at rated voltage, percent of full load torque			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM 02 224 REV 11 76

MOTOR DATA SHEETS (CONTD)

NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**N.	Breakdown torque at rated voltage, percent of full load torque			
***O.	Accelerating time at starting voltage specified above, seconds			
***P.	Successive starting limitations			
***Q.	"Safe" locked rotor time "cold" at rated voltage, seconds			
***R.	"Safe" locked rotor time "hot" at rated voltage, seconds			
**S.	Efficiency, Percent			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			
**T.	Power Factor			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**U. Losses, kW			
a. Service factor load	N/A		
b. Full load	N/A		
c. 75 percent load	N/A		
d. 50 percent load	N/A		
V. WK^2, $lb\text{-}ft^2$			
**a. Of load			
**b. Of motor			
**c. Load capability of motor			
3. CONSTRUCTION			
*A. Enclosure			
a. Open Dripproof	☐	☐	☐
b. TEFC	☒	☐	☐
c. TENV	☐	☐	☐
d. Dust-ignition proof	☐	☐	☐
e. Weather-protected	☐ I ☐ II	☐ I ☐ II	☐ I ☐ II
f. Other			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**8. Bearings			
a. Antifriction	☐	☐	☐
b. Split-sleeve	☐	☐	☐
c. Other			
d. Type lubrication			
e. Minimum AFBMA (L-10) antifriction bearing life rating (belt or chain drive motors only), hours			
**C. Insulation			
a. Class			
b. Maximum design total temperature rating for insulation, degrees C			
c. Maximum service ambient temperature, degrees C			
d. Temperature rise (by resistance) at service elevation and at service factor rating, degrees C			
e. Total hot-spot temperature at service factor rating, degrees C			
**D. NEMA Code letter (If applicable)			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

MOTOR DATA SHEETS (CONTD)

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**E. NEMA Design letter (If applicable)			
***F. Net weight, pounds			
***G. Dimensions, inches			
a. Length			
b. Width			
c. Height			
**H. Rotor bar and end ring material (4kV and above)			
4. ACCESSORIES			
**A. Baseplate	☐	☐	☐
**B. Soleplate	☐	☐	☐
**C. Space heater	☐	☐	☐
**D. Space heater demand, watts			
*E. Stator thermocouples or RTD's	☐	☐	☐
*F. Stator thermostatic-type protection	☐	☐	☐
*G. Bearing thermocouples or thermostats	☐	☐	☐
*H. Bearing oil sump heaters	☐	☐	☐

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
*I. Differential protection current transformers	☐	☐	☐
*J. Surge capacitor	☐	☐	☐
*K. Motor controller by motor supplier	☐ Yes ☒ No	☐ Yes ☐ No	☐ Yes ☐ No

5. DRIVE COMPATIBILITY

**A. Gear	☐	☐	☐
**B. Belt	☐	☐	☐
**C. Chain	☐	☐	☐
*D. Direct coupled	☒	☐	☐
*E. Half coupling to be pressed on by motor supplier	☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
*F. Sheave to be pressed on by motor supplier	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

***6. TERMINAL BOXES AND GROUND CONNECTORS

A. Terminal boxes (inside dimensions), inches

a. Height	_____	_____	_____
b. Width	_____	_____	_____
c. Depth	_____	_____	_____
B. Ground connector size, AWG	_____	_____	_____

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM SR 224 REV 11 76

NAME OF BIDDER _____

**7. OTHER INFORMATION

(Special Starting, Etc.)

*8. ACCEPTABLE MANUFACTURERS

N/A

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM 02 224 REV 11 76

Area 300 (TSS)

TSS FLASH TANK DRAIN PUMP (P-307)

One (1) TSS Flash Tank Drain Pump and drive motor assembly described as follows and in accordance with Engineering Standard JD40.4.11.

1. Vertical turbine can type, single stage centrifugal pump similar to Bingham-Willamette model 4 x 6 x 10A type VCR. (Ref. Design Data Sheet Pg. 1 of 2, Standard No. JD40.4.11-1). The pump shall comply with the requirements specified in the Stearns-Roger "Specification for Vertical Centrifugal Pumps," Standard No. JD40.4.11.

2. One (1) 480V, 3 phase, 60 hertz electric drive motor of sufficient horsepower for the specified pump operating conditions, as specified in the Stearns-Roger "NEMA Frame Induction Motor," Standard JF16.02.02.

3. One (1) set of manufacturers recommended spare parts sufficient for two years of operation.

4. The pump nameplate shall include; Model, Serial No., Total Head, Capacity and Speed.

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER JD 40.4.11-1
MM	P	PP	SH	FI	SP		
	X						
APPROVALS Des. Sect. Sect. Supv. Div						DESIGN DATA SHEET VERTICAL CENTRIFUGAL PUMPS	PAGE 1 OF 2 ISSUED 11/1/73 REVISED 12/18/78

1	Job No. C-21700	Customer DOE - STMPO No.	
2	Project 10 MWe Solar Pilot Plant	By JRB	Date 12/20/79
3	Equipment Nomenclature TSS Flash Tank Drain Pump		
4	Number of Pumps One	Driver by Vendor [X] Yes [ ] No	
5	CONDITIONS OF SERVICE (EACH)		
6	Fluid Pumped (Characteristics, if known, are specified elsewhere)		Condensate
7	Design Flow/Temp.	USGPM/°F	265 / 360 *
8	Operating Range, Minimum to Maximum (if required)	USGPM	10 / 265
9	Discharge Pressure	PSIG	165
10	Suction Pressure	PSIG	150
11	Specific Gravity at Design Temp (Ref 60°F)		0.887
12	Required Total Head (exclusive of pump losses)	Ft.	40
13	Available NPSH/Reference Point	Ft.	1 / E Suction
14	Barometric Pressure	PSIA	13.7
15	Vapor Pressure at Design Temp.	PSIA	150
16	Viscosity at Design Temp.	SSU (or Cp)	0.15
17	Maximum Allowable Shut Off Discharge Pressure	PSIG	215
18	Installation Indoors or Outdoors		Outdoors
19	Height, Centerline of Discharge Nozzle Above Mounting Surface	Ft.-In.	
20	Length, Mounting Surface to Bottom of Suction or Strainer		
21	(If required)	Ft.-In.	
22	Sump Depth, Mounting Surface to Bottom of Sump	Ft.-In.	
23	Static Head, Mounting Surfaces to Minimum Liquid Level	Ft.-In.	
24	DESIGN REQUIREMENTS		
25	Pump Type [X] Vertical Turbine [ ] Mixed Flow [ ] Propeller		
26	Drive Arrangement [X] Direct [ ] Gear [ ] Other		
27	Foundation Plate [X] Yes [ ] No Dimensions:		
28	Impeller Type [X] Enclosed ** [ ] Semi-Open Parallel Operation [ ] Yes [X] No		
29	Pumps Identical? [ ] Yes [ ] No RPM Maximum 1760		
30	Lineshaft Bearing Lubrication [X] Open [ ] Enclosed		
31	(If Enclosed) Lineshaft Bearing Lubrication [ ] Oil [ ] Grease [ ] Water [ ] Pumped Fluid		
32	Enclosing Tube: Material Coating		
33	Can, if required [ ] Furnished by Vendor [ ] By others		
34	Can Dimensions, Approx. 14"Dia. 45" Length o' Suction Size Coating		
35	Strainer [ ] Yes [X] No Material		
36	Suction [ ] Suction Case [ ] Suction Bell		
37	Bowls [ ] Threaded [X] Flanged		
38	Column Pipe [ ] Threaded [X] Flanged [ ] Coated		
39	Discharge [X] Above Mounting [ ] Below Mounting		
40	Discharge Pipe Diameter, Inches 4" [X] Flanged [ ] Threaded [ ] Plain End		
41	(If flanged) ANSI Rating ANSI B16.5 Class 300		
42	Sealing Detail [ ] Packed Box [X] Mechanical Seal with Cooler		
43	Sealing Lube, if required [ ] Filtered Pumped Medium [ ] Outside Water		
44	Spacer Type Coupling [X] Yes [ ] No		
45	Driver Type [X] Motor [ ] Turbine [ ] Engine [ ] Other		
46	(If motor or right angle gear) [ ] Vertical Hollow Shaft [X] Vertical Solid Shaft		
47	Driver Enclosure (specify) TEFC [ ] Non Reverse Ratchet [ ] Self Release Coupling		
48	Factory Tests Certified Curves [X] Yes [ ] No		
49	Performance [ ] None [X] Non-Witnessed [ ] Witnessed		
50	Hydrostatic [ ] None [X] Non-Witnessed [ ] Witnessed		
51	NPSH [ ] None [X] Non-Witnessed [ ] Witnessed		
52	Bearing Life B10 17500 hrs. **Keyed Impellers with Retaining Rings		

*Bowl and Impeller Materials to be suitable for 360°F.

DIVISION USAGE					
WM	P	PP	SH	FI	SP
	X				

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STANDARD NUMBER
JD 40.4.11-1

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DESIGN DATA SHEET
VERTICAL CENTRIFUGAL PUMPS
TO BE COMPLETED BY MANUFACTURER

ISSUED 11/1/73
REVISED 12/18/78

1| Job No. C-21700 Customer DOE - STMPO No.
2| Project 10 MWe Solar Pilot Plant Manufacturer
3| Equipment Nomenclature TSS Flash Tank Drain Pump

	PART	MATERIAL	ASTM NO.	PART	MATERIAL	ASTM NO.
5	Bowl			Suct.Case/Bell		
6	Impeller			Lineshaft Brgs.		
7	Imp.Wrz.Ring			Bowl Brgs.		
8	Bowl Wrz.Ring			Column Pipe		
9	Bowl Shaft			Discharge Head		
10	Lineshaft			Stuffing Box		
11	Shaft Sleeve			Strainer		
12	Enclosure Tube					
13						
14						

	GENERAL DESCRIPTION AND CONSTRUCTION		PERFORMANCE
16	Size	52	Performance Curve No.
17	Mfg. Catalog No.	53	NPSH Required, Feet
18	Type Pump	54	Design
19	No. of Stages	55	Runout (1 Pump Operating)
20	Bowl, Max. Hydro. PSIG	56	Pump Efficiency %
21	Bn Hardness	57	Design
22	Wrg. Ring, Bn Hardness	58	Runout
23	Impeller/Propeller	59	Pump Speed, RPM
24	Type	60	Operating
25	Bn Hardness	61	First Critical
26	Wrg. Ring, Bn Hardness	62	Brake Horsepower
27	Diameter, Bid, Inches	63	Design Point
28	Diameter, Max/Min. Inches /	64	Runout
29	Bowl Shaft, Diameter, Inches	65	Max. at Any Point
30	Bn Hardness	66	Minimum Recommended Flow, GPM
31	Line Shaft, Diameter, Inches	67	Min. Recommended Submergence, Ft.
32	Sleeve, Bn Hardness	68	Cooling Water (If Required)
33	Enclosing Tube, Diameter, Inches	69	GPM
34	Column Pipe, Dia., Inches/Schedule /	70	Temp. Rise °F
35	Stuffing Box, Packing Material	71	Sealing Water (If Required)
36	Length/No. Rings /	72	GPM
37	Oiler Assembly (If required)	73	Temp. °F
38	Type Solenoid/Voltage Reqd. /	74	PSIG
39	Tank Capacity	75	Filter/Strainer Type
40	Mechanical Seal (If required)	76	Initial Upthrust, Lbs.
41	Manufacturer	77	Maximum Downthrust, Lbs.
42	API No./Model /	78	WK² (Wet), Lb-Ft²
43	Coupling Size, Inches	79	Max. Dia. Solids, In.
44	Manufacturer/Model /	80	
45	Foundation Plate Material	81	Recommended Spare Parts:
46	Dimensions, Inches X X	82	
47	Strainer, Diameter, Inches Size Perf.	83	
48	Material/Type /	84	
49	Outline and Dim. Dwg. No.	85	
50	Assembled Weight (Less Driver), Lbs.	86	
87		87	

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	Y				

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

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JF16.02.02-1

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MOTOR DATA SHEETS

ISSUED 7/7/76
REVISED 3/27/79

NAME OF BIDDER _____

1. GENERAL	No. 1	No. 2	No. 3
*A. Application	TSS Flash Tank Drain Pump		
*B. Location (outdoors/indoors)	Outdoors		
*C. Quantity	1		
**D. Manufacturer			
***E. Frame size			
***F. Motor Type			
a. Horizontal	☐	☐	☐
b. Vertical, solid shaft	☐	☐	☐
c. Vertical, hollow shaft	☐	☐	☐
d. Squirrel cage	☐	☐	☐
e. Wound rotor	☐	☐	☐
f. Synchronous	☐	☐	☐
g. Capacitor start	☐	☐	☐
h. Split phase	☐	☐	☐
i. Shaded pole	☐	☐	☐
j. Repulsion start	☐	☐	☐
k. Repulsion induction	☐	☐	☐
l. DC	☐	☐	☐
m. Other			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

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NAME OF BIDDER _____

2. PERFORMANCE	No. 1	No. 2	No. 3
**A. Rated output, horsepower			
**B. Load brake horsepower			
**C. Service factor			
*D. Rated voltage, volts	460		
**E. Field voltage, dc volts			
*F. Phase	3		
*G. Frequency, hertz	60		
**H. Rated Speed, rpm			
a. Synchronous			
b. Actual full load			
c. Base speed - DC			
*I. Minimum motor starting voltage, percent of rated	80		
**J. Full load current, amperes			
**K. Field current at base speed, dc amperes			
**L. Locked rotor current at rated voltage, amperes			
**M. Starting torque at rated voltage, percent of full load torque			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

		No. 1	No. 2	No.3
**N.	Breakdown torque at rated voltage, percent of full load torque			
***O.	Accelerating time at starting voltage specified above, seconds			
***P.	Successive starting limitations			
***Q.	"Safe" locked rotor time "cold" at rated voltage, seconds			
***R.	"Safe" locked rotor time "hot" at rated voltage, seconds			
**S.	Efficiency, Percent			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			
**T.	Power Factor			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			

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**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**U. Losses, kW			
a. Service factor load	N/A		
b. Full load	N/A		
c. 75 percent load	N/A		
d. 50 percent load	N/A		
V. WK^2, $lb\text{-}ft^2$			
**a. Of load			
**b. Of motor			
**c. Load capability of motor			
3. CONSTRUCTION			
*A. Enclosure			
a. Open Dripproof	☐	☐	☐
b. TEFC	☒	☐	☐
c. TENV	☐	☐	☐
d. Dust-ignition proof	☐	☐	☐
e. Weather-protected	☐ I ☐ II	☐ I ☐ II	☐ I ☐ II
f. Other			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**B.	Bearings			
	a. Antifriction	☐	☐	☐
	b. Split-sleeve	☐	☐	☐
	c. Other			
	d. Type lubrication			
	e. Minimum AFBMA (L-10) antifriction bearing life rating (belt or chain drive motors only), hours			
**C.	Insulation			
	a. Class			
	b. Maximum design total temperature rating for insulation, degrees C			
	c. Maximum service ambient temperature, degrees C			
	d. Temperature rise (by resistance) at service elevation and at service factor rating, degrees C			
	e. Total hot-spot temperature at service factor rating, degrees C			
**D.	NEMA Code letter (If applicable)			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM 02 224 REV 11-76

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**E. NEMA Design letter (If applicable)			
***F. Net weight, pounds			
***G. Dimensions, inches			
a. Length			
b. Width			
c. Height			
**H. Rotor bar and end ring material (4kV and above)			
4. ACCESSORIES			
**A. Baseplate	☐	☐	☐
**B. Soleplate	☐	☐	☐
**C. Space heater	☐	☐	☐
**D. Space heater demand, watts			
*E. Stator thermocouples or RTD's	☐	☐	☐
*F. Stator thermostatic-type protection	☐	☐	☐
*G. Bearing thermocouples or thermostats	☐	☐	☐
*H. Bearing oil sump heaters	☐	☐	☐

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
*I. Differential protection current transformers	☐	☐	☐
*J. Surge capacitor	☐	☐	☐
*K. Motor controller by motor supplier	☐ Yes ☒ No	☐ Yes ☐ No	☐ Yes ☐ No

5. DRIVE COMPATIBILITY

**A. Gear	☐	☐	☐
**B. Belt	☐	☐	☐
**C. Chain	☐	☐	☐
*D. Direct coupled	☒	☐	☐
*E. Half coupling to be pressed on by motor supplier	☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
*F. Sheave t be pressed on by motor supplier	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

***6. TERMINAL BOXES AND GROUND CONNECTORS

A. Terminal boxes (inside dimensions), inches			
a. Height	_____	_____	_____
b. Width	_____	_____	_____
c. Depth	_____	_____	_____
B. Ground connector size, AWG	_____	_____	_____

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM 02 224 REV 11 76

NAME OF BIDDER _____

**7. OTHER INFORMATION

(Special Starting, Etc.)

*8. ACCEPTABLE MANUFACTURERS

N/A

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

Area 700 (PSS)

BCS HEAT FLUX TRANSDUCER COOLING SYSTEM 2

The Contractor shall furnish and install the BSC Heat Flux Transducer Cooling System, which consists of the following equipment:

1. Pallet-mounted, motor-driven pump, fan-cooled radiator and temperature control valve. 2

2. Interconnecting coolant (ethylene glycol-water mixture) piping between components and the Heat Flux Sensors.

3. An elevated TBD gallon head tank.

The pump shall be in accordance with the Horizontal Centrifugal Pump Specification JD40.4.10 and the Centrifugal Pump Data Sheet JD40.4.10-1. It shall be driven by a 460 V three phase TEFC motor and selected in accordance with Specification JF16.02.02. 3

The radiator shall consist of two (2) Young Radiator Co. units, Model OCH-41 in series or equal each with a 1/8 HP 460 V three phase TEFC motor driven fan. The radiator shall be capable of cooling 1.6 gpm of coolant from 130 F to 125 F with an ambient air temperature of 117 F. (Total cooling duty 4600 Btu/hr). 2 3 2

The head tank shall be of sufficient capacity to accommodate expansion of the coolant in the system as it heats from 13°F to 130°F, and shall be located at the high point of the coolant piping system. It shall be equipped with a vent, filler cap, vent, level glass with isolating valves, overflow and drain connections, and inlet and outlet nozzles. 2

The temperature control valve (TV-1418) shall be pallet-mounted and with the associated instrumentation, and capable of maintaining the temperature downstream of the BCS Heat Flux Transducers below 130°F. The associated instrumentation shall consist of a temperature sensor, a temperature controller, a high temperature alarm output contact, and a compatible solenoid valve. 2

The equipment cooling piping to the BCS Heat Flux Transducer shall be installed such that each leg is approximately the same length to provide uniform flow to each sensor. 2

This system shall be installed on the 15th Level of the Receiver Tower as shown on Drawing 40A2005131600, Sheet A12-1, "Receiver Tower Electronic Rooms Plans and Sections." A schematic of the system is shown on Drawing 40P7005133152, Sheet P3-13. Data sheets for the pump and the temperature control valve are enclosed with this Appendix. 3 2

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X				

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

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DESIGN DATA SHEET
HORIZONTAL CENTRIFUGAL PUMPS

ISSUED 11/1/73
REVISED 11/3/78

1	Job No. C21700	Customer MDAC	
2	Project Solar One	By SUM	Date 6-26-80
3	Equipment Nomenclature BCS Fluid Receiver Pump (P-201)		
4	No. of Pumps One	Driver by Vendor:	X Yes ☐ No
5	CONDITIONS OF SERVICE (EACH)		
6	Fluid Pumped (Characteristics, if known, are specified elsewhere)		50% Ethylene Glycol
7	Flow Design	USGPM	1.6
8	Operating Range Minimum to Maximum (If required)	USGPM	1.6 / 2
9	Design Temperature	°F	125
10	Discharge Pressure	PSIG	22
11	Suction Pressure	PSIG	1.1
12	Specific Gravity @ Design Temp. (Ref. 60 °F)		1.042
13	Required Total Head	Ft.	44.3
14	Available NPSH	Ft.	
15	Barometric Pressure	PSIA	13.7
16	Vapor Pressure @ Design Temp.	PSIA	
17	Viscosity @ Design Temp.	Cs	4.0
18	Max. Allowable Shut Off Head	Ft.	
19	Cooling Water (If Required) Max. Temp.	°F	None
20	Installation Indoors or Outdoors		Outdoors
21			
22	DESIGN REQUIREMENTS		
23	Pump Type	X Single Stage	☐ Multi-Stage
24	Casing Split	X Axial	☐ Radial ☐ Back Pull ☐ Front Pull
25	Drive Arrangement	☐ Coupled	X Close Coupled ☐ V-Belt
26	Base Type	☐ Cast Iron	☐ Fab. Steel ☐ Drain Rim
27	Mount. Arrangement	X Common	☐ Separate ☐ Vertical In-Line
28	Rotation (From Colg. End)	X Clockwise	☐ Counter Clockwise
29	Pumps Identical?	☐ Yes	☐ No 1760 RPM Maximum
30	Impeller Type	☐ Enclosed	☐ Semi-Enclosed ☐ Open ☐ Non-Clog
31	Type of Operation	☐ Parallel	☐ Series X Single
32	Nozzle Detail	Required Min. Press Rating: Suction	Discharge
33	Suction Location	☐ Side	☐ End ☐ Bottom
34	Suction Type	☐ Flanged	☐ Screwed ☐ Welded
35	Discharge Location	☐ Side ☐ Top	☐ Tangential ☐ Centerline
36	Discharge Type	☐ Flanged	☐ Screwed ☐ Welded
37	Bearing Detail	Lube Medium: ☐ Oil	XX Grease
38	Radial	☐ Ball	☐ Split Sleeve
39	Radial Lube./Cooling	☐ Ring ☐ Flood ☐ Pressure	☐ Sealed ☐ Watercooled
40	Thrust	☐ Ball ☐ Spherical Roller	☐ Kingsbury
41	Thrust Lube/Cooling	☐ Ring ☐ Flood ☐ Pressure	☐ Sealed ☐ Watercooled
42	Sealing Detail	XX Packed Box ☐ Mech. Seal	☐ Injection Seal
43	Sealing Cooling	XX None ☐ Water Jacketed	☐ Heat Exchanger
44	Driver Type	XX Motor ☐ Turbine ☐ Engine	☐ Other
45	Driver Enclosure (Specify)		
46	Factory Tests	Certified curves ☐ Yes	X No
47	Performance	☐ None ☐ Non-Witnessed	☐ Witnessed
48	Hydrostatic	☐ None ☐ Non-Witnessed	☐ Witnessed
49	NPSH	☐ None ☐ Non-Witnessed	☐ Witnessed
50			
51			

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
WM	P	PP	SH	FI	SP		JD40.4.10-1
	X						

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DESIGN DATA SHEET
HORIZONTAL CENTRIFUGAL PUMPS
TO BE COMPLETED BY MANUFACTURER

ISSUED 11/1/73
REVISED 11/3/78

1	Job No. C21700			Customer MDAC			
2	Project Solar One			Manufacturer:			
3	Equipment Nomenclature BCS Fluid Receiver Pump (P-201)						
4	PART	MATERIAL	ASTM NO.	PART	MATERIAL	ASTM NO.	
5	Case			Shaft Sleeve			
6	Impeller			Bearing Lube			
7	Imp.Wrg.Ring			Baseplate			
8	Case Wrg.Ring						
9	Shaft						
10							

11	GENERAL DESCRIPTION AND CONSTRUCTION		PERFORMANCE
12	Size	52	Performance Curve No.
13	Manufacturer's Catalog No.	53	NPSH Required, Feet
14	Type	54	Design
15	No. of Stages	55	Runout (1 Pump Oper.)
16	Casing ☐ Single Volute ☐ Double Volute ☐ Diffuser	56	Pump Efficiency, %
17	Max. Hydro., PSIG	57	Design
18	Bn. Hardness	58	Runout
19	Wrg. Ring, Bn. Hard	59	Pump Speed, RPM
20		60	Operating
21	Impeller ☐ Enclosed ☐ Open ☐ Semi Open	61	First Critical
22	Bn. Hardness	62	Brake Horsepower, BHP
23	Wrg. Ring Bn. Hard	63	Design Point
24	Diameter, Bid, Inches	64	Runout
25	Diameter, Max/Min, Inches /	65	Max. at any Point
26	Thrust Bal. Method	66	Min. Recommended Flow, GPM
27	Shaft	67	Cooling Water (If Req'd)
28	Sleeve Bn. Hard	68	GPM
29	Diameter, Inches	69	Temp. Rise, °F
30	@ Coupling/Stuff. Box /	70	Sealing Water (If Req'd)
31	Bearings	71	GPM
32	Type, Radial/Thrust /	72	Temp., °F
33	Lube (Flood, Press or Seal)	73	PSIG
34	Radial, Mfgr./Model /	74	WK² (Wet) Lb.-Ft.²
35	Thrust, Mfgr./Model /	75	Max. Allowable X, Y, Z
36	Stuffing Box, Packing Material	76	Forces, Lbs. (If Req'd)
37	Length/No. Rings /	77	Suction
38	Mechanical Seal	78	Discharge
39	Manufacturer	79	Max. Dia. Solids, In.
40	A.P.I. No./Model /	80	Recommended Spare Parts:
41	Coupling Size, Inches	81	
42	Manufacturer/Model /	82	
43	Suction Size, Inches	83	
44	Rating/Type/Face / /	84	
45	Discharge, Size, Inches	85	
46	Rating/Type/Face / /	86	
47	Outline & Dimension Dwg. No.	87	
48	Assembled Weight with	88	
49	Base, Colg. (No Driver), Lbs.	89	
50		90	
51		91	

DIVISION USAGE					
WM	P	PP	SH	FI	SP
	X				

Stearns-Roger
ENGINEERING CORPORATION

STANDARD NUMBER
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Div.

MOTOR DATA SHEETS

ISSUED 7/7/76
REVISED 7/2/80

NAME OF BIDDER _____

1. GENERAL	No. 1 BCS Fluid Receiver Pump	No. 2 Radiator Fan A	No. 3 Radiator Fan B
*A. Application			
*B. Location (outdoors/indoors)	Outdoors	Outdoors	Outdoors
*C. Quantity	1	1	1
**D. Manufacturer			
***E. Frame size			
***F. Motor Type			
a. Horizontal	☒	☐	☐
b. Vertical, solid shaft	☐	☐	☐
c. Vertical, hollow shaft	☐	☐	☐
d. Squirrel cage	☐	☐	☐
e. Wound rotor	☐	☐	☐
f. Synchronous	☐	☐	☐
g. Capacitor start	☐	☐	☐
h. Split phase	☐	☐	☐
i. Shaded pole	☐	☐	☐
j. Repulsion start	☐	☐	☐
k. Repulsion induction	☐	☐	☐
l. DC	☐	☐	☐
m. Other			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM 224 REV. 4/80

NAME OF BIDDER _____

2. PERFORMANCE	No. 1	No. 2	No.3
**A. Rated output, horsepower		1/8	1/8
**B. Load brake horsepower			
**C. Service factor			
*D. Rated voltage, volts	460	460	460
**E. Field voltage, dc volts			
*F. Phase	3	3	3
*G. Frequency, hertz	60	60	60
**H. Rated Speed, rpm			
a. Synchronous			
b. Actual full load			
c. Base speed - DC			
*I. Minimum motor starting voltage, percent of rated	80	80	80
**J. Full load current, amperes			
**K. Field current at base speed, dc amperes			
**L. Locked rotor current at rated voltage, amperes			
**M. Starting torque at rated voltage, percent of full load torque			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

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4

NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**N.	Breakdown torque at rated voltage, percent of full load torque			
***O.	Accelerating time at starting voltage specified above, seconds			
***P.	Successive starting limitations			
***Q.	"Safe" locked rotor time "cold" at rated voltage, seconds			
***R.	"Safe" locked rotor time "hot" at rated voltage, seconds			
**S.	Efficiency, Percent			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			
**T.	Power Factor			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**U. Losses, kW			
a. Service factor load	N/A	N/A	N/A
b. Full load	N/A	N/A	N/A
c. 75 percent load	N/A	N/A	N/A
d. 50 percent load	N/A	N/A	N/A
V. WK^2, $lb\text{-}ft^2$			
*a. Of load			
**b. Of motor			
**c. Load capability of motor			
3. CONSTRUCTION			
*A. Enclosure			
a. Open Dripproof	☐	☐	☐
b. TEFC	☒	☒	☒
c. TENV	☐	☐	☐
d. Explosion proof (Class I, Group D)	☐	☐	☐
e. Dust-ignition proof (Class II, Group F)	☐	☐	☐
f. Weather-protected	☐I ☐II	☐I ☐II	☐I ☐II
g. Other			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**B.	Bearings			
	a. Antifriction	☐	☐	☐
	b. Split-sleeve	☐	☐	☐
	c. Other			
	d. Type lubrication			
	e. Minimum AFBMA (L-10) antifriction bearing life rating (belt or chain drive motors only), hours			
**C.	Insulation			
	a. Class			
	b. Maximum design total temperature rating for insulation, degrees C			
	c. Maximum service ambient temperature, degrees C			
	d. Temperature rise (by resistance) at service elevation and at service factor rating, degrees C			
	e. Total hot-spot temperature at service factor rating, degrees C			
**D.	NEMA Code letter (If applicable)			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**E. NEMA Design letter (If applicable)			
***F. Net weight, pounds			
***G. Dimensions, inches			
a. Length			
b. Width			
c. Height			
**H. Rotor bar and end ring material (4kV and above)			
4. ACCESSORIES			
**A. Baseplate	☐	☐	☐
**B. Soleplate	☐	☐	☐
**C. Space heater	☐	☐	☐
**D. Space heater demand, watts			
*E. Stator thermocouples or RTD's	☐	☐	☐
*F. Stator thermostatic-type protection	☐	☐	☐
*G. Bearing thermocouples or thermostats	☐	☐	☐
*H. Bearing oil sump heaters	☐	☐	☐

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM 0324 REV 4/80

NAME OF BIDDER _____

	No. 1	No. 2	No.3
*I. Differential protection current transformers	☐	☐	☐
*J. Surge capacitor	☐	☐	☐
*K. Motor controller by motor supplier	☒ Yes ☐ No	☒ Yes ☐ No	☒ Yes ☐ No

5. DRIVE COMPATIBILITY

* A. Gear	☐	☐	☐
* B. Belt	☐	☐	☐
* C. Chain	☐	☐	☐
* D. Direct coupled	☒	☒	☒
*E. Half coupling to be pressed on by motor supplier	☒ Yes ☐ No	☒ Yes ☐ No	☒ Yes ☐ No
*F. Sheave to be pressed on by motor supplier	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

***6. TERMINAL BOXES AND GROUND CONNECTORS

A. Terminal boxes (inside dimensions), inches

a. Height	_____	_____	_____
b. Width	_____	_____	_____
c. Depth	_____	_____	_____
B. Ground connector size, AWG	_____	_____	_____

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

**7. OTHER INFORMATION

(Special Starting, Etc.)

*8. ACCEPTABLE MANUFACTURERS

N/A

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

Area 700 (PSS)

MAINTENANCE OIL SUMP PUMP (P-718) 5

1. One (1) Maintenance Oil Sump Pump and Drive in accordance with Engineering Standard No. JD40.4.16 and to these specifications and design data sheets. 5

   a. One (1) submersible portable type sump pump and accessories.

   b. One (1) horsepower, watertight, 460 volt, three phase 60 hertz electric drive motor, as specified in the Stearns-Roger Motor Data Sheets, 8 pages, Standard No. JF16.02.02-1.

   c. Pump shall include self-contained level switches and motor controller.

   d. Assorted spare parts for two (2) years operation boxed separately.

   e. Enclosures for all electrical equipment shall be suitable for hazardous area Class I, Division II Group D as defined by the National Electrical Code.

2. The unit will be shipped with the pump and motor assembled and coupled ready for submersion.

3. The spare parts will not be installed by the Contractor and will remain in the custody of the Construction Manager.

4. The pump nameplates shall include; Model, Serial No., Total Head, Capacity, Speed.

DIVISION USAGE				
MMI P	PP	SH	FI	SP
X				

Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JD40.4.16-1

APPROVALS
Des. Supv. BCK
Supv. [illegible]
Div. [illegible]

DESIGN DATA SHEET
VERTICAL SUMP PUMPS

ISSUED 4/8/75
REVISED 3/12/79

1	Job No. C-21700	Customer MDAC	
2	Project Solar One	By SDM	Date 4/28/80
3	Equipment Nomenclature 718 Maintenance Oil Sump Pump		
4	Number of Pumps 1	Driver by Vendor [X] Yes [ ] No	
5			
	CONDITIONS OF SERVICE (EACH)		
7	Fluid Pumped (Characteristics, if known, are specified elsewhere)		Exxon Caloria HT43
8	Flow, Normal/Design	USGPM	25 / 27.5
9	Design Temperature	°F	50
10	Discharge Pressure, Design	PSIG	34.7
11	Specific Gravity at Design Temp. (Ref 60°F)		.85897
12	Required Total Developed Head, Design	Ft.	93.28
13	Barometric Pressure	PSIA	14.0
14	Viscosity at Design Temp.	Cs	214.3
15	Installation Indoors or Outdoors		Ourdoors
16	Length(Base of Motor Support Plate to Bottom of Strainer)	Ft.-In.	-----
17	Sump Depth	Ft.-In.	9'0"
18	Minimum Liquid Level (ref. floor level)	Ft.-In.	
19	Solids in Suspension:		
20	Special Requirements:		
21			
22	Portable Submersible Sump Pump		
23			
24			
25			
26			
27			
	CONSTRUCTION REQUIREMENTS		
29			
30	Drive Arrangement [X] Direct [ ] V-Belt [ ] Other		
31	Mounting Plate: [ ] Yes [X] No Dimensions:		
32	Impeller Type [X] Open or [X] Semi-Open		
33	Steady Bearing Lubrication [ ] Grease [ ] Water [ ] Pumped Fluid [ ] Vendor Option		
34	Column Pipe: Material		
35	Strainer [X] Yes [ ] No Material		
36	Discharge Pipe [ ] Threaded [X] Flanged [ ] Coated Diameter: 2 Inch Sch. 80		
37	(If flanged, in accordance with ANSI B16.5) Class: 150		
38	Level Control [X] Yes [ ] No Alternator NA. [ ] Yes [X] No		
39	Wet Pit Type [X] Dry Pit Type [ ]		
40	Vapor Tight Arrangement [ ] Yes [X] No		
41	Motor Shaft Type [ ] Vertical Hollow Shaft [ ] Vertical Solid Shaft		
42	Motor Enclosure (Specify) Watertight, class I, division II, group D		
43	hazardous area classification.		
44			
45	Factory Tests	Certified Curves [X] Yes [ ] No	
46	Performance [ ] None	[X] Non-Witnessed	[ ] Witnessed
47	Hydrostatic [ ] None	[X] Non-Witnessed	[ ] Witnessed
48	Remarks: B10 Bearing Life 17500 hrs.		
49	Guide Rails to be Supplied		
50			
51			

DIVISION USAGE					Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER JD40.4.16-1
MMI P	PP	SH	FI	SP		
X						

APPROVALS	DESIGN DATA SHEET VERTICAL SUMP PUMPS TO BE COMPLETED BY MANUFACTURER	PAGE 2 OF 2
Des. Sect. BCK Sect. Supv. Div.		ISSUED 4/8/75 REVISED 3/12/79

1 Job No. C-21700 — Customer MDAC

2 Project Solar One — Manufacturer

3 Equipment Nomenclature 718 Maintenance Oil Sump Pump 5

	PART	MATERIAL	ASTM NO.		PART	MATERIAL	ASTM NO.
4	Casing			11	Strainer		
5	Impeller			12	Bearings		
6	Shaft			13	Discharge Pipe		
7	Mounting Plt.			14	Column Pipe		
8				15			
9				16			
10				17			

	GENERAL DESCRIPTION AND CONSTRUCTION		PERFORMANCE
18	Size	57	Performance Curve No.
19	Mfr. Catalog No.	58	Pump Efficiency %
20	Type	59	Design
21	Casing, Max. Hydro. PSIG	60	Runout
22	Impeller	61	Pump Speed, RPM
23	Type	62	Brake Horsepower
24	Diameter Bid, Inches	63	Design Point
25	Diameter, Max./Min. Inches /	64	Runout
26	Shaft, Diameter, Inches	65	Max. at any Point
27	Discharge Pipe, Dia., In/Sched /	66	Minimum Recommended Flow, GPM
28	Oiler Assembly (if required)	67	Min. Recommended Submergence, Ft.
29	Tank Solenoid/Voltage Reqd. /	68	WK^2 (Wet), Lb-Ft^2
30	Tank Capacity	69	
31	Coupling Size, Inches	70	
32	Manufacturer/Model /	71	Recommended Spare Parts:
33	Mounting Plate	72	
34	Dimensions	73	
35	Strainer, Openings, Inches	74	
36	Type	75	
37	Outline and Dim. Dwg. No.	76	
38	Assembled Weight (Less Driver), Lbs.	77	Accessories:
39	Level Control Type	78	
40	Manufacturer/Model /	79	
41	Alternator Control Type	80	
42	Manufacturer/Model /	81	
43		82	
44		83	
45		84	
46		85	
47		86	
48		87	
49		88	
50		89	
51		90	
52		91	
53		92	
54		93	
55		94	
56		95	

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	Y				

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JF16.02.02-1

APPROVALS
Des. Sec.
Sect. Supv.
Div.

MOTOR DATA SHEETS

PAGE 1 OF 3

ISSUED 7/7/78
REVISED 3/27/79

NAME OF BIDDER

1. GENERAL	No. 1	No. 2	No. 3
*A. Application	Maintenance Oil Sump Pump		
*B. Location (outdoors/indoors)	Outdoors		
*C. Quantity	1		
**D. Manufacturer			
***E. Frame size			
***F. Motor Type			
a. Horizontal	☐	☐	☐
b. Vertical, solid shaft	☐	☐	☐
c. Vertical, hollow shaft	☐	☐	☐
d. Squirrel cage	☐	☐	☐
e. Wound rotor	☐	☐	☐
f. Synchronous	☐	☐	☐
g. Capacitor start	☐	☐	☐
h. Split phase	☐	☐	☐
i. Shaded pole	☐	☐	☐
j. Repulsion start	☐	☐	☐
k. Repulsion induction	☐	☐	☐
l. DC	☐	☐	☐
m. Other			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

5

NAME OF BIDDER _____

2. PERFORMANCE	No. 1	No. 2	No. 3
**A. Rated output, horsepower			
**B. Load brake horsepower			
**C. Service factor			
*D. Rated voltage, volts	460		
**E. Field voltage, dc volts			
*F. Phase	3		
*G. Frequency, hertz	60		
**H. Rated Speed, rpm			
a. Synchronous			
b. Actual full load			
c. Base speed - DC			
*I. Minimum motor starting voltage, percent of rated	90		
**J. Full load current, amperes			
**K. Field current at base speed, dc amperes			
**L. Locked rotor current at rated voltage, amperes			
**M. Starting torque at rated voltage, percent of full load torque			

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NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**N.	Breakdown torque at rated voltage, percent of full load torque			
***O.	Accelerating time at starting voltage specified above, seconds			
***P.	Successive starting limitations			
***Q.	"Safe" locked rotor time "cold" at rated voltage, seconds			
***R.	"Safe" locked rotor time "hot" at rated voltage, seconds			
**S.	Efficiency, Percent			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			
**T.	Power Factor			
	a. Service factor load	NA		
	b. Full load	NA		
	c. 75 percent load	NA		
	d. 50 percent load	NA		

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**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**U. Losses, kW			
a. Service factor load	NA		
b. Full load	NA		
c. 75 percent load	NA		
d. 50 percent load	NA		
V. WK^2, $lb\text{-}ft^2$			
***a. Of load			
***b. Of motor			
***c. Load capability of motor			
3. CONSTRUCTION			
*A. Enclosure			
a. Open Dripproof	☐	☐	☐
b. TEFC	☐	☐	☐
c. TENV	☐	☐	☐
d. Dust-ignition proof	☐	☐	☐
e. Weather-protected	☐ I ☐ II	☐ I ☐ II	☐ I ☐ II
f. Other	Submersible Class I, Div. II Group D hazardous area.		

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***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**8.	Bearings			
	a. Antifriction	☐	☐	☐
	b. Split-sleeve	☐	☐	☐
	c. Other			
	d. Type lubrication			
	e. Minimum AFBMA (L-10) antifriction bearing life rating (belt or chain drive motors only), hours			
**C.	Insulation			
	a. Class			
	b. Maximum design total temperature rating for insulation, degrees C			
	c. Maximum service ambient temperature, degrees C			
	d. Temperature rise (by resistance) at service elevation and at service factor rating, degrees C			
	e. Total hot-spot temperature at service factor rating, degrees C			
**D.	NEMA Code letter (If applicable)			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**E. NEMA Design letter (If applicable)			
***F. Net weight, pounds			
***G. Dimensions, inches			
a. Length			
b. Width			
c. Height			
**H. Rotor bar and end ring material (4kV and above)			
4. ACCESSORIES			
**A. Baseplate	☐	☐	☐
**B. Soleplate	☐	☐	☐
**C. Space heater	☐	☐	☐
**D. Space heater demand, watts			
*E. Stator thermocouples or RTD's	☐	☐	☐
*F. Stator thermostatic-type protection	☐	☐	☐
*G. Bearing thermocouples or thermostats	☐	☐	☐
*H. Bearing oil sump heaters	☐	☐	☐

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER

	No. 1	No. 2	No. 3
*I. Differential protection current transformers	☐	☐	☐
*J. Surge capacitor	☐	☐	☐
*K. Motor controller by motor supplier	☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

5. DRIVE COMPATIBILITY

**A. Gear	☐	☐	☐
**B. Belt	☐	☐	☐
**C. Chain	☐	☐	☐
**D. Direct coupled	☐	☐	☐
*E. Half coupling to be pressed on by motor supplier	☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
*F. Sheave to be pressed on by motor supplier	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

***6. TERMINAL BOXES AND GROUND CONNECTORS

A. Terminal boxes (inside dimensions), inches

a. Height			
b. Width			
c. Depth			
B. Ground connector size, AWG			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

DIVISION USAGE					
WM	P	PP	SH	FI	SP

Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JF16.02.02-1

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MOTOR DATA SHEETS (CONTD)

ISSUED 7/7/76
REVISED 3/27/79

NAME OF BIDDER _____

**7. OTHER INFORMATION

(Special Starting, Etc.)

*8. ACCEPTABLE MANUFACTURERS

NA

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM 02 224 REV 11-76

Area 700 (PSS)

RAW/SERVICE WATER SUMP PUMP (P-715) 5

1. One (1) Raw/Service Water Sump Pump and Drive in accordance with Engineering Standard No. JD40.4.16 and to these specifcations and design data sheets. 5

   a. One (1) Submersible Sump Pump and accessories including

   b. One (1) 1/2 horsepower, watertight 460 volt, three phase, 60 hertz electric drive motor, as specified in the Stearns-Roger Motor Data Sheets, 8 pages, Standard No. JF16.02.02-1.

   c. Miscellaneous fittings, valves and instrumentation including self-contained level switches and motor controller.

   d. Assorted spare parts for two (2) years operation boxed separately.

2. The unit will be shipped with the pump and motor assemled and coupled ready for submersion.

3. The spare parts will not be installed by the Contractor and will remain in the custody of the Construction Manager.

4. The pump nameplate shall include; Model, Serial No., Total Head, capacity, speed.

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
M&I	P	PP	SH	SI	SP		JD40.4.16-1
	X						
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Des. Sect.							ISSUED 4/8/75
Sect. Supv							REVISED 3/12/79
Div.							

1	Job No. C-21700	Customer MDAC		
2	Project Solar One	By SUM	Date 7/24/80	
3	Equipment Nomenclature P-715 Raw/Service Water Sump Pump			
4	Number of Pumps 1	Driver by Vendor [X] Yes [ ] No		
5				
	CONDITIONS OF SERVICE (EACH)			
7	Fluid Pumped			Waste Water
8	Flow, Normal/Design	USGPM		35 / 38.5
9	Design Temperature	°F		60 F
10	Discharge Pressure, Design	PSIG		9.7
11	Specific Gravity at Design Temp. (Ref 60°F)			1
12	Required Total Developed Head, Design	Ft.		22.43
13	Barometric Pressure	PSIA		14
14	Viscosity at Design Temp.	Cp		1.22
15	Installation Indoors or Outdoors			indoors
16	Length(Base of Motor Support Plate to Bottom of Strainer)	Ft.-In.		
17	Sump Depth	Ft.-In.		1'-0"
18	Minimum Liquid Level (ref. floor level)	Ft.-In.		
19	Solids in Suspension:			
20	Special Requirements:			
21				
22	Submersible type pump			
23				
24				
25				
26				
27				
	CONSTRUCTION REQUIREMENTS			
29				
30	Drive Arrangement [X] Direct [ ] V-Belt [ ] Other			
31	Mounting Plate: [ ] Yes [ ] No Dimensions:			
32	Impeller Type [X] Open or [X] Semi-Open			
33	Steady Bearing Lubrication [ ] Grease [ ] Water [ ] Pumped Fluid [ ] Vendor Option			
34	Column Pipe: Material			
35	Strainer [X] Yes [ ] No Material			
36	Discharge Pipe* [ ] Threaded [X] Flanged [ ] Coated Diameter: 1-1/2" Sch 80			
37	(If flanged, in accordance with ANSI B16.5) Class: 150			
38	Level Control [X] Yes [ ] No Alternator NA [ ] Yes [ ] No			
39	Wet Pit Type [X] Dry Pit Type [ ]			
40	Vapor Tight Arrangement [ ] Yes [X] No			
41	Motor Shaft Type [ ] Vertical Hollow Shaft [ ] Vertical Solid Shaft			
42	Motor Enclosure (Specify) Watertight, Class I, Division II, Group D			
43	Discharge Pipe is not supplied by pump supplier			
44				
45	Factory Tests Certified Curves [X] Yes [ ] No			
46	Performance [ ] None [X] Non-Witnessed [ ] Witnessed			
47	Hydrostatic [ ] None [X] Non-Witnessed [ ] Witnessed			
48	Remarks:			
49	B-10 Bearing Life 17500 hrs.			
50				
51				

DIVISION USAGE					Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
MMI P	PP	SH	FI	SP		JD40.4.16-1
X						
APPROVALS						PAGE 2 OF 2
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Sect. Supv						
Dis.						

1	Job No. C-21700				Customer MDAC		
2	Project Solar One				Manufacturer SDM		
3	Equipment Nomenclature P-715 Raw/Service Water Sump Pump						
	PART	MATERIAL	ASTM NO.		PART	MATERIAL	ASTM NO.
4	Casing			11	Strainer		
5	Impeller			12	Bearings		
6	Shaft			13	Discharge Pipe		
7	Mounting Plate			14	Column Pipe		
8				15			
9				16			
10				17			
	GENERAL DESCRIPTION AND CONSTRUCTION				PERFORMANCE		
18	Size			57	Performance Curve No.		
19	Mfr. Catalog No.			58	Pump Efficiency %		
20	Type			59	Design		
21	Casing, Max. Hydro. PSIG			60	Runout		
22	Impeller			61	Pump Speed, RPM		
23	Type			62	Brake Horsepower		
24	Diameter Bid, Inches			63	Design Point		
25	Diameter, Max./Min. Inches /			64	Runout		
26	Shaft, Diameter, Inches			65	Max. at any Point		
27	Discharge Pipe, Dia., In/Sched /			66	Minimum Recommended Flow, GPM		
28	Oiler Assembly (if required)			67	Min. Recommended Submergence, Ft.		
29	Tank Solenoid/Voltage Reqd. /			68	WK^2 (Wet), $Lb\text{-}Ft^2$		
30	Tank Capacity			69			
31	Coupling Size, Inches			70			
32	Manufacturer/Model /			71	Recommended Spare Parts:		
33	Mounting Plate			72			
34	Dimensions			73			
35	Strainer, Openings, Inches			74			
36	Type			75			
37	Outline and Dim. Dwg. No.			76			
38	Assembled Weight (Less Driver), Lbs.			77	Accessories:		
39	Level Control Type			78			
40	Manufacturer/Model /			79			
41	Alternator Control Type			80			
42	Manufacturer/Model /			81			
43				82			
44				83			
45				84			
46				85			
47				86			
48				87			
49				88			
50				89			
51				90			
52				91			
53				92			
54				93			
55				94			
56				95			

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	Y				

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Stearns-Roger
INCORPORATED
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ISSUED 7/7/76
REVISED 3/27/79

MOTOR DATA SHEETS

NAME OF BIDDER _____

1. GENERAL	No. 1	No. 2	No. 3
*A. Application	Raw/Service Water Sump Pump		
*B. Location (outdoors/indoors)	Indoors		
*C. Quantity	1		
**D. Manufacturer			
***E. Frame size			
***F. Motor Type			
a. Horizontal	☐	☐	☐
b. Vertical, solid shaft	☐	☐	☐
c. Vertical, hollow shaft	☐	☐	☐
d. Squirrel cage	☐	☐	☐
e. Wound rotor	☐	☐	☐
f. Synchronous	☐	☐	☐
g. Capacitor start	☐	☐	☐
h. Split phase	☐	☐	☐
i. Shaded pole	☐	☐	☐
j. Repulsion start	☐	☐	☐
k. Repulsion induction	☐	☐	☐
l. DC	☐	☐	☐
m. Other			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

5

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X				

APPROVALS
Des. Sec.
Sect. Supv.
Div.

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JF16.02.02-1

PAGE 2 OF 3

MOTOR DATA SHEETS (CONTD)

ISSUED 7/7/76
REVISED 3/27/79

NAME OF BIDDER _____

2. PERFORMANCE	No. 1	No. 2	No. 3
**A. Rated output, horsepower			
**B. Load brake horsepower			
**C. Service factor			
*D. Rated voltage, volts	460		
**E. Field voltage, dc volts			
*F. Phase	3		
*G. Frequency, hertz	60		
**H. Rated Speed, rpm			
a. Synchronous			
b. Actual full load			
c. Base speed - DC			
*I. Minimum motor starting voltage, percent of rated	90		
**J. Full load current, amperes			
**K. Field current at base speed, dc amperes			
**L. Locked rotor current at rated voltage, amperes			
**M. Starting torque at rated voltage, percent of full load torque			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM 02 224 REV 11 76

NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**N.	Breakdown torque at rated voltage, percent of full load torque			
***O.	Accelerating time at starting voltage specified above, seconds			
***P.	Successive starting limitations			
***Q.	"Safe" locked rotor time "cold" at rated voltage, seconds			
***R.	"Safe" locked rotor time "hot" at rated voltage, seconds			
**S.	Efficiency, Percent			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			
**T.	Power Factor			
	a. Service factor load	NA		
	b. Full load	NA		
	c. 75 percent load	NA		
	d. 50 percent load	NA		

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**U. Losses, kW			
a. Service factor load	NA		
b. Full load	NA		
c. 75 percent load	NA		
d. 50 percent load	NA		
V. WK^2, $lb\text{-}ft^2$			
**a. Of load			
**b. Of motor			
**c. Load capability of motor			
3. CONSTRUCTION			
*A. Enclosure			
a. Open Dripproof	☐	☐	☐
b. TEFC	☐	☐	☐
c. TENV	☐	☐	☐
d. Dust-ignition proof	☐	☐	☐
e. Weather-protected	☐I ☐II	☐I ☐II	☐I ☐II
f. Other	Submersible		

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**8.	Bearings			
	a. Antifriction	☐	☐	☐
	b. Split-sleeve	☐	☐	☐
	c. Other			
	d. Type lubrication			
	e. Minimum AFBMA (L-10) antifriction bearing life rating (belt or chain drive motors only), hours			
**C.	Insulation			
	a. Class			
	b. Maximum design total temperature rating for insulation, degrees C			
	c. Maximum service ambient temperature, degrees C			
	d. Temperature rise (by resistance) at service elevation and at service factor rating, degrees C			
	e. Total hot-spot temperature at service factor rating, degrees C			
**D.	NEMA Code letter (If applicable)			

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

FORM 02 224 REV 11 76

NAME OF BIDDER

	No. 1	No. 2	No. 3
**E. NEMA Design letter (If applicable)			
***F. Net weight, pounds			
***G. Dimensions, inches			
a. Length			
b. Width			
c. Height			
**H. Rotor bar and end ring material (4kV and above)			
4. ACCESSORIES			
**A. Baseplate	☐	☐	☐
**B. Soleplate	☐	☐	☐
**C. Space heater	☐	☐	☐
**D. Space heater demand, watts			
*E. Stator thermocouples or RTD's	☐	☐	☐
*F. Stator thermostatic-type protection	☐	☐	☐
*G. Bearing thermocouples or thermostats	☐	☐	☐
*H. Bearing oil sump heaters	☐	☐	☐

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X				

APPROVALS
Des. Sec.
Sect. Supv.
Div.

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

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MOTOR DATA SHEETS (CONTD)

ISSUED 7/7/78
REVISED 3/27/79

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
*I. Differential protection current transformers	☐	☐	☐
*J. Surge capacitor	☐	☐	☐
*K. Motor controller by motor supplier	☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

5. DRIVE COMPATIBILITY

**A. Gear	☐	☐	☐
**B. Belt	☐	☐	☐
**C. Chain	☐	☐	☐
**D. Direct coupled	☐	☐	☐
*E. Half coupling to be pressed on by motor supplier	☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
*F. Sheave to be pressed on by motor supplier	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

***6. TERMINAL BOXES AND GROUND CONNECTORS

A. Terminal boxes (inside dimensions), inches

a. Height	_____	_____	_____
b. Width	_____	_____	_____
c. Depth	_____	_____	_____
B. Ground connector size, AWG	_____	_____	_____

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

**7. OTHER INFORMATION

(Special Starting, Etc.)

*8. ACCEPTABLE MANUFACTURERS

NA

*Denotes items to be completed by Buyer.
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Area 700 (PSS)

TSU AREA SUMP PUMP (P-717)

1. One (1) TSU area sump pump and drive in accordance with Engineering Standard No. JD40.4.16 and to these specifications and design data sheets.

   a. Vertical shaft, centrifugal pump supported from its motor mounting base by means of a column pipe.

   b. A 3/4 HP, 460 volt, three phase, 60 hertz electric drive motor as specified in the Stearns-Roger Motor Data Sheets, 8 pages, Standard No. JF16.02.02-1.

   c. Miscellaneous fittings, valves, and instrumentation including self contained level switches and motor controller.

   d. One set of recommended spare parts sufficient for two years of operation.

   e. The pump nameplate shall include; Model, Serial No., Total Head, Capacity and Speed.

   f. The motor enclosure shall be suitable for hazardous area Class I, Division II, Group D as defined by the National Electrical Code.

DIVISION USAGE				
MMI	P	PP	SH	FI	SP
	X				

Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

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JD40.4.16-1

APPROVALS
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DESIGN DATA SHEET
VERTICAL SUMP PUMPS

PAGE 1 OF 2

ISSUED 4/8/75
REVISED 3/12/79

1	Job No. C-21700	Customer MDAC	
2	Project Solar One	By JEG	Date 4/18/80
3	Equipment Nomenclature P-717 TSU Area Sump Pump		
4	Number of Pumps 1	Driver by Vendor [X] Yes [ ] No	
5			
	CONDITIONS OF SERVICE (EACH)		
7	Fluid Pumped		Waste Water
8	Flow, Normal/Design	USGPM	50 / 55
9	Design Temperature	°F	60
10	Discharge Pressure, Design	PSIG	12.93
11	Specific Gravity at Design Temp. (Ref 60°F)		1.0
12	Required Total Developed Head, Design	Ft.	29.86
13	Barometric Pressure	PSIA	14
14	Viscosity at Design Temp.	Cs	1
15	Installation Indoors or Outdoors		Outdoors
16	Length(Base of Motor Support Plate to Bottom of Strainer)	Ft.-In.	5'-9"
17	Sump Depth	Ft.-In.	6-0
18	Minimum Liquid Level (ref. floor level)	Ft.-In.	1'-0"
19	Solids in Suspension: Fine sand and silt		Yes
20	Special Requirements:		
21			
22			
23			
24			
25			
26			
27			
	CONSTRUCTION REQUIREMENTS		
29			
30	Drive Arrangement [X] Direct [ ] V-Belt [ ] Other		
31	Mounting Plate: [X] Yes [ ] No Dimensions:		
32	Impeller Type [X] Open [ ] Semi-Open		
33	Steady Bearing Lubrication [X] Grease [ ] Water [ ] Pumped Fluid [ ] Vendor Option		
34	Column Pipe: Material Vendor Option		
35	Strainer [X] Yes [ ] No Material		
36	Discharge Pipe [ ] Threaded [X] Flanged [ ] Coated Diameter: 2 inch Sch 80		
37	(If flanged, in accordance with ANSI B16.5) Class: 150		
38	Level Control [X] Yes [ ] No Alternator NA [ ] Yes [ ] No		
39	Wet Pit Type [X] Dry Pit Type [ ]		
40	Vapor Tight Arrangement [ ] Yes [X] No		
41	Motor Shaft Type [ ] Vertical Hollow Shaft [X] Vertical Solid Shaft		
42	Motor Enclosure (Specify) TEFC		
43			
44			
45	Factory Tests Certified Curves [X] Yes [ ] No		
46	Performance [ ] None [X] Non-Witnessed [ ] Witnessed		
47	Hydrostatic [ ] None [X] Non-Witnessed [ ] Witnessed		
48	Remarks:		
49	B10 Bearing Life of 17500 hrs.		
50			
51			

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
MMI	P	PD	SH	FI	SP		JD40.4.16-1
	X						
APPROVALS						DESIGN DATA SHEET VERTICAL SUMP PUMPS TO BE COMPLETED BY MANUFACTURER	PAGE 2 OF 2
Des. Sect. BCK							ISSUED 4/8/75 REVISED 3/12/79
Sect. Supv							
Dis.							

1 Job No. C-21700 Customer MDAC

2 Project Solar One Manufacturer

3 Equipment Nomenclature P-717 TSU Area Sump Pump

	PART	MATERIAL	ASTM NO.		PART	MATERIAL	ASTM NO.
4	Casing			11	Strainer		
5	Impeller			12	Bearings		
6	Shaft			13	Discharge Pipe		
7	Mounting Plt.			14	Column Pipe		
8				15			
9				16			
10				17			

	GENERAL DESCRIPTION AND CONSTRUCTION		PERFORMANCE
18	Size	57	Performance Curve No.
19	Mfr. Catalog No.	58	Pump Efficiency %
20	Type	59	Design
21	Casing, Max. Hydro. PSIG	60	Runout
22	Impeller	61	Pump Speed, RPM
23	Type	62	Brake Horsepower
24	Diameter Bid, Inches	63	Design Point
25	Diameter, Max./Min. Inches /	64	Runout
26	Shaft, Diameter, Inches	65	Max. at any Point
27	Discharge Pipe, Dia., In/Sched /	66	Minimum Recommended Flow, GPM
28	Oiler Assembly (if required)	67	Min. Recommended Submergence, Ft.
29	Tank Solenoid/Voltage Reqd. /	68	WK^2 (Wet), Lb-Ft^2
30	Tank Capacity	69	
31	Coupling Size, Inches	70	
32	Manufacturer/Model /	71	Recommended Spare Parts:
33	Mounting Plate	72	
34	Dimensions	73	
35	Strainer, Openings, Inches	74	
36	Type	75	
37	Outline and Dim. Dwg. No.	76	
38	Assembled Weight (Less Driver), Lbs.	77	Accessories:
39	Level Control Type	78	
40	Manufacturer/Model /	79	
41	Alternator Control Type	80	
42	Manufacturer/Model /	81	
43		82	
44		83	
45		84	
46		85	
47		86	
48		87	
49		88	
50		89	
51		90	
52		91	
53		92	
54		93	
55		94	
56		95	

DIVISION USAGE					
WM	P	PP	SH	FI	SP
	Y				

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
JF16.02.02-1

APPROVALS
Des. Sec.
Sect. Supv.
Div.

MOTOR DATA SHEETS

PAGE 1 OF 3

ISSUED 7/7/76
REVISED 3/27/79

NAME OF BIDDER

1. GENERAL	No. 1	No. 2	No. 3
*A. Application	TSU Area Sump Pump		
*B. Location (outdoors/indoors)	Outdoors		
*C. Quantity	1		
**D. Manufacturer			
***E. Frame size			
***F. Motor Type			
a. Horizontal	☐	☐	☐
b. Vertical, solid shaft	☐	☐	☐
c. Vertical, hollow shaft	☐	☐	☐
d. Squirrel cage	☐	☐	☐
e. Wound rotor	☐	☐	☐
f. Synchronous	☐	☐	☐
g. Capacitor start	☐	☐	☐
h. Split phase	☐	☐	☐
i. Shaded pole	☐	☐	☐
j. Repulsion start	☐	☐	☐
k. Repulsion induction	☐	☐	☐
l. DC	☐	☐	☐
m. Other			

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FORM 02 224 REV 11-76

NAME OF BIDDER _____

2. PERFORMANCE	No. 1	No. 2	No. 3
**A. Rated output, horsepower			
**B. Load brake horsepower			
**C. Service factor			
*D. Rated voltage, volts	460		
**E. Field voltage, dc volts			
*F. Phase	3		
*G. Frequency, hertz	60		
**H. Rated Speed, rpm			
a. Synchronous			
b. Actual full load			
c. Base speed - OC			
*I. Minimum motor starting voltage, percent of rated	90		
**J. Full load current, amperes			
**K. Field current at base speed, dc amperes			
**L. Locked rotor current at rated voltage, amperes			
**M. Starting torque at rated voltage, percent of full load torque			

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NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**N.	Breakdown torque at rated voltage, percent of full load torque			
***O.	Accelerating time at starting voltage specified above, seconds			
***P.	Successive starting limitations			
***Q.	"Safe" locked rotor time "cold" at rated voltage, seconds			
***R.	"Safe" locked rotor time "hot" at rated voltage, seconds			
**S.	Efficiency, Percent			
	a. Service factor load			
	b. Full load			
	c. 75 percent load			
	d. 50 percent load			
**T.	Power Factor			
	a. Service factor load	NA		
	b. Full load	NA		
	c. 75 percent load	NA		
	d. 50 percent load	NA		

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NAME OF BIDDER _____

	No. 1	No. 2	No. 3
**U. Losses, kW			
a. Service factor load	NA		
b. Full load	NA		
c. 75 percent load	NA		
d. 50 percent load	NA		
V. WK^2, $lb\text{-}ft^2$			
*a. Of load			
**b. Of motor			
**c. Load capability of motor			
3. CONSTRUCTION			
*A. Enclosure			
a. Open Drippproof	☐	☐	☐
b. TEFC	☐	☐	☐
c. TENV	☐	☐	☐
d. Dust-ignition proof	☐	☐	☐
e. Weather-protected	☐I ☐II	☐I ☐II	☐I ☐II
f. Other	Submersible		

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

		No. 1	No. 2	No. 3
**B.	Bearings			
	a. Antifriction	☐	☐	☐
	b. Split-sleeve	☐	☐	☐
	c. Other			
	d. Type lubrication			
	e. Minimum AFBMA (L-10) antifriction bearing life rating (belt or chain drive motors only), hours			
**C.	Insulation			
	a. Class			
	b. Maximum design total temperature rating for insulation, degrees C			
	c. Maximum service ambient temperature, degrees C			
	d. Temperature rise (by resistance) at service elevation and at service factor rating, degrees C			
	e. Total hot-spot temperature at service factor rating, degrees C			
**D.	NEMA Code letter (If applicable)			

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**Denotes items to be completed by each Bidder.
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FORM 02 224 REV 11 76

NAME OF BIDDER

	No. 1	No. 2	No. 3
**E. NEMA Design letter (If applicable)			
***F. Net weight, pounds			
***G. Dimensions, inches			
a. Length			
b. Width			
c. Height			
**H. Rotor bar and end ring material (4kV and above)			
4. ACCESSORIES			
**A. Baseplate	☐	☐	☐
**B. Soleplate	☐	☐	☐
**C. Space heater	☐	☐	☐
**D. Space heater demand, watts			
*E. Stator thermocouples or RTD's	☐	☐	☐
*F. Stator thermostatic-type protection	☐	☐	☐
*G. Bearing thermocouples or thermostats	☐	☐	☐
*H. Bearing oil sump heaters	☐	☐	☐

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

	No. 1	No. 2	No. 3
*I. Differential protection current transformers	☐	☐	☐
*J. Surge capacitor	☐	☐	☐
*K. Motor controller by motor supplier	☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

5. DRIVE COMPATIBILITY

**A. Gear	☐	☐	☐
**B. Belt	☐	☐	☐
**C. Chain	☐	☐	☐
**D. Direct coupled	☐	☐	☐
*E. Half coupling to be pressed on by motor supplier	☒ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
*F. Sheave to be pressed on by motor supplier	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No

***6. TERMINAL BOXES AND GROUND CONNECTORS

A. Terminal boxes (inside dimensions), inches

a. Height	_____	_____	_____
b. Width	_____	_____	_____
c. Depth	_____	_____	_____
B. Ground connector size, AWG	_____	_____	_____

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

NAME OF BIDDER _____

**7. OTHER INFORMATION

(Special Starting, Etc.)

*8. ACCEPTABLE MANUFACTURERS

*Denotes items to be completed by Buyer.
**Denotes items to be completed by each Bidder.
***Denotes items to be completed by successful Bidder either at time of bid or submitted with first drawing transmittal.

Area 700 (PSS)

HEAT TRANSFER FLUID

The Contractor will be responsible for the purchase of the heat transfer fluid which will be used in the Thermal Storage Unit (TSU). This responsibility will include the purchase of the fluid, the delivery to the Plant Site according to the schedule provided by the Construction Manger, the unloading of the fluid from the delivery vehicle into the Caloria Make Up Tank, TK-301 and the pumping of the fluid into the TSU.

The fluid to be purchased is specified as follows:

Fluid Type	Caloria HT43	
Supplier	Exxon Company P.O. Box 2180, Houston, Tex. 77001	
Purchasing Contacts	Los Angeles, Ca. Jack Stradtner, 213-552-5596 Houston, Tex. Tom Lipscomb, 713-656-5318	
Transportation (Most Economical)	Jumbo Tank Cars to Plant Site	
Quantity of Fluid For Bid Purposes	TSU	250,000 gals.
	Lines and Ht. Exchangers	10,000 gals.
	Total	260,000 gals.

D.O.E NO. 401 7002171

6

Stearns-Roger

ORIFICE PLATES AND FLANGES

DATA SHEET FE
PAGE 1
S-R PROJECT C-21700
ACCOUNT
DATE 4-30-80 REV P1
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 6-22-80 BY FOR 2 3-3-81 BY REB 3 BY 4 BY
MANUFACTURER SOURCE: QUOTE OF

FORM NO. N-705 REV. 11/77
BASED ON ISA S20

ORIFICE PLATES

1 CONCENTRIC ■ OTHER
2 ISA STANDARD ☐ OTHER
3 BORE: ■ FULL SCALE RATE ☐ NEXT 1/8"
4 MAT'L ■ 304SS ☐ 316SS OTHER
5 RING MATERIAL & TYPE
(6) MODEL NUMBER

ORIFICE FLANGES

7 TAPS: ■ FLANGE ☐ VENA CONTRACTA ☐ PIPE OTHER
8 TAP SIZE: ■ 1/2" OTHER
9 TYPE: ☐ WELD NK ■ SLIP ON ☐ THREADED
10 MAT'L: ■ STEEL OTHER
11 FLANGES ■ INCL ☐ BY OTHERS

GENERAL	12	TAG NUMBER		FE - 1601				
	13	SERVICE		SE-701 ORSCH. FLOW ELEMENT				
	14							
	15	LINE NUMBER		4"-WD-1-A81				
	16	TYPE OF METER		dP CELL				
	17	DIFFERENTIAL RANGE-DRY		0-100" WTR				
	18	LINE SIZE & SCHEDULE (1)		4" -				
	19	FLOW SHEET		40P7005133149				
FLANGE AND PLATE	20	ORIFICE BORE DIAMETER		3.02				
	21	PLATE THICKNESS		1/4"				
	22	FLANGE SIZE, BORE, RATING		FLAT FACE, DRILLED		IN ACC. W/ ANSI B16.5 - CLASS 150		
	23	VENT OR DRAIN HOLE		NO				
	24	BETA (d/D)		0.72				
	25	K_1	K_2	1"	1"			
FITTING	~~26~~	~~SIZE~~	~~BORE~~					
	~~27~~	~~RATING~~						
	~~28~~	~~MATERIAL~~						
	~~29~~	~~CONN: INLET~~	~~OUTLET~~					
	~~30~~	~~MODEL~~						
	31							
~~METER TUBE~~	~~32~~	~~SIZE~~	~~BORE~~					
	~~33~~	~~END CONN: INLET~~	~~OUTLET~~					
	~~34~~	~~LENGTH: UPSTREAM~~	~~DOWNSTREAM~~					
	~~35~~	~~STRAIGHTENING VANES: TYPE~~						
		~~LENGTH~~	~~LOCATION~~					
	~~36~~	~~CPLGS IN OUTER SECT: NUMBER~~	~~SIZE~~					
	~~37~~	~~MODEL~~						
	38							
FLUID DATA	39	FLUID		WATER				
	40	FLOW: NORMAL		350 GPM				
	41	FLOW: MIN.	MAX.					
	42	FLOW: FULL SCALE (OR CALC)						
	43	OPER: PRESS, PSIG	TEMP °F	65 PSIG	70 °F			
	44	SPECIFIC GRAVITY: 60 °F	O.T.	1.0				
	45	% SOLIDS		—				
	46	SUPERCOMPRESSIBILITY FACTOR		—				
	47	MOLECULAR WEIGHT	CP/CV	—				
	48	VISCOSITY: CP AT O.T.						
	49	STEAM: QUAL, %-SUPERHEAT, °F		—				
	50	CHART - SCALE RANGE		—				
	51	ORIFICE COEFFICIENT (C')		—				
	52	CHART MULTIPLIER		—				
	53	CORROSIVE/EROSIVE DUE TO		—				

NOTES: (1) PIPE MATERIAL IS PLASTIC (FRP)
(2) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

Flow Nozzle Data Sheet
for FE-35B

Deleted

D.O.E. No. 401 7002171

Stearns-Roger

DIFFERENTIAL PRESSURE INSTRUMENTS

DATA SHEET FT
PAGE 1
S-R PROJECT C-21700
ACCOUNT
DATE 4-30-80 REV P1
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT SOLAR ONE
LOCATION DAGGETT, CALIFORNIA

REVISIONS 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____

MANUFACTURER ____ SOURCE: QUOTE OF ____

	1	TAG NO	ET-1601 SERVICE ____
GENERAL	2	FUNCTION	RECORD ☐ INDICATE ■ CONTROL ☐ BLIND ☐ TRANS ■ INTEG ☐ OTHER ____
	3	CASE	MFR STD ■ NOM SIZE ____ COLOR: MFR STD ■ OTHER ____
	4	MOUNTING	FLUSH ☐ SURFACE ■ YOKE ☐ OTHER ____
	5	ENCLOSURE CLASS	GEN PUR ☐ WTH PROOF ■ EXP PROOF ☐ CLASS ____ GROUP ____ DIVISION ____ FOR USE IN INTRIN SAFE SYS ☐ OTHER ____
	6	POWER SUPPLY	117V 60 HZ ☐ OTHER: ____ AC ☐ DC ■ VOLTS 24
	~~7~~	~~CHART~~	____ "STRIP ☐ ____ "CIRC ☐ TIME MARKS ☐ RANGE ____ NO ____
	~~8~~	~~CHART DRIVE~~	24 HR ☐ OTHER ____ ELEC ☐ SPRING ☐ OTHER ____
	9	SCALE	TYPE LIN STD RANGE: 1 0-100% 2 ____ 3 ____
XMTR	10	TRANSMITTER OUTPUT	4-20 MA ■ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ____ FOR RECEIVER SEE DATA SHEET ____
CONTROLLER	~~11~~	~~CONTROL MODES~~	P-PROP(GAIN), I-INTEGRAL(AUTO RESET), D-DERIVATIVE(RATE), SUB: S-SLOW, F-FAST P ☐ PI_S ☐ PI_F ☐ PI_FD_F ☐ PI_SD_S ☐ I_F ☐ OTHER ____
	~~12~~	~~ACTION~~	ON MEAS INCREASE OUTPUT: INCREASES ☐ DECREASES ☐
	~~13~~	~~AUTO MAN SWITCH~~	NONE ☐ MFR STD ☐ OTHER ____
	~~14~~	~~SET POINT ADJ~~	MANUAL ☐ EXTERNAL ☐ REMOTE ☐ OTHER ____
	~~15~~	~~MAN REG~~	NONE ☐ MFR STD ☐ OTHER ____
	~~16~~	~~OUTPUT~~	4-20 MA ☐ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ____
DIFF UNIT	17	SERVICE	FLOW ■ LEVEL ☐ DIFF PRESS ☐ DENSITY ☐ OTHER ____
	18	ELEMENT TYPE	DIAPHRAGM ■ BELLOWS ☐ MERCURY ☐ OTHER ____
	19	MATERIAL	BODY CADMIUM PLATED CS ELEMENT 316 SS
	(20)	RATING	OVER RANGE (MAX ΔP) 1000 PSI BODY RATING 1000 PSIG
	21	DIFF RANGE	FIXED ☐ ADJ RANGE YES SET AT [illegible]
	22	PROC DATA	FLUID WATER OPER: PRESS/TEMP 65 PSIG / 70 °F MAX: PRESS/TEMP 60 PSIG/140 °F
	23	PROC CONN	1/2" NPT ■ OTHER ____
ALARM	~~24~~	~~ALARM SWITCHES~~	QUANTITY ____ FORM ____ RATING ____
	~~25~~	~~FUNCTION~~	MEAS VAR ☐ DEVIATION ☐ CONTACTS TO ____ ON INC MEAS
ACCESSORIES	26	ACCESSORIES	PRESSURE ELEMENT ☐ RANGE ____ MATERIAL ____ TEMP ELEMENT ☐ RANGE ____ TYPE ____ FILT REG ☐ SUP GAGE ☐ OUTPUT GAGE ☐ MTG YOKE ☐ CHARTS ____ VALVE MANIFOLD AGCO 3 VLV MANIFOLD MODEL [illegible] COND POTS ☐ ADJ DAMP ☐ INTEGRAL SQ RT EXT ☐ MERCURY ☐ INTEGRATOR ____ OTHER STD. ACCESSORIES: FLANGE ADAPTERS, VENT/DRAIN VALVE
	(27)	MODEL NO.	ROSEMOUNT OR ENGR APPD EQUAL

NOTES: 1. ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY SUPPLIER.

TAG NO.

Form no. N-704a 12/71
Based on ISA S20

D.O.E. NO. 40I 700 2171

Stearns-Roger

LEVEL SWITCHES
FLOAT-DISPLACER

DATA SHEET LS
PAGE 1
S-R PROJECT C-21700

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO
ACCOUNT
PROJECT 10 MWe SOLAR PILOT PLANT
DATE 4-28-80 REV A1
LOCATION DAGGETT, CALIFORNIA
BY CAM

REVISIONS 1 C [illegible] BY [illegible] 2 △1 11-20-80 BY RGB 3 ____ BY ____ 4 ____ BY ____

MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N 728 12/77
BASED ON ISA S20

GENERAL	1	TAG NUMBER	LS-1010		LS-1011		LS-1012	
	2	SERVICE	4"VT-1-KEB		6"MS-6-QEG		10"MS-7-FEA	
	3		DRN POT LVL CONTR		DRN POT LVL CONTR		DRN POT LVL CONTR	
	4	LINE NO./VESSEL NO.	4"VT-1-KEB DRN POT		6"MS-6-QEG DRN POT		10"MS-7-FEA DRN POT	
	5	FLOW SHEET	4097005133140		4097005133140		4097005133140	
BODY	6	TYPE	EXTERNAL CAGE		EXTERNAL CAGE		EXTERNAL CAGE	
	7	MATERIAL	ALLOY STEEL		ALLOY STEEL		ALLOY STEEL	
	(8)	MFR RATING: PRESS / TEMP						
	9	TOP CONN LOCATION	TOP		TOP		TOP	
	10	BTM CONN LOCATION	BOTTOM		BOTTOM		BOTTOM	
	11	CONN SIZE & TYPE	1" SW NIPPLE		1" SW		1"-SW NIPPLE	
	12	COOLING FIN	YES		YES		YES	
	13	GAUGE GLASS CONN	NO		NO		NO	
	14	GAUGE GLASS	NO		NO		NO	
	15							
FLOAT DISPL	16	TYPE	FLOAT		FLOAT		FLOAT	
	(17)	SIZE / MATERIAL	3" DIA	347 SS			3" DIA	347 SS
	(18)	ROD: LENGTH / MATERIAL						
	19							
SWITCH	20	ENCLOSURE	NEMA 4		NEMA 4		NEMA 4	
	21	QUANTITY / FORM	1	DPDT	1	DPDT	1	DPDT
	22	RATING: VOLTS / HZ OR DC	120 V	60 HZ	120 V	60 HZ	120 V	60 HZ
	(23)	AMPS						
	24 / 25	ACTION	OPEN / (CLOSE) ON LEVEL	(INCR) / DECR	OPEN / (CLOSE) ON LEVEL	(INCR) / DECR	OPEN / (CLOSE) ON LEVEL	(INCR) / DECR
PNEU PILOT	~~26~~	~~ACTION ON LEVEL INC~~						
	~~27~~	~~OPER MEDIUM / PRESS~~						
	28							
FLUID DATA	29	FLUID	CONDENSATE & STEAM		CONDENSATE & STM		CONDENSATE & STM	
	30	OPER: PRESS, PSIG / TEMP °F	470	960°	1451	630°/863°	9X	342°
	31	MAX: PRESS, PSIG / TEMP °F	525	960°	1775	1010°F	102	1010°
	32	SP GR @ 60°F / @ O.T. - UPPER						
	33	SP GR @ 60°F / @ O.T. - LOWER						
	34	LEVEL REQ'D FOR ACTUATION						
	35	ACTUATES	LV-1010		LV-1011		LV-1012	
	36	% SOLIDS						
	37	CORROSIVE DUE TO						
	(38)	MODEL NUMBER	MAGNETROL 402 OR ENGR APPD EQUAL		MSW 208 OR ENGR APPD EQ		MAGNETROL 402 OR ENGR APPD. EQUAL	

△1

NOTES: 1. ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

D.O.E. NO. 40C 700217I

Stearns-Roger

LEVEL SWITCHES
FLOAT-DISPLACER

DATA SHEET LS
PAGE 2
S-R PROJECT C-21700
ACCOUNT
DATE 2-23-80 REV PI
BY CAM

CLIENT MCDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT CALIFORNIA

REVISIONS 1 BY 2 ⚠ 11-20-80 BY RGA 3 BY 4 BY

MANUFACTURER SOURCE: QUOTE OF

FORM NO. N-728 12/77
BASED ON ISA S20

GENERAL	1	TAG NUMBER			LS-1013						LS-1015		
	2	SERVICE			6"-MS-3-QEB						2"-MS-8-QEB		
	3				DRN POT LVL CONTR						DRN POT LVL CONTR		
	4	~~LINE NO.~~/VESSEL NO.			6" MS-3-QEB DRN POT						2"-MS-8-QEB DRN POT		
	5	FLOW SHEET			4007005132 A0						4007005132 A0		
BODY	6	TYPE			EXTERNAL CAGE						EXTERNAL CAGE		
	7	MATERIAL			ALLOY STEEL						ALLOY STEEL		
	(8)	MFR RATING: PRESS	TEMP										⚠
	9	TOP CONN LOCATION			TOP						TOP		
	10	BTM CONN LOCATION			BOTTOM						BOTTOM		
	11	CONN SIZE & TYPE			1" SW						1" SW		
	12	COOLING FIN			YES						YES		
	13	GAUGE GLASS CONN			NO						N O		
	14	GAUGE GLASS			NO						NO		
	15												
FLOAT DISPL	16	TYPE			FLOAT						FLOAT		
	(17)	SIZE	MATERIAL										
	(18)	ROD: LENGTH	MATERIAL										
	19												
SWITCH	20	ENCLOSURE			NEMA 4						NEMA 4		
	21	QUANTITY	FORM		1	DPDT					1	DPDT	
	22	RATING: VOLTS	HZ OR DC		120V	60 HZ					120V	60 HZ	
	(23)	AMPS											
	24	ACTION			OPEN (CLOSE)	ON LEVEL	(INCR) DECR		OPEN CLOSE	ON LEVEL	INCR DECR		OPEN (CLOSE)	ON LEVEL	INCR DECR
	25														
PNEU PILOT	26	ACTION ON LEVEL INC													
	27	OPER MEDIUM	PRESS												
	28														
FLUID DATA	29	FLUID			CONDENSATE & STM						CONDENSATE & STM		
	30	OPER: PRESS, PSIG	TEMP °F		1451 PSI	650/960°					1451 PSI	650/960°	
	31	MAX: PRESS, PSIG	TEMP °F		1775 PSI	1010°F					1775 PSI	1010°F	
	32	SP GR @ 60°F	@ O.T. - UPPER										
	33	SP GR @ 60°F	@ O.T. - LOWER										
	34	LEVEL REQ'D FOR ACTUATION											
	35	ACTUATES			LV-1013						LV-1015		
	36	% SOLIDS											
	37	CORROSIVE DUE TO											
	(38)	MODEL NUMBER			MSW-208						MSW-208 OR		

OR ENGR APPD EQUAL ENGR APPD EQUAL

NOTES: ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

D.O.E.# 4057002/7 I

Stearns-Roger

LEVEL SWITCHES FLOAT-DISPLACER

DATA SHEET LS
PAGE 3
S-R PROJECT C-21700
ACCOUNT
DATE 4-23-80 REV P1
BY CAM

CLIENT McCONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 11-20-80 BY [illegible] 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N 728 12/77
BASED ON ISA S20

Section	No.	Item						
GENERAL	1	TAG NUMBER		LS-1016 A			LS-1016 B	
	2	SERVICE		6"-MS-2-QEB			6"-MS-2-QEB	
	3	~~ACCOUNT NO.~~		DRN POT LVL CONTR			DRN POT LVL CONTR	
	4	~~LINE NO.~~/VESSEL NO.		6"-MS-2-QEB DRN POT			6"-MS-2-QEB DRN POT	
	5	FLOW SHEET		10P7005/1331-4C			10P7005/1331-[illegible]	
BODY	6	TYPE		EXTERNAL CAGE			EXTERNAL CAGE	
	7	MATERIAL		ALLOY STEEL			ALLOY STEEL	
	(8)	MFR RATING: PRESS	TEMP					
	9	TOP CONN LOCATION		TOP			TOP	
	10	BTM CONN LOCATION		BOTTOM			BOTTOM	
	11	CONN SIZE & TYPE		1" SW			1" SW	
	12	COOLING FIN		YES			YES	
	13	GAUGE GLASS CONN		NO			NO	
	14	GAUGE GLASS		NO			NO	
	15							
FLOAT DISPL	(16)	TYPE		FLOAT			FLOAT	
	(17)	SIZE	MATERIAL					
	18	ROD: LENGTH	MATERIAL					
	19							
SWITCH	20	ENCLOSURE		NEMA 4			NEMA 4	
	21	QUANTITY	FORM	1	DPDT		1	DPDT
	22	RATING: VOLTS	HZ OR DC	120 V	60		120 V	60
	(23)	AMPS						
	24 / 25	ACTION		OPEN / (CLOSE)	ON LEVEL / (INCR) DECR	OPEN CLOSE / ON LEVEL / INCR DECR	OPEN / (CLOSE)	ON LEVEL / (INCR) DECR
PNEU PILOT	~~26~~	~~ACTION ON LEVEL INC~~						
	~~27~~	~~OPER MEDIUM~~	~~PRESS~~					
	28							
FLUID DATA	29	FLUID		CONDENSATE & STEAM			CONDENSATE & STEAM	
	30	OPER: PRESS, PSIG	TEMP °F	1451	593/960°		1451	593/960°
	31	MAX: PRESS, PSIG	TEMP °F	1775	1010°		1775	1010°
	32	SP GR @ 60°F	@ O.T. - UPPER					
	33	SP GR @ 60°F	@ O.T. - LOWER					
	34	LEVEL REQ'D FOR ACTUATION						
	35	ACTUATES		LV-1016			LV-1016	
	36	% SOLIDS						
	37	CORROSIVE DUE TO						
	(38)	MODEL NUMBER		MSW-208 OR ENGR APPD EQUAL			MSW-208 OR ENGR APPD EQUAL	

NOTES: 1. ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

D.O.E. # 4CI700217I

Stearns-Roger

CONTROL VALVES (SPECIAL)

DATA SHEET	LV
PAGE	4
S-R PROJECT	C-21700
ACCOUNT	
DATE	4-10-80 REV 1
BY	CAM

CUSTOMER: McDONNELL DOUGLAS ASTRONAUTICS Co
PROJECT: 10 MWe SOLAR PILOT PLANT
LOCATION: DAGGETT CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-721A 12/71 BASED ON ISA S20

	No.	Item								
GENERAL	1	TAG NUMBER			LV-1010			LV-1011		
	2	SERVICE			4" VT-1-KEB			6" MS-6-QEB MN STM COND		
	3				DRN POT LVL CONTR			DRN POT LVL CONTROL		
	4	LINE: SIZE, NUMBER			1"-DR-18-KEB			1"-DR-8-QEB		
BODY & TRIM	5	TYPE OF BODY			GLOBE			GLOBE		
	6	BODY SIZE	PORT SIZE		1"	FULL		1"	FULL	
	(7)	GUIDING	NO. OF PORTS			1			1	
	8	END CONN & RATING			SOCKET WELD 1500#			SOCKET WELD 2500#		
	9	PIPE SCHEDULE OR BORE (2)			SCH. 80			SCH. 80		
	10	BODY MATERIAL			CR-MOLY WC9			CR-MOLY WC9		
	(11)	PACKING MATERIAL								
	~~12~~	~~LUBRICATOR~~	~~ISO VALVE~~							
	13	BONNET TYPE (HI TEMP)			BOLTED			BOLTED		
	14	TRIM FORM			QUICK OPENING			QUICK OPENING		
	(15)	TRIM MATERIAL			HARDENED			[illegible]		
	16	TIGHT SHUTOFF REQD			CLASS IV			CLASS IV		
ACTUATOR	17	TYPE OF ACTUATOR			DIAPHRAGM			DIAPHRAGM		
	(18)	MODEL NO. & SIZE								
	19	CLOSE AT	OPEN AT		30 PSIG	0 PSIG		30 PSIG	0 PSIG	
	(20)	PUSH DOWN TO	FLOW ACTION TO							
	21	FAIL POSITION			OPEN			OPEN		
	22	HANDWHEEL & LOCATION			YES & TOP			YES & TOP		
	23	AIR SUPPLY PRESSURE (NOM.)			80~100 PSIG			80~100 PSIG		
	24	TRAVEL INDICATOR			YES			YES		
POSIT.	~~25~~	~~MODEL NO.~~			-			-		
	26	FILTER REG	GAUGES	BYPASS	YES	YES	-	YES	YES	-
	~~27~~	~~INPUT SIGNAL~~			-			-		
	~~28~~	~~OUTPUT SIGNAL~~			-			-		
PILOT	~~29~~	~~MODEL NO.~~	~~ACTION~~							
	~~30~~	~~CONTROL MODES~~								
	~~31~~	~~MOUNTING~~	~~OUTPUT~~							
	~~32~~	~~ELEMENT: TYPE~~	~~RANGE~~							
	~~33~~	~~MATERIAL~~								
	(34)	TOTAL VALVE WEIGHT								
ACCESS.	35	SOLENOID (5)			SOV-1010			SOV-1011		
	36	LIMIT SWITCHES (4)			ZS-1010A &	ZS-1010B		ZS-1011A &	ZS-1011B	
	37									
FLUID DATA	38	FLUID (1)			CONDENSATE & STEAM			CONDENSATE & STEAM		
	39	FLOW	MAX DES MIN		240	240	30	4750	4750	545
	40	TEMP °F	MAX DES MIN		1010°	960°		1010°	960	
	41	Δ PRESS	MAX DES MIN							
	42	INLET PRESS	MAX DES MIN		585	470	psig	1775	1450	
	43	MAXIMUM SHUTOFF ΔP			585 psi			1775 psi		
	(44)	CAL. CV	MAX DES MIN							
	(45)	VALVE CV	MAX DES MIN							
	46	VALVE VEL.	MAX DES MIN							
	47	PERCENT FLASH	PERCENT SOLIDS		0	NEGLIGIBLE		0	NEGLIGIBLE	
	(48)	MODEL NUMBER								

NOTES: (1) FLOW UNITS: LIQUID lbs/hr STEAM ____ GAS ____
(2) PIPE MATERIAL: 2¼% CHROME - 1% MOLY STEEL ASTM A335 P22
3) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER
4) LIMIT SWITCH SHALL BE MICROSWITCH 1CX-43 OR ENGR. APPD. EQ. TERMINALS SHALL BE SUITABLE FOR RING-TONGUE TERMINATIONS OF #12 AWG FIELD WIRING
5) REFER TO DATA SHEET SOV PAGE 1 FOR MORE DETAILS.

TAG NO.

D.O.E. # 40I7002171

Stearns-Roger

CONTROL VALVES (SPECIAL)

DATA SHEET LV
PAGE 5
S-R PROJECT C-21700
ACCOUNT
DATE 4-10-80 REV
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-721A 12/71
BASED ON ISA S20

GENERAL	1	TAG NUMBER				LV-1012							LV-1013			
	2	SERVICE				10"-MS-7-FEA MN STM DUMP							6"-MS-3-QEB			
	3					DRN POT LVL CONTROL							DRN POT LVL CONTROL			
	4	LINE: SIZE, NUMBER				1"-DR-11-FEA							1"-DR-13-QEB			
BODY & TRIM	5	TYPE OF BODY				GLOBE							GLOBE			
	6	BODY SIZE	PORT SIZE			1"	FULL						1"	FULL		
	(7)	GUIDING	NO. OF PORTS													
	8	END CONN & RATING				SOCKETWELD 2500#							SOCKETWELD 2500#			
	9	PIPE SCHEDULE OR BORE				SCH 80 (2)							SCH 80 (6)			
	(10)	BODY MATERIAL				CR-MOLY WC9							CR-MOLY WC9			
	(11)	PACKING MATERIAL														
	~~12~~	~~LUBRICATOR~~	~~ISO VALVE~~													
	13	BONNET TYPE (HI TEMP)				BOLTED							BOLTED			
	14	TRIM FORM				QUICK OPENING							QUICK OPENING			
	(15)	TRIM MATERIAL				HARDENED							HARDENED			
	16	TIGHT SHUTOFF REQD				CLASS IV							CLASS IV			
ACTUATOR	17	TYPE OF ACTUATOR				DIAPHRAGM							DIAPHRAGM			
	(18)	MODEL NO. & SIZE														
	19	CLOSE AT	OPEN AT			30 PSIG	OPEN						30 PSIG	OPEN		
	(20)	PUSH DOWN TO	FLOW ACTION TO													
	21	FAIL POSITION				OPEN							OPEN			
	22	HANDWHEEL & LOCATION				YES / TOP							YES / TOP			
	23	AIR SUPPLY PRESSURE (NOM)				80 ~ 100 PSIG							80 ~ 100 PSIG			
	24	TRAVEL INDICATOR				YES							YES			
POSIT.	~~25~~	~~MODEL NO.~~				—										
	26	FILTER REG	GAUGES	BYPASS		YES	YES	—					YES	YES		
	~~27~~	~~INPUT SIGNAL~~				—										
	~~28~~	~~OUTPUT SIGNAL~~				—										
PILOT	~~29~~	~~MODEL NO.~~	~~ACTION~~													
	~~30~~	~~CONTROL MODES~~														
	~~31~~	~~MOUNTING~~	~~OUTPUT~~													
	~~32~~	~~ELEMENT: TYPE~~	~~RANGE~~													
	~~33~~	~~MATERIAL~~														
	(34)	TOTAL VALVE WEIGHT														
ACCESS.	35	SOLENOID (5)				SOV-1012	(5)						SOV-1013	(5)		
	36	LIMIT SWITCHES (4)				ZS-1012A & ZS-1012B							ZS-1013A & 1013B			
	37															
FLUID DATA	38	FLUID (1)				CONDENSATE & STEAM							CONDENSATE & STEAM			
	39	FLOW	MAX	DES	MIN	2300	2000	280					2240	2000	280	
	40	TEMP °F	MAX	DES	MIN	1010°	740°						1010°F	960°		
	41	△ PRESS	MAX	DES	MIN											
	42	INLET PRESS	MAX	DES	MIN	93	90						1775 PSIA	1415 PSIA		
	43	MAXIMUM SHUTOFF △P					110 PSI						1775 PSI			
	(44)	CAL. CV	MAX	DES	MIN											
	(45)	VALVE CV	MAX	DES	MIN											
	46	VALVE VEL.	MAX	DES	MIN											
	47	PERCENT FLASH	PERCENT SOLIDS			0	NEGLIGIBLE						0	NEGLIGIBLE		
	(48)	MODEL NUMBER														

NOTES:
(1) FLOW UNITS: LIQUID lbs/hr. STEAM ____ GAS ____
(2) PIPE MATERIAL: 1¼% CHROME ½% MOLY STEEL ASTM A 335 GRADE P11
(3) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER
(4) LIMIT SWITCH SHALL BE MICROSWITCH 1CX-43 OR ENGR APPD EQ. TERMINALS SHALL BE SUITABLE FOR RING-TONGUE TERMINATIONS OF NO. 12 AWG FIELD WIRING
(5) REFER TO DATA SHEET SOV PAGE 2 FOR MORE DETAILS.
(6) PIPE MATERIAL: 2¼% CHROME 1% MOLY STEEL ASTM A 335 GRADE [illegible]

TAG NO.

D.O.E. # 40I7002171

Stearns-Roger

CONTROL VALVES (SPECIAL)

DATA SHEET LV
PAGE 6
S.R PROJECT C-21700
ACCOUNT
DATE 4-11-80 REV P
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS Co
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 0 4-22-80 BY PAS 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. M-721A 12/71
BASED ON ISA S20

GENERAL	1	TAG NUMBER				LV-1015							LV-1016				
	2	SERVICE				2"-MS-9-GEB MN STM							6"-MS 2-GE3 MN STM				
	3					DESHTR DRN POT LVL CONTR							DRN POT LVL CONTR				
	4	LINE: SIZE, NUMBER				1"-OR-10-QEB							1"-OR-12-QEB				
BODY & TRIM	5	TYPE OF BODY				GLOBE							GLOBE				
	6	BODY SIZE	PORT SIZE			1"	FULL						1"	FULL			
	(7)	GUIDING	NO. OF PORTS														
	8	END CONN & RATING				SOCKETWELD 2500#							SOCKETWELD 2500				
	9	PIPE SCHEDULE OR BORE				SCH. 80 (3)							SCH 80 (3)				
	(10)	BODY MATERIAL				CR-MOLY WC9							CR-MOLY WC9				
	(11)	PACKING MATERIAL															
	~~12~~	~~LUBRICATOR~~	~~ISO VALVE~~														
	13	BONNET TYPE				BOLTED							BOLTED				
	14	TRIM FORM				QUICK OPENING							QUICK OPENING				
	(15)	TRIM MATERIAL				HARDENED							HARDENED				
	16	TIGHT SHUTOFF REQD				YES, CLASS IV							YES CLASS IV				
ACTUATOR	17	TYPE OF ACTUATOR				DIAPHRAGM							DIAPHRAGM				
	(18)	MODEL NO. & SIZE															
	19	CLOSE AT	OPEN AT			30 PSIG	[illegible]						30 PSIG	[illegible]			
	(20)	PUSH DOWN TO	FLOW ACTION TO														
	21	FAIL POSITION				OPEN							OPEN				
	22	HANDWHEEL & LOCATION				YES / TOP							YES / TOP				
	23	AIR SUPPLY PRESSURE				80 ~ 100 PSIG							80 ~ 100 PSIG				
	24	TRAVEL INDICATOR				YES							YES				
POSIT.	~~25~~	~~MODEL NO.~~															
	26	FILTER REG	GAUGES	BYPASS		YES	YES	—					YES	YES	—		
	~~27~~	~~INPUT SIGNAL~~															
	~~28~~	~~OUTPUT SIGNAL~~															
PILOT	~~29~~	~~MODEL NO.~~	~~ACTION~~														
	~~30~~	~~CONTROL MODES~~															
	~~31~~	~~MOUNTING~~	~~OUTPUT~~														
	~~32~~	~~ELEMENT: TYPE~~	~~RANGE~~														
	~~33~~	~~MATERIAL~~															
	(34)	TOTAL VALVE WEIGHT															
ACCESS.	35	SOLENOID	(5)			SOV-1015							SOV-1016				
	36	LIMIT SWITCHES	(6)			ZS-1015A	ZS-1015B						ZS-1016A	ZS-1016B			
	37																
FLUID DATA	38	FLUID (1)				CONDENSATE & STEAM							CONDENSATE & STEAM				
	39	FLOW	MAX	DES	MIN	72	72						5290	5290	545		
	40	TEMP OF	MAX	DES	MIN	1010°	960°						1010	960°			
	41	Δ PRESS	MAX	DES	MIN												
	42	INLET PRESS	MAX	DES	MIN	1775	1450						1775	1451			
	43	MAXIMUM SHUTOFF ΔP				1775 PSI							1775 PSI				
	(44)	CAL. CV	MAX	DES	MIN												
	(45)	VALVE CV	MAX	DES	MIN												
	46	VALVE VEL.	MAX	DES	MIN												
	47	PERCENT FLASH	PERCENT SOLIDS			0	NEGLIGIBLE						0	NEGLIGIBLE			
	(48)	MODEL NUMBER															

NOTES: (1) FLOW UNITS: LIQUID Lbs/HR STEAM ____ GAS ____
(2)
(3) PIPE MATERIAL: 2¼% CHROME - 1% MOLY STEEL ASTM A335 GRADE P22
(4) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER
(5) REFER TO DATA SHEET SOV PAGE FOR MORE DETAILS
(6) LIMIT SWITCH SHALL BE MICROSWITCH 1CR-43 OR ENGR APPD EQ.
TERMINALS SHALL BE SUITABLE FOR RING-TONGUE TERMINATIONS OF #12 AWG FIELD WIRING

TAG NO.

D.O.E. # 40I700217I

Stearns-Roger

CONTROL VALVES (SPECIAL)

DATA SHEET LV
PAGE 7
S-R PROJECT C-21700
ACCOUNT
DATE 4-24-80 REV B
BY CAM

CUSTOMER MCDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 △ 10-27-80 BY [illegible] 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

Section	No.	Item				
GENERAL	1	TAG NUMBER	LV-1203			LV-1702
	2	SERVICE	DEMINERALIZED WTR			RAW WATER STORAGE
	3		STOR. TK LVL CONTR			TK LVL CONTROL
	4	LINE: SIZE. NUMBER	2"-DW-5-BSA			8"-RW-7-AQO
BODY & TRIM	5	TYPE OF BODY	GLOBE			GLOBE
	(6)	BODY SIZE / PORT SIZE				
	(7)	GUIDING / NO. OF PORTS				
	8	END CONN & RATING	SOCKETWELD 150			FLANGE 125
	9	PIPE SCHEDULE OR BORE	SCH. 40S (2)			SCH. 40 (3)
	10	BODY MATERIAL	STAINLESS STEEL			CARBON STEEL
	(11)	PACKING MATERIAL				
	~~12~~	~~LUBRICATOR / ISO VALVE~~				
	13	BONNET TYPE	BOLTED			BOLTED
	14	TRIM FORM	LINEAR			LINEAR
	(15)	TRIM MATERIAL				
	16	TIGHT SHUTOFF REQD	ANSI II			ANSI II
ACTUATOR	17	TYPE OF ACTUATOR	DIAPHRAGM			DIAPHRAGM
	(18)	MODEL NO. & SIZE				
	19	CLOSE AT / OPEN AT	0 PSIG △ / 30 PSIG	△		3 [illegible] / [illegible]
	(20)	PUSH DOWN TO / FLOW ACTION TO				
	21	FAIL POSITION	CLOSED △			OPEN
	22	HANDWHEEL & LOCATION	YES @ TOP			YES @ TOP
	23	AIR SUPPLY PRESSURE NOM.	80~100 PSIG			80~100 PSIG
	24	TRAVEL INDICATOR	YES			YES
POSIT.	~~25~~	~~MODEL NO.~~				
	26	FILTER REG / GAUGES / ~~BYPASS~~	YES / YES / —			YES / YES / —
	~~27~~	~~INPUT SIGNAL~~				
	~~28~~	~~OUTPUT SIGNAL~~				
PILOT	~~29~~	~~MODEL NO. / ACTION~~				
	~~30~~	~~CONTROL MODES~~				
	~~31~~	~~MOUNTING / OUTPUT~~				
	~~32~~	~~ELEMENT: TYPE / RANGE~~				
	~~33~~	~~MATERIAL~~				
	(34)	TOTAL VALVE WEIGHT				
ACCESS.	35	SOLENOID (5)	SOV-1203			SOV-1702
	~~36~~	~~LIMIT SWITCHES~~				
	37					
FLUID DATA	38	FLUID (1)	DEMINERALIZED WTR			RAW WTR
	39	FLOW MAX / DES / MIN	60 / 50 / 10			1000 / 1000 / [illegible]
	40	TEMP °F MAX / DES / MIN	100 / 100 / 10.			[illegible] / 80° / 70°
	41	△PRESS MAX / DES / MIN	6[illegible] / 56.97 / 53.93			155.75 / 144.06 / 10[illegible]
	42	INLET PRESS MAX / DES / MIN	60 / 60 / 60			155.75 / 155.75 / 10[illegible]
	43	MAXIMUM SHUTOFF △P	80 PSI			250 PSI
	(44)	CAL. CV MAX / DES / MIN	7.45			83.32
	(45)	VALVE CV MAX / DES / MIN				
	46	VALVE VEL. MAX / DES / MIN				
	47	PERCENT FLASH / PERCENT SOLIDS	0 / NEGLIGIBLE			0 / NEGLIGIBLE
	(48)	MODEL NUMBER				

NOTES: (1) FLOW UNITS: LIQUID GPM, STEAM ____, GAS ____

(2) PIPE MATERIAL: ASTM A312 TP304 AUTOMATICALLY WELDED STAINLESS STEEL PIPE.

(3) PIPE MATERIAL: SEAMLESS CARBON STEEL ASTM A53 OR ASTM A106 GR. B

(4) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

(5) REFER TO DATA SHEET SOV PAGE 3 & 10 FOR SOV DETAILS.

TAG NO.

FORM NO. N-721A 12/71
BASED ON ISA S20

FORM NO. N-721A 6/78
BASED ON ISA S20

Stearns-Roger

CONTROL VALVES (SPECIAL)

DATA SHEET LY
PAGE 8
S-R PROJECT [illegible]
ACCOUNT
DATE [illegible]-6-[illegible]
BY [illegible]

CLIENT McDonnell Douglas Astronautics Co
PROJECT 10 MW SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

GENERAL	1	TAG NUMBER	LV-1		
	2	SERVICE	CROSSOVER H_2O	TSS FW	
	3		TO AUX BOILER		
	4	LINE: SIZE, NUMBER	CCS-3[illegible]-1"-R-1H		
BODY & TRIM	5	TYPE OF BODY	GLOBE		
	6	BODY SIZE / PORT SIZE	1" / FULL		
	(7)	GUIDING / NO. OF PORTS			
	8	END CONN & RATING	SOCKETWELD [illegible]		
	9	PIPE SCHEDULE OR BORE	SCH 40		
	10	BODY MATERIAL	CARBON STEEL		
	(11)	PACKING MATERIAL			
	12	~~LUBRICATOR~~ / ~~ISO VALVE~~			
	13	BONNET TYPE	BOLTED		
	14	TRIM FORM	[illegible]		
	(15)	TRIM MATERIAL			
	16	TIGHT SHUTOFF REQD	[illegible]		
ACTUATOR	17	TYPE OF ACTUATOR	DIAPHRAGM		
	(18)	MODEL NO. & SIZE			
	19	CLOSE AT / OPEN AT	[illegible] / 30 PSIG		
	(20)	PUSH DOWN TO / FLOW ACTION TO			
	21	FAIL POSITION	CLOSED		
	22	HANDWHEEL & LOCATION	YES [illegible] TOP		
	23	AIR SUPPLY PRESSURE	80 ~ 100 PSIG		
	24	TRAVEL INDICATOR	YES		
POSIT.	~~25~~	~~MODEL NO.~~			
	26	FILTER REG / GAUGES / ~~BYPASS~~	YES / [illegible] / —		
	~~27~~	~~INPUT SIGNAL~~			
	~~28~~	~~OUTPUT SIGNAL~~			
PILOT	~~29~~	~~MODEL NO.~~ / ~~ACTION~~			
	~~30~~	~~CONTROL MODES~~			
	~~31~~	~~MOUNTING~~ / ~~OUTPUT~~			
	~~32~~	~~ELEMENT: TYPE~~ / ~~RANGE~~			
	~~33~~	~~MATERIAL~~			
	~~34~~	~~FILTER REG~~ ~~MOUNTING~~			
ACCESS.	35	SOLENOID (3)	SOV-1		
	~~36~~	~~LIMIT SWITCHES~~ / ~~TAG NO. REF~~			
	37				
FLUID DATA	38	FLUID (1)	DEMINERALIZED WTR.		
	39	FLOW MAX / DES / MIN	4950 / 4950 / 0		
	40	TEMP °F MAX / DES / MIN	285°F / 285°F		
	41	Δ PRESS MAX / DES / MIN	≤2 psia / ≤ psia		
	42	INLET PRESS MAX / DES / MIN	170 psia / 122 psia / 127 psia		
	43	MAXIMUM SHUTOFF ΔP	170 psi		
	(44)	CAL. CV MAX / DES / MIN			
	(45)	VALVE CV MAX / DES / MIN			
	46	VALVE VEL. MAX / DES / MIN			
	47	PERCENT FLASH / PERCENT SOLIDS			
	(48)	MODEL NUMBER			

NOTES: (1) FLOW UNITS: LIQUID lbs/hr STEAM ____ GAS ____
(2) ENCIRCLED ITEM NOS. TO BE COMPLETED BY [illegible]
(3) REFER TO DATA SHEET [illegible] PAGE 2 FOR DETAIL

D.O.E. NO. 40I700C/T I

Stearns-Roger

PRESSURE GAUGES

DATA SHEET PI
PAGE 1
S-R PROJECT C-21700
ACCOUNT
DATE 4-30-80 REV P1
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-716a REV. 11/77
BASED ON ISA S20

GENERAL

1 TYPE: ■ DIRECT ROG ☐ 3-15# RECEIVER
OTHER ____
2 MTG: ☐ SURFACE ☐ LOCAL ☐ FLUSH
3 DIAL: DIAMETER 4 1/2 " COLOR BLACK
4 CASE: ☐ CAST IRON ☐ ALUMINUM ■ PHENOL
OTHER ____
5 RING: ■ SCREWED ☐ HINGED ☐ SLIP
☐ SNAP OTHER ____
6 BLOW-OUT: ☐ NONE ☐ BACK ■ DISC
OTHER ____
~~7 LIQ FIL: ☐ GLYCERINE ☐ SILICONE~~
OTHER ____
8 WINDOW: ■ GLASS ☐ PLASTIC
OTHER SHATTERPROOF
(9) MODEL NUMBER ____

ELEMENT

10 PRESS ELEMENT: ■ BOURDON ☐ BELLOWS
OTHER ____
11 ELEM MTL: ■ BRONZE ☐ STEEL ____ SS
OTHER
12 SOCK MTL: ■ BRASS ☐ STEEL ____ SS
OTHER ____
13 CONN: NPT ☐ 1/4" ■ 1/2" OTHER ____
■ BOTTOM ☐ BACK
14 MOVEMENT: ☐ BRONZE ■ SS ☐ NYLON
OTHER ____
15 ZERO ADJUSTMENT YES
16 ACCURACY: ☐ 1/4% ■ 1/2%
☐ 1% ☐ 2%

REV	TAG NO	NO REQD	ACCT NO	RANGE PSIG	OP PRES PSIG	SERVICE	ACCESSORIES	NOTES
	PI-1201	1		0-100	35 PSIG @ 60°F	P710 (DEMINERALIZED WTR TRANSFER PP) DISCH PRESS	PULSATION DAMPENER	

NOTES: 1. ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.

D.O.E. No. 40I 7002/7J

Stearns-Roger

PRESSURE GAUGES

DATA SHEET PI
PAGE 2
S-R PROJECT C-21703
ACCOUNT
DATE 5-20-80 REV P
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-715a REV. 11/77
BASED ON ISA S20

GENERAL

1 TYPE: ■ DIRECT RDG ☐ 3-15# RECEIVER
OTHER ____
2 MTG: ☐ SURFACE ■ LOCAL ☐ FLUSH
3 DIAL: DIAMETER 4 1/2" COLOR BLACK
4 CASE: ☐ CAST IRON ☐ ALUMINUM ■ PHENOL
OTHER ____
5 RING: ■ SCREWED ☐ HINGED ☐ SLIP
☐ SNAP OTHER ____
6 BLOW-OUT: ☐ NONE ☐ BACK ■ DISC
OTHER ____
~~7 LIQ.FIL:~~ ☐ ~~GLYCERINE~~ ☐ ~~SILICONE~~
OTHER ____
8 WINDOW: ■ GLASS ☐ PLASTIC
OTHER SHATTERPROOF
(9) MODEL NUMBER ____

ELEMENT

10 PRESS ELEMENT: ■ BOURDON ☐ BELLOWS
OTHER ____
11 ELEM MTL: ☐ BRONZE ■ STEEL ____ SS
OTHER
12 SOCK MTL: ☐ BRASS ■ STEEL ____ SS
OTHER ____
13 CONN: NPT ☐ 1/4" ■ 1/2" OTHER ____
■ BOTTOM ☐ BACK
14 MOVEMENT: ☐ BRONZE ■ SS ☐ NYLON
OTHER ____
15 ZERO ADJUSTMENT YES
16 ACCURACY: ☐ 1/4% ■ 1/2%
☐ 1% ☐ 2%

REV	TAG NO	NO REQD	ACCT NO	RANGE PSIG	OP PRES PSIG	SERVICE	ACCESSORIES	NOTES
	PI-1102	1		0-5000	2054	FW PRESS AFTER 1ST PT HEATER PRESS	PULSATION DAMPER	

NOTES:

Stearns-Roger

PRESSURE GAUGES

DATA SHEET PI
PAGE 3
S-R PROJECT C 21700
ACCOUNT
DATE 7-14-80
BY RES

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT SOLAR ONE
LOCATION DAGGETT, CA
REVISIONS 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-716a REV. 11/77
BASED ON ISA S20

GENERAL

1 TYPE: ■ DIRECT ROG ☐ 3 - 15# RECEIVER
OTHER ____
2 MTG: ☐ SURFACE ■ LOCAL ☐ FLUSH
3 DIAL: DIAMETER 4½" COLOR BLACK
4 CASE: ☐ CAST IRON ☐ ALUMINUM ■ PHENOL
OTHER ____
5 RING: ■ SCREWED ☐ HINGED ☐ SLIP
☐ SNAP OTHER ____
6 BLOW-OUT: ☐ NONE ☐ BACK ■ DISC
OTHER ____
~~7 LIQ.FIL: ☐ GLYCERINE ☐ SILICONE~~
OTHER ____
8 WINDOW: ■ GLASS ☐ PLASTIC
OTHER SHATTERPROOF
(9) MODEL NUMBER ____

ELEMENT

10 PRESS ELEMENT: ■ BOURDON ☐ BELLOWS
OTHER ____
11 ELEM MTL: ■ BRONZE ☐ STEEL ____ SS
OTHER
12 SOCK MTL: ■ BRASS ☐ STEEL ____ SS
OTHER ____
13 CONN: NPT ☐ 1/4" ■ 1/2" OTHER ____
■ BOTTOM ☐ BACK
14 MOVEMENT: ☐ BRONZE ■ SS ☐ NYLON
OTHER ____
15 ZERO ADJUSTMENT YES
16 ACCURACY: ☐ 1/4% ■ 1/2%
☐ 1% ☐ 2%

REV	TAG NO	NO REQD	ACCT NO	RANGE PSIG	OP PRES PSIG	SERVICE	ACCESSORIES	NOTES
	PI 55	1		0-700	485	TSS FEEDWATER DISCHARGE PRESSURE	PULSATION DAMPENER	

NOTES: 1. ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.

Stearns-Roger

PRESSURE GAUGES

DATA SHEET PI
PAGE 4
S-R PROJECT 31700
ACCOUNT
DATE 8-15-90
BY REB

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT SOLAR ONE
LOCATION DAGGETT, CA
REVISIONS 1 0 8-15-90 BY REB 2 BY 3 BY 4 BY
MANUFACTURER SOURCE: QUOTE OF

FORM NO. N-716a REV. 11/77
BASED ON ISA S20

GENERAL

1 TYPE: ■ DIRECT RDG ☐ 3-15# RECEIVER
OTHER
2 MTG: ☐ SURFACE ■ LOCAL ☐ FLUSH
3 DIAL: DIAMETER 9 1/2" COLOR BLACK
4 CASE: ☐ CAST IRON ☐ ALUMINUM ■ PHENOL
OTHER
5 RING: ■ SCREWED ☐ HINGED ☐ SLIP
☐ SNAP OTHER
6 BLOW-OUT: ☐ NONE ☐ BACK ■ DISC
OTHER
~~7 LIQ. FIL. ☐ GLYCERINE ☐ SILICONE~~
OTHER
8 WINDOW: ■ GLASS ☐ PLASTIC
OTHER
(9) MODEL NUMBER

ELEMENT

10 PRESS ELEMENT: ■ BOURDON ☐ BELLOWS
OTHER
11 ELEM MTL: ■ BRONZE ☐ STEEL ____ SS
OTHER
12 SOCK MTL: ■ BRASS ☐ STEEL ____ SS
OTHER
13 CONN: NPT ☐ 1/4" ■ 1/2" OTHER
☐ BOTTOM ☐ BACK
14 MOVEMENT: ☐ BRONZE ■ SS ☐ NYLON
OTHER
15 ZERO ADJUSTMENT YES
16 ACCURACY: ☐ 1/4% ■ 1/2%
☐ 1% ☐ 2%

REV	TAG NO	NO REQD	ACCT NO	RANGE PSIG	OP PRES PSIG	SERVICE	ACCESSORIES	NOTES
	PI 1703A	1		0-150	PSIG	SERVICE WATER	Pulsation Dampner	
	PI1703B	1		0-150	PSIG	SERVICE WATER	Pulsation Damper	

NOTES: 1. ENCIRCLED ITEMS INDICATE DATA TO BE COMPLETED BY BIDDER.

D.O.E. No. 401700217I

Stearns-Roger

PRESSURE INSTRUMENTS

DATA SHEET PIT
PAGE 1
S-R PROJECT C-2170
ACCOUNT
DATE 4-10-80 REV P1
BY CAM

CUSTOMER MCDONNELL DOUGLAS ASTRONAUTICS Co
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 6-20-80 BY RJB 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

	1	TAG NO. PIT-1000	SERVICE RS FLASH TK VENT TO COND CONTROL
GENERAL	2	FUNCTION	RECORD ☐ INDICATE ■ CONTROL ☐ BLIND ☐ TRANS ■ OTHER NOTE: INDICATOR TO BE INTEGRALLY MTD IN TRANSMITTER
	3	CASE	MFR STD ■ NOM SIZE ____ COLOR: MFR STD ■ OTHER ____
	4	MOUNTING	FLUSH ☐ SURFACE ☐ YOKE ■ OTHER ____
	5	ENCLOSURE CLASS	GEN PUR ☐ WTH PROOF ■ EXP PROOF: CLASS ____ GROUP ____ DIVISION ____ FOR USE IN INTRIN SAFE SYS ☐ OTHER NEMA 4
	6	POWER SUPPLY	117V 60 HZ ☐ OTHER ____ AC ☐ DC ■ VOLTS 24
	~~7~~	~~CHART~~	____"STRIP ☐ ____"CIRC ☐ TIME MARKS ☐ RANGE ____ NO ____
	~~8~~	~~CHART DRIVE~~	24 HR ☐ OTHER ____ ELEC ☐ SPRING ☐ OTHER
	9	SCALE	TYPE LINEAR RANGE: 1 0-600 PSIG 2 ____ 3 ____
XMTR	10	TRANSMIT. OUTPUT	4-20 MA ■ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ____ FOR RECEIVER SEE DATA SHEET ____
CONTROLLER	~~11~~	~~CONTROL MODES~~	P-PROP(GAIN), I-INTEGRAL(AUTO RESET), D-DERIVATIVE(RATE), SUB: S-SLOW, F-FAST P ☐ PI_S ☐ PI_F ☐ PI_FD_F ☐ PI_SD_S ☐ I_F ☐ OTHER ____
	~~12~~	~~ACTION~~	ON MEAS INCREASE OUTPUT: INCREASES ☐ DECREASES ☐
	~~13~~	~~AUTO-MAN SWITCH~~	NONE ☐ MFR STD ☐ OTHER ____
	~~14~~	~~SET POINT ADJ~~	MANUAL ☐ EXTERNAL ☐ REMOTE ☐ OTHER ____
	~~15~~	~~MAN RES~~	NONE ☐ MFR STD ☐ OTHER ____
	~~16~~	~~OUTPUT~~	4-20 MA ☐ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ____
ELEMENT	17	APPLICATION	GAUGE PRESS ■ VACUUM ☐ ABS PRESS ☐ COMPOUND ☐
	18	ELEMENT TYPE	DIAPHRAGM ■ HELIX ☐ BOURDON ☐ BELLOWS ☐ OTHER ____
	19	MATERIAL	316 SS ■ BE-CU ☐ OTHER ____
	20	RANGE	FIXED ☐ ADJ RANGE YES SET AT 0 - 700 PSIG
	21	PROCESS DATA	FLUID STEAM OPER: PRESS/TEMP 470 PSIG / 960°F MAX: PRESS/TEMP 585 PSIG / 960°F OVERRANGE PROTECTION TO 100 % OF CAPSULE SPAN
	22	PROCESS CONN	1/4" NPT ☐ 1/2" NPT ■ OTHER WITH FLANGE ADAPTERS
~~ALARM~~	~~23~~	~~ALARM SWITCHES~~	QUANTITY ____ FORM ____ RATING ____
	~~24~~	~~FUNCTION~~	PRESSURE ☐ DEVIATION ☐ CONTACTS TO ____ ON INC PRESS
ACCESSORIES	25	ACCESSORIES	FILT-REG ☐ SUP GAGE ☐ OUT GAGE ☐ ____ CHARTS DIAPH SEAL ☐ TYPE ____ MATERIAL: DIAPH ____ BOT FLANGE ____ CONNECTION ____ CAPILLARY: LENGTH ____ MAT'L ____ OTHER MOUNTING BRACKET
	(26)	MODEL NUMBER	ROSEMOUNT 1151GP OR ENGR APPD EQUAL

NOTES: 1. ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.

TAG NO.

Form no. N-714a 12/71
Based on ISA S20

D.O.E. NO. 4OI 7OC217 I

Stearns-Roger

PRESSURE INSTRUMENTS

DATA SHEET PIT
PAGE 2
S-R PROJECT C-21700

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 0 5-[illegible] BY RJS 1 9-30-80 BY RJS 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____

ACCOUNT ____
DATE 4-10-80 REV 1
BY CAM

MANUFACTURER ____ SOURCE: QUOTE OF ____

	1	TAG NO. PIT-1001 1	SERVICE MN STM BYPASS TO CONDENSER CONTROL
GENERAL	2	FUNCTION	RECORD ☐ INDICATE ■ CONTROL ☐ BLIND ☐ TRANS ■ OTHER NOTE: INDICATOR TO BE INTEGRALLY MTD IN TRANSMITTER
	3	CASE	MFR STD ■ NOM SIZE ____ COLOR: MFR STD ■ OTHER ____
	4	MOUNTING	FLUSH ☐ SURFACE ☐ YOKE ■ OTHER ____
	5	ENCLOSURE CLASS	GEN PUR ☐ WTH PROOF ■ EXP PROOF: CLASS ____ GROUP ____ DIVISION ____ FOR USE IN INTRIN SAFE SYS ☐ OTHER NEMA 4
	6	POWER SUPPLY	117V 60 HZ ☐ OTHER ____ AC ☐ DC ■ VOLTS 24V
	~~7~~	~~CHART~~	____"STRIP ☐ ____"CIRC ☐ TIME MARKS ☐ RANGE ____ NO ____
	~~8~~	~~CHART DRIVE~~	24 HR ☐ OTHER ____ ELEC ☐ SPRING ☐ OTHER
	9	SCALE	TYPE LINEAR RANGE: 1 0-1900 PSIA 2 ____ 3 ____
XMTR	10	TRANSMIT. OUTPUT	4-20 MA ■ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ____ FOR RECEIVER SEE DATA SHEET
CONTROLLER	~~11~~	~~CONTROL MODES~~	P-PROP(GAIN), I-INTEGRAL(AUTO RESET), D-DERIVATIVE(RATE), SUB: S-SLOW, F-FAST P ☐ PI_S ☐ PI_F ☐ PI_FD_F ☐ PI_SD_S ☐ I_F ☐ OTHER ____
	~~12~~	~~ACTION~~	ON MEAS INCREASE OUTPUT: INCREASES ☐ DECREASES ☐
	~~13~~	~~AUTO MAN SWITCH~~	NONE ☐ MFR STD ☐ OTHER ____
	~~14~~	~~SET POINT ADJ~~	MANUAL ☐ EXTERNAL ☐ REMOTE ☐ OTHER ____
	~~15~~	~~MAN REG~~	NONE ☐ MFR STD ☐ OTHER ____
	~~16~~	~~OUTPUT~~	4-20 MA ☐ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ____
ELEMENT	17	APPLICATION	GAUGE PRESS ■ VACUUM ☐ ABS PRESS ☐ COMPOUND ☐
	18	ELEMENT TYPE	DIAPHRAGM ■ HELIX ☐ BOURDON ☐ BELLOWS ☐ OTHER ____
	19	MATERIAL	316 SS ■ BE-CU ☐ OTHER ____
	20	RANGE	FIXED ☐ ADJ RANGE YES SET AT 0-1900
	21	PROCESS DATA	FLUID STEAM OPER: PRESS/TEMP 145 PSIG / 600 ~ 963°F MAX: PRESS/TEMP 1775 PSIG / 1013°F OVERRANGE PROTECTION TO 100% OF CAPSULE SPAN
	22	PROCESS CONN	1/4" NPT ☐ 1/2" NPT ■ OTHER WITH FLANGE ADAPTER
~~ALARM~~	~~23~~	~~ALARM SWITCHES~~	QUANTITY ____ FORM ____ RATING ____
	~~24~~	~~FUNCTION~~	PRESSURE ☐ DEVIATION ☐ CONTACTS TO ____ ON INC PRESS
ACCESSORIES	25	ACCESSORIES	FILT-REG ☐ SUP GAGE ☐ OUT GAGE ☐ ____ CHARTS DIAPH SEAL ☐ TYPE ____ MATERIAL: DIAPH ____ BOT FLANGE ____ CONNECTION ____ CAPILLARY: LENGTH ____ MAT'L ____ OTHER MOUNTING BRACKET
	(26)	MODEL NUMBER	ROSEMOUNT 1151 OR ENGR APPD EQUAL

NOTES: 1. ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

TAG NO.

Form no. N-714a 12/71
Based on ISA S20

D.O.E. NO. 401 7002,171

Stearns-Roger

PRESSURE INSTRUMENTS

DATA SHEET PIT
PAGE 3
S-R PROJECT C-21700
ACCOUNT
DATE 4-10-80 REV P1
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 △ 6-20-80 BY ___ 2 △ 9-30-80 BY RAD 3 ___ BY ___ 4 ___ BY ___
MANUFACTURER ___ SOURCE: QUOTE OF ___

Form no. N-714a 12/71
Based on ISA S20

Section	No.	Item	Data
	1	TAG NO. PIT-1001 △	SERVICE
GENERAL	2	FUNCTION	RECORD [ ] INDICATE [X] CONTROL [ ] BLIND [ ] TRANS [X] OTHER NOTE: INDICATOR TO BE INTEGRALLY MTD IN TRANSMITTER
	3	CASE	MFR STD [X] NOM SIZE ___ COLOR: MFR STD [X] OTHER ___
	4	MOUNTING	FLUSH [ ] SURFACE [ ] YOKE [X] OTHER ___
	5	ENCLOSURE CLASS	GEN PUR [ ] WTH PROOF [X] EXP PROOF: CLASS ___ GROUP ___ DIVISION ___ FOR USE IN INTRIN SAFE SYS [ ] OTHER NEMA 4
	6	POWER SUPPLY	117V 60 HZ [ ] OTHER ___ AC [ ] DC [X] VOLTS 24
	~~7~~	~~CHART~~	___ "STRIP [ ] ___ "CIRC [ ] TIME MARKS [ ] RANGE ___ NO. ___
	~~8~~	~~CHART DRIVE~~	24 HR [ ] OTHER ___ ELEC [ ] SPRING [ ] OTHER
	9	SCALE	TYPE LINEAR RANGE: 1 0-1800 psig 2 ___ 3 ___
XMTR	10	TRANSMIT. OUTPUT	4-20 MA [X] 10-50 MA [ ] 3-15 PSIG [ ] OTHER ___ FOR RECEIVER SEE DATA SHEET ___
CONTROLLER	~~11~~	~~CONTROL MODES~~	P-PROP(GAIN), I-INTEGRAL(AUTO RESET), D-DERIVATIVE(RATE), SUB: S-SLOW, F-FAST P [ ] PI_S [ ] PI_F [ ] PI_FD_F [ ] PI_SD_S [ ] I_F [ ] OTHER ___
	~~12~~	~~ACTION~~	ON MEAS INCREASE OUTPUT: INCREASES [ ] DECREASES [ ]
	~~13~~	~~AUTO-MAN SWITCH~~	NONE [ ] MFR STD [ ] OTHER ___
	~~14~~	~~SET POINT ADJ~~	MANUAL [ ] EXTERNAL [ ] REMOTE [ ] OTHER ___
	~~15~~	~~MAN REG~~	NONE [ ] MFR STD [ ] OTHER ___
	~~16~~	~~OUTPUT~~	4-20 MA [ ] 10-50 MA [ ] 3-15 PSIG [ ] OTHER ___
ELEMENT	17	APPLICATION	GAUGE PRESS [X] VACUUM [ ] ABS PRESS [ ] COMPOUND [ ]
	18	ELEMENT TYPE	DIAPHRAGM [X] HELIX [ ] BOURDON [ ] BELLOWS [ ] OTHER ___
	19	MATERIAL	316 SS [X] BE-CU [ ] OTHER ___
	20	RANGE	FIXED [ ] ADJ RANGE YES SET AT 0-1800 △
	21	PROCESS DATA	FLUID STEAM OPER: PRESS/TEMP 1451 PSIG/650°-863°F MAX: PRESS/TEMP [illegible] OVERRANGE PROTECTION TO 100% OF CAPSULE SPAN
	22	PROCESS CONN	1/4" NPT [ ] 1/2" NPT [X] OTHER WITH FLANGE ADAPTER
ALARM	~~23~~	~~ALARM SWITCHES~~	QUANTITY ___ FORM ___ RATING ___
	~~24~~	~~FUNCTION~~	PRESSURE [ ] DEVIATION [ ] CONTACTS TO ___ ON INC PRESS
ACCESSORIES	25	ACCESSORIES	FILT-REG [ ] SUP GAGE [ ] OUT GAGE [ ] ___ CHARTS DIAPH SEAL [ ] TYPE ___ MATERIAL: DIAPH ___ BOT FLANGE ___ CONNECTION ___ CAPILLARY: LENGTH ___ MAT'L ___ OTHER MOUNTING BRACKET
	(26)	MODEL NUMBER	ROSEMOUNT 1151 OR ENGR APPD EQUAL

NOTES: 1. ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY SELLER.

2. PROVIDE AS SPARE FOR PIT 1001

TAG NO.

D.O.E. NO. 40I70C2172

Stearns-Roger

PRESSURE INSTRUMENTS

DATA SHEET PIT
PAGE 4
S-R PROJECT C-21700
ACCOUNT
DATE 4-11-80 REV. 1
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 Q 2 BY 3 BY 4 BY
MANUFACTURER SOURCE: QUOTE OF

	1	TAG NO.	PIT-1002 SERVICE CONDENSATE TO DSHTR QS-901 CONTROL
GENERAL	2	FUNCTION	RECORD ☐ INDICATE ■ CONTROL ☐ BLIND ☐ TRANS ■ OTHER NOTE: INDICATOR TO BE INTEGRALLY MTD. IN TRANSMITTER
	3	CASE	MFR STD ■ NOM SIZE ____ COLOR: MFR STD ■ OTHER ____
	4	MOUNTING	FLUSH ☐ SURFACE ☐ YOKE ■ OTHER ____
	5	ENCLOSURE CLASS	GEN PUR ☐ WTH PROOF ■ EXP PROOF: CLASS ____ GROUP ____ DIVISION ____ FOR USE IN INTRIN SAFE SYS ☐ OTHER NEMA 4
	6	POWER SUPPLY	117V 60 HZ ☐ OTHER ____ AC ☐ DC ■ VOLTS 24 V
	~~7~~	~~CHART~~	____"STRIP ☐ ____"CIRC ☐ TIME MARKS ☐ RANGE ____ NO ____
	~~8~~	~~CHART DRIVE~~	24 HR ☐ OTHER ____ ELEC ☐ SPRING ☐ OTHER
	9	SCALE	TYPE LINEAR RANGE: 1 0-100 psia 2 ____ 3 ____
XMTR	10	TRANSMIT. OUTPUT	4-20 MA ■ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ____ FOR RECEIVER SEE DATA SHEET ____
CONTROLLER	~~11~~	~~CONTROL MODES~~	P-PROP(GAIN), I-INTEGRAL(AUTO RESET), D-DERIVATIVE(RATE), SUB: S-SLOW, F-FAST P ☐ PI_S ☐ PI_F ☐ PI_FD_F ☐ PI_SD_S ☐ I_F ☐ OTHER ____
	~~12~~	~~ACTION~~	ON MEAS INCREASE OUTPUT: INCREASES ☐ DECREASES ☐
	~~13~~	~~AUTO-MAN SWITCH~~	NONE ☐ MFR STD ☐ OTHER ____
	~~14~~	~~SET POINT ADJ~~	MANUAL ☐ EXTERNAL ☐ REMOTE ☐ OTHER ____
	~~15~~	~~MAN REG~~	NONE ☐ MFR STD ☐ OTHER ____
	~~16~~	~~OUTPUT~~	4-20 MA ☐ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ____
ELEMENT	17	APPLICATION	GAUGE PRESS ■ VACUUM ☐ ABS PRESS ☐ COMPOUND ☐
	18	ELEMENT TYPE	DIAPHRAGM ■ HELIX ☐ BOURDON ☐ BELLOWS ☐ OTHER ____
	19	MATERIAL	316 SS ■ BE-CU ☐ OTHER ____
	20	RANGE	FIXED ☐ ADJ RANGE YES SET AT 0 - 100 psia
	21	PROCESS DATA	FLUID STEAM OPER: PRESS/TEMP 98 PSIG/338~960°F MAX: PRESS/TEMP 99 PSIG/960°F OVERRANGE PROTECTION TO 100% OF CAPSULE SPAN
	22	PROCESS CONN	1/4" NPT ☐ 1/2" NPT ■ OTHER WITH FLANGE ADAPTER
~~ALARM~~	~~23~~	~~ALARM SWITCHES~~	QUANTITY ____ FORM ____ RATING ____
	~~24~~	~~FUNCTION~~	PRESSURE ☐ DEVIATION ☐ CONTACTS TO ____ ON INC PRESS
ACCESSORIES	25	ACCESSORIES	FILT-REG ☐ SUP GAGE ☐ OUT GAGE ☐ ____ CHARTS DIAPH SEAL ☐ TYPE ____ MATERIAL: DIAPH ____ BOT FLANGE ____ CONNECTION ____ CAPILLARY: LENGTH ____ MAT'L ____ OTHER MOUNTING BRACKET
	(26)	MODEL NUMBER	ROSEMOUNT 1151 OR ENGR APPD EQUAL

NOTES: 1. ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

TAG NO.

Form no. N-714a 12/71
Based on ISA S20

D.O.E. No. 40I 700 217I

Stearns-Roger

PRESSURE INSTRUMENTS

DATA SHEET PIT
PAGE 5
S-R PROJECT C-21700

CUSTOMER McCONNELL DOUGLAS ASTRONAUTICS CO.
ACCOUNT
PROJECT 10 MWe SOLAR PILOT PLANT
DATE 4-11-80 REV H
LOCATION DAGGETT, CALIFORNIA
BY CAM
REVISIONS 1 O [illegible] BY [illegible] 2 ___ BY ___ 3 ___ BY ___ 4 ___ BY ___
MANUFACTURER ___ SOURCE: QUOTE OF ___

	1	TAG NO. PIT- 1003	SERVICE MN STM TO AUXILIARY STM TIE
GENERAL	2	FUNCTION	RECORD ☐ INDICATE ☒ CONTROL ☐ BLIND ☐ TRANS ☒ OTHER NOTE: INDICATOR TO BE INTEGRALLY MTD. IN TRANSMITTER
	3	CASE	MFR STD ☒ NOM SIZE ___ COLOR: MFR STD ☒ OTHER ___
	4	MOUNTING	FLUSH ☐ SURFACE ☐ YOKE ☒ OTHER ___
	5	ENCLOSURE CLASS	GEN PUR ☐ WTH PROOF ☒ EXP PROOF: CLASS ___ GROUP ___ DIVISION ___ FOR USE IN INTRIN SAFE SYS ☐ OTHER NEMA 4
	6	POWER SUPPLY	117V 60 HZ ☐ OTHER ___ AC ☐ DC ☒ VOLTS 24 V
	~~7~~	~~CHART~~	___"STRIP ☐ ___"CIRC ☐ TIME MARKS ☐ RANGE ___ NO. ___
	~~8~~	~~CHART DRIVE~~	24 HR ☐ OTHER ___ ELEC ☐ SPRING ☐ OTHER
	9	SCALE	TYPE LINEAR RANGE: 1 0-100 psig 2 ___ 3 ___
XMTR	10	TRANSMIT. OUTPUT	4-20 MA ☒ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ___ FOR RECEIVER SEE DATA SHEET ___
~~CONTROLLER~~	~~11~~	~~CONTROL MODES~~	P-PROP (GAIN), I-INTEGRAL (AUTO RESET), D-DERIVATIVE (RATE), SUB: S-SLOW, F-FAST P ☐ PI_S ☐ PI_F ☐ PI_FD_F ☐ PI_SD_S ☐ I_F ☐ OTHER ___
	~~12~~	~~ACTION~~	ON MEAS INCREASE OUTPUT: INCREASES ☐ DECREASES ☐
	~~13~~	~~AUTO-MAN SWITCH~~	NONE ☐ MFR STD ☐ OTHER ___
	~~14~~	~~SET POINT ADJ~~	MANUAL ☐ EXTERNAL ☐ REMOTE ☐ OTHER ___
	~~15~~	~~MAN REG~~	NONE ☐ MFR STD ☐ OTHER ___
	~~16~~	~~OUTPUT~~	4-20 MA ☐ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ___
ELEMENT	17	APPLICATION	GAUGE PRESS ☒ VACUUM ☐ ABS PRESS ☐ COMPOUND ☐
	18	ELEMENT TYPE	DIAPHRAGM ☒ HELIX ☐ BOURDON ☐ BELLOWS ☐ OTHER ___
	19	MATERIAL	316 SS ☒ BE-CU ☐ OTHER ___
	20	RANGE	FIXED ☐ ADJ RANGE YES SET AT 0-100 psig
	21	PROCESS DATA	FLUID STEAM OPER: PRESS/TEMP 66 PSIG / 425-865 °F MAX: PRESS/TEMP 76 PSIG / 865 °F OVERRANGE PROTECTION TO 100% OF CAPSULE SPAN
	22	PROCESS CONN	1/4" NPT ☐ 1/2" NPT ☒ OTHER WITH FLANGE ADAPTER
~~ALARM~~	~~23~~	~~ALARM SWITCHES~~	QUANTITY ___ FORM ___ RATING ___
	~~24~~	~~FUNCTION~~	PRESSURE ☐ DEVIATION ☐ CONTACTS TO ___ ON INC PRESS
ACCESSORIES	25	ACCESSORIES	FILT-REG ☐ SUP GAGE ☐ OUT GAGE ☐ ___ CHARTS DIAPH SEAL ☐ TYPE ___ MATERIAL: DIAPH ___ BOT FLANGE ___ CONNECTION ___ CAPILLARY: LENGTH ___ MAT'L ___ OTHER MOUNTING BRACKET
	(26)	MODEL NUMBER	ROSEMOUNT 1151 OR ENGR APPD EQUAL

NOTES: 1. ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

TAG NO.

Form no. N-714a 12/71
Based on ISA S20

D.O.E. NO. 40I 700217I

Stearns-Roger

PRESSURE INSTRUMENTS

DATA SHEET PIT
PAGE 6
S-R PROJECT C-21700
ACCOUNT
DATE 4-11-80 REV A
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 0 5-21-80 BY PSR 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

	1	TAG NO. PIT-1005	SERVICE AUXILIARY STEAM CONTROL
GENERAL	2	FUNCTION	RECORD ☐ INDICATE ■ CONTROL ☐ BLIND ☐ TRANS ■ OTHER NOTE: INDICATOR TO BE INTEGRALLY MTD IN TRANSMITTER
	3	CASE	MFR STD ■ NOM SIZE ____ COLOR: MFR STD ■ OTHER ____
	4	MOUNTING	FLUSH ☐ SURFACE ☐ YOKE ■ OTHER ____
	5	ENCLOSURE CLASS	GEN PUR ☐ WTH PROOF ■ EXP PROOF: CLASS ____ GROUP ____ DIVISION ____ FOR USE IN INTRIN SAFE SYS ☐ OTHER NEMA 4
	6	POWER SUPPLY	117V 60 HZ ☐ OTHER ____ AC ☐ DC ■ VOLTS 24V
	~~7~~	~~CHART~~	____"STRIP ☐ ____"CIRC ☐ TIME MARKS ☐ RANGE ____ NO ____
	~~8~~	~~CHART DRIVE~~	24 HR ☐ OTHER ____ ELEC ☐ SPRING ☐ OTHER
	9	SCALE	TYPE LINEAR RANGE: 1 0-100 psia 2 ____ 3 ____
XMTR	10	TRANSMIT. OUTPUT	4-20 MA ■ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ____ FOR RECEIVER SEE DATA SHEET ____
~~CONTROLLER~~	~~11~~	~~CONTROL MODES~~	P-PROP(GAIN), I-INTEGRAL(AUTO RESET), D-DERIVATIVE(RATE), SUB: S-SLOW, F-FAST P ☐ PI_S ☐ PI_F ☐ PI_FD_F ☐ PI_SD_S ☐ I_F ☐ OTHER ____
	~~12~~	~~ACTION~~	ON MEAS INCREASE OUTPUT: INCREASES ☐ DECREASES ☐
	~~13~~	~~AUTO-MAN SWITCH~~	NONE ☐ MFR STD ☐ OTHER ____
	~~14~~	~~SET POINT ADJ~~	MANUAL ☐ EXTERNAL ☐ REMOTE ☐ OTHER ____
	~~15~~	~~MAN REG~~	NONE ☐ MFR STD ☐ OTHER ____
	~~16~~	~~OUTPUT~~	4-20 MA ☐ 10-50 MA ☐ 3-15 PSIG ☐ OTHER ____
ELEMENT	17	APPLICATION	GAUGE PRESS ■ VACUUM ☐ ABS PRESS ☐ COMPOUND ☐
	18	ELEMENT TYPE	DIAPHRAGM ■ HELIX ☐ BOURDON ☐ BELLOWS ☐ OTHER ____
	19	MATERIAL	316 SS ■ BE-CU ☐ OTHER ____
	20	RANGE	FIXED ☐ ADJ RANGE YES SET AT 0-100 psia
	21	PROCESS DATA	FLUID STEAM OPER: PRESS/TEMP 51 PSIG/455°F MAX: PRESS/TEMP 76 PSIG/520°F OVERRANGE PROTECTION TO 100 % OF CAPSULE SPAN
	22	PROCESS CONN	1/4" NPT ☐ 1/2" NPT ■ OTHER WITH FLANGE ADAPTER
~~ALARM~~	~~23~~	~~ALARM SWITCHES~~	QUANTITY ____ FORM ____ RATING ____
	~~24~~	~~FUNCTION~~	PRESSURE ☐ DEVIATION ☐ CONTACTS TO ____ ON INC PRESS
ACCESSORIES	25	ACCESSORIES	FILT-REG ☐ SUP GAGE ☐ OUT GAGE ☐ ____ CHARTS DIAPH SEAL ☐ TYPE ____ MATERIAL: DIAPH ____ BOT FLANGE ____ CONNECTION ____ CAPILLARY: LENGTH ____ MAT'L ____ OTHER MOUNTING BRACKET
	(26)	MODEL NUMBER	ROSEMOUNT 1151 DP ENGR APPD EQUAL

NOTES: 1. ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.

TAG NO.

Form no. N-714a 12/71
Based on ISA S20

D.O.E. NO. 40I 7002171

Stearns-Roger

PRESSURE INSTRUMENTS

DATA SHEET PIT
PAGE 7
S-R PROJECT C-21700
ACCOUNT
DATE 4-11-80 REV H
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 C ... BY ... 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

Section	No.	Item	Data
	1	TAG NO. PIT-1020	SERVICE DS-202 OUTLET PRESS. TRANSMITTER
GENERAL	2	FUNCTION	RECORD [ ] INDICATE [X] CONTROL [ ] BLIND [ ] TRANS [X] OTHER NOTE: INDICATOR TO BE INTEGRALLY MTD IN TRANSMITTER
	3	CASE	MFR STD [X] NOM SIZE ____ COLOR: MFR STD [X] OTHER ____
	4	MOUNTING	FLUSH [ ] SURFACE [ ] YOKE [X] OTHER ____
	5	ENCLOSURE CLASS	GEN PUR [ ] WTH PROOF [X] EXP PROOF: CLASS ____ GROUP ____ DIVISION ____ FOR USE IN INTRIN SAFE SYS [ ] OTHER NEMA 4
	6	POWER SUPPLY	117V 60 HZ [ ] OTHER ____ AC [ ] DC [X] VOLTS 24 V
	~~7~~	~~CHART~~	____ "STRIP [ ] ____ "CIRC [ ] TIME MARKS [ ] RANGE ____ NO ____
	~~8~~	~~CHART DRIVE~~	24 HR [ ] OTHER ____ ELEC [ ] SPRING [ ] OTHER
	9	SCALE	TYPE LINEAR RANGE: 1 0-100 psig 2 ____ 3 ____
XMTR	10	TRANSMIT. OUTPUT	4-20 MA [X] 10-50 MA [ ] 3-15 PSIG [ ] OTHER ____ FOR RECEIVER SEE DATA SHEET ____
~~CONTROLLER~~	~~11~~	~~CONTROL MODES~~	P-PROP(GAIN), I-INTEGRAL(AUTO RESET), D-DERIVATIVE(RATE), SUB: S-SLOW, F-FAST P [ ] PI_S [ ] PI_F [ ] PI_FD_F [ ] PI_SD_S [ ] I_F [ ] OTHER ____
	~~12~~	~~ACTION~~	ON MEAS INCREASE OUTPUT: INCREASES [ ] DECREASES [ ]
	~~13~~	~~AUTO-MAN SWITCH~~	NONE [ ] MFR STD [ ] OTHER ____
	~~14~~	~~SET POINT ADJ~~	MANUAL [ ] EXTERNAL [ ] REMOTE [ ] OTHER ____
	~~15~~	~~MAN RES~~	NONE [ ] MFR STD [ ] OTHER ____
	~~16~~	~~OUTPUT~~	4-20 MA [ ] 10-50 MA [ ] 3-15 PSIG [ ] OTHER ____
ELEMENT	17	APPLICATION	GAUGE PRESS [X] VACUUM [ ] ABS PRESS [ ] COMPOUND [ ]
	18	ELEMENT TYPE	DIAPHRAGM [X] HELIX [ ] BOURDON [ ] BELLOWS [ ] OTHER ____
	19	MATERIAL	316 SS [X] BE-CU [ ] OTHER ____
	20	RANGE	FIXED [ ] ADJ RANGE YES SET AT 0-100 psig
	21	PROCESS DATA	FLUID STEAM OPER: PRESS/TEMP 61 PSIG / 865°F MAX: PRESS/TEMP 76 PSIG / 870°F OVERRANGE PROTECTION TO 100% OF CAPSULE SPAN
	22	PROCESS CONN	1/4" NPT [ ] 1/2" NPT [X] OTHER WITH FLANGE ADAPTERS
~~ALARM~~	~~23~~	~~ALARM SWITCHES~~	QUANTITY ____ FORM ____ RATING ____
	~~24~~	~~FUNCTION~~	PRESSURE [ ] DEVIATION [ ] CONTACTS TO ____ ON INC PRESS
ACCESSORIES	25	ACCESSORIES	FILT-REG [ ] SUP GAGE [ ] OUT GAGE [ ] ____ CHARTS DIAPH SEAL [ ] TYPE ____ MATERIAL: DIAPH ____ BOT FLANGE ____ CONNECTION ____ CAPILLARY: LENGTH ____ MAT'L ____ OTHER MOUNTING BRACKET
	(26)	MODEL NUMBER	ROSEMOUNT 1151 OR ENGR APPD EQUAL

NOTES: 1. ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.

TAG NO.

Form no. N-714a 12/71
Based on ISA S20

Pressure Instrument Data Sheet
for PIT (page 8)

Deleted

FORM NO. N-714a REV. 11/77
BASED ON ISA S20

Stearns-Roger PRESSURE INSTRUMENTS

DATA SHEET PIT
PAGE 9
S-R PROJECT C-21700
ACCOUNT
DATE 7-14-80
BY REB

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

Section	No.	Item	Data
	1	TAG NO. PIT-34	FLOW SHEET 40890051330I SERVICE ISS FEEDWATER
GENERAL	2	FUNCTION	[ ] RECORD [ ] INDICATE [ ] CONTROL [ ] BLIND [x] TRANS; OTHER NOTE: INDICATOR TO BE INTEGRALLY MTD. IN TRANSMITTER
	3	CASE	[x] MFR STD NOM SIZE ____ [ ] COLOR: [ ] MFR STD OTHER ____
	4	MOUNTING	[ ] FLUSH [ ] SURFACE [x] YOKE OTHER ____
	5	ENCLOSURE CLASS	[ ] GEN PUR [x] WTH PROOF [ ] EXP PROOF: CLASS ____ GROUP ____ DIVISION ____; [ ] FOR USE IN INTRIN SAFE SYS OTHER NEMA 4
	6	POWER SUPPLY	[ ] 117V 60 HZ OTHER ____ [ ] AC [x] DC VOLTS 24 VDC
	7	~~CHART~~	[ ] ___" STRIP [ ] ___" CIRC [ ] TIME MARKS RANGE ____ NO ____
	8	~~CHART DRIVE~~	[ ] 24 HR OTHER ____ [ ] ELEC [ ] SPRING OTHER ____
	9	SCALE	TYPE LINEAR RANGE: 1 0-700psig 2 ____ 3 ____
XMTR	10	TRANSMIT. OUTPUT	[x] 4-20 MA [ ] 10-50 MA [ ] 3-15 PSIG OTHER ____; FOR RECEIVER SEE DATA SHEET ____
CONTROLLER	11	~~CONTROL MODES~~	P - PROP (GAIN), I - INTEGRAL (AUTO RESET), D - DERIVATIVE (RATE), SUB: S - SLOW, F - FAST [ ] P [ ] PI_S [ ] PI_F [ ] PI_FD_F [ ] PI_SD_S [ ] I_F; OTHER ____
	12	~~ACTION~~	ON MEAS INCREASE OUTPUT: [ ] INCREASES [ ] DECREASES
	13	~~AUTO-MAN SWITCH~~	[ ] NONE [ ] MFR STD OTHER ____
	14	~~SET POINT ADJ~~	[ ] MANUAL [ ] EXTERNAL [ ] REMOTE OTHER ____
	15	~~MAN REG~~	[ ] NONE [ ] MFR STD OTHER ____
	16	~~OUTPUT~~	[ ] 4-20 MA [ ] 10-50 MA [ ] 3-15 PSIG OTHER ____
ELEMENT	17	APPLICATION	[x] GAUGE PRESS [ ] VACUUM [ ] ABS PRESS [ ] COMPOUND
	18	ELEMENT TYPE	[x] DIAPHRAGM [ ] HELIX [ ] BOURDON [ ] BELLOWS OTHER ____
	19	MATERIAL	[x] 316 SS [ ] BE-CU OTHER ____
	20	RANGE	[ ] FIXED ADJ RANGE YES SET AT ____
	21	PROCESS CONN	[ ] 1/4" NPT [x] 1/2" NPT OTHER WITH FLANGE ADAPTER
ALARM	22	~~ALARM SWITCHES~~	QUANTITY ____ FORM ____ RATING ____
	23	~~FUNCTION~~	[ ] PRESSURE [ ] DEVIATION CONTACTS TO ____ ON INC PRESS
		~~ALARM SETTINGS~~	HIGH ____ LOW ____
	24	~~ENCLOSURE CLASS~~	[ ] GEN PUR [ ] WTH PROOF [ ] EXP PROOF CLASS ____ GROUP ____ DIVISION ____
ACCESSORIES	25	ACCESSORIES	[ ] FILT-REG [ ] SUP GAGE [ ] OUT GAGE ____ CHARTS; [ ] DIAPH SEAL TYPE ____; MATERIAL: DIAPH ____ BOT FLANGE ____; CONNECTION ____; CAPILLARY: LENGTH ____ MAT'L ____; OTHER MOUNTING BRACKET
FLUID DATA	26	FLUID DATA	FLUID CONDENSATE; OPER PRESS, PSIG 435 OPER. TEMP. °F 231; MAX PRESS, PSIG 535 MAX. TEMP. °F 281; SPEC. GRAV. @ O.T. ____; CORROSIVE DUE TO ____
	(27)	MODEL NUMBER	ROSEMOUNT 1151 OR EOS APPROVED EQUAL

NOTES: 1. ENCIRCLED NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

D.O.E. No. 4CI 7002171

Stearns-Roger

PRESSURE SWITCHES

DATA SHEET PS
PAGE 1
S-R PROJECT C-21700
ACCOUNT
DATE 4-21-80 REV P1
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

GENERAL

1 APPLICATION: ☒ PRES ☐ VACUUM ☐ DIFF. PRESS
2 SET PT: ☐ FIELD SET ☒ FACTORY SET
☐ INTERNAL ☒ EXTERNAL
☐ FIXED ☒ ADJUSTABLE
3 DEAD BAND: ☐ FIXED ☒ ADJUSTABLE MIN ____

ELEMENT

4 TYPE: ☐ DIAPHRAGM ☒ BOURDON ☐ BELLOWS
OTHER ____
5 MATERIAL ☐ BRASS 316 ☒ SS ☐ ALLOY ST
6 CONN SIZE: ☒ MFR STD OTHER ____
LOC: ☒ BOTTOM ☐ BACK

(7) TYPE: ☒ SWITCH ☐ MERCURY ☐ SNAP
OTHER ____
8 QUANTITY: ☐ SINGLE ☒ DUAL
9 FORM: ☐ SPST ☒ SPDT ☐ DPDT
OTHER ____
10 RATING: 5 AMPS 120 V 60 HZ
OTHER ____
11 HOUSING: ☐ GEN PUR ☒ WTHPROOF ☐ NONE
☐ EXP PROOF
CLASS ____ GROUP ____ DIVISION ____
APPROVAL REQD ☐ UL ☐ CSA
(12) MODEL NUMBER ____

REV	TAG NO	ACCT NO	ACTUATION CONDITION	RANGE	SET POINT	OP TEMP °F	OP PRES PSIG	SERVICE	NOTES
	PS-1703A		CLOSE ON INCREASE	0-160	LATER	100°F	60~80	RAW/SERVICE WATER PUMPS RECIRCULATION	1,3
	↓		OPEN ON DECREASE	0-160	↓	↓	↓	↓	↓
	PS-1703B		OPEN ON INCREASE	0-160	↓	↓	↓	↓	1,3
	↓		CLOSE ON DECREASE	0-160	↓	↓	↓	↓	↓

NOTES: 1. TO BE FURNISHED WITH PULSATION DAMPENER.
2. ENCIRCLED ITEM NOS INDICATE DATA TO BE COMPLETED BY SELLER.
3. THESE ARE TO BE ELECTRICALLY INDEPENDENT SWITCHES EACH WITH INDIVIDUALLY ADJUSTABLE SET POINT IN ONE HOUSING.

FORM NO. N-716a 6/78
BASED ON ISA S20

Stearns-Roger

PRESSURE SWITCHES

DATA SHEET PS
PAGE 2
S-R PROJECT C-21700
ACCOUNT
DATE 5-21-80 REV P1
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA

REVISIONS 1 [illegible] BY RCB 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____

MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-716a 6/78
BASED ON ISA S20

GENERAL

1 APPLICATION: ■ PRES ☐ VACUUM ☐ DIFF. PRESS
2 SET PT: ☐ FIELD SET ■ FACTORY SET
☐ INTERNAL ■ EXTERNAL
☐ FIXED ■ ADJUSTABLE
3 DEAD BAND: ☐ FIXED ■ ADJUSTABLE MIN ____

ELEMENT

4 TYPE: ☐ DIAPHRAGM ■ BOURDON ☐ BELLOWS
OTHER ____
5 MATERIAL ☐ BRASS 3/6 ■ SS ☐ ALLOY ST
6 CONN SIZE: ■ MFR STD OTHER ____
LOC: ■ BOTTOM ☐ BACK

■ SWITCH
(7) TYPE: ☐ MERCURY ☐ SNAP
OTHER ____
8 QUANTITY: ☐ SINGLE ■ DUAL
9 FORM: ☐ SPST ■ SPDT ☐ DPDT
OTHER ____
10 RATING: 5 AMPS 120 V 60 HZ
OTHER ____
11 HOUSING: ☐ GEN PUR ■ WTHPROOF ☐ NONE
☐ EXP PROOF
CLASS ____ GROUP ____ DIVISION ____
APPROVAL REQD ☐ UL ☐ CSA
(12) MODEL NUMBER ____

REV	TAG NO	ACCT NO	ACTUATION CONDITION	RANGE	SET POINT	OP TEMP °F	OP PRES PSIG	SERVICE	NOTES
	PS-1024		CONTACT CLOSES ON	25-600	90 PSIG	530°	400	TSS STEAM TO TURBINE [illegible]	1
			PRESSURE INCREASE	PSIG					

NOTES: 1. PIGTAIL SIPHON TO BE FURNISHED

2. [illegible]

Stearns-Roger

RELIEF VALVES

DATA SHEET PSV
PAGE 1
S-R PROJECT 21700
ACCOUNT 71140
DATE 5-6-80
BY SDM

CLIENT MDAC
PROJECT Solar One
LOCATION Daggett California
REVISIONS 1 5/2/1980 BY SDM 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-724 12/77
BASED ON ISA S20

GENERAL	1	TAG NUMBER	PSV-1032		PSV-1033		
	2	SERVICE	Steam		Steam		
	3	ACCOUNT NO.					
	4	LINE NO./VESSEL NO.	4" AS-9-FBA		4" ST-9-FE4		
	5	FULL NOZZLE/SEMI-NOZZLE	Full		Full		
	6	CONV. BELLOWS, PILOT OPER.	Conventional		Conventional		
	7	BONNET: OPEN/CLOSED					
	8	FLOW SHEET	P3-1		P3-1		
CONN.	9	SIZE: INLET / OUTLET	1"	2"	2"	3"	
	10	FLANGE RATING OR SCREWED	150	150.	150	150	
	11	TYPE OF FACING	R.F	R.F	R.F	R.F	
MATERIALS	12	BODY	ASTM A216 Gr. WCB		A217 Gr. C1 Alloy		
	13	SEAT AND DISC	316 SS		316 SS		
	14	RESILIENT SEAT SEAL					
	15	GUIDE AND RINGS	17-20% Chrome SS		17-20% Chrome SS		
	16	SPRING	Tungsten		Tungsten		
	17	BELLOWS	N.A.		N.A.		
	18						
ACCESS.	19	CAP: SCREWED OR BOLTED	Screwed		Screwed		
	20	LEVER: PLAIN OR PACKED	Plain		Plain		
	21	TEST GAGE					
	22	DRIP PAN EL + DRAIN	3" VENT		6" VENT		
	23						
BASIS	24	CODE	ASME UPV		UPV		
	25	SIZING BASIS	Full Relief		Full Relief		
	26	RELIEVES TO	83.6 psig		83.6 psig		
	27						
FLUID DATA	28	FLUID	Superheated Steam		Superheated Steam		
	29	REQUIRED CAPACITY	960 #/hr		4518 #/hr		
	30	SP GR @ 60°F / O.T.	1	455°F	1	865	
	31	MOLECULAR WEIGHT	18		18		
	32	OPER. PRESSURE, PSIG	41		51		
	33	SET PRESSURE, PSIG	76		76		
	34	OPER. TEMPERATURE, °F	287		455		
	35	RELIEVING TEMPERATURE, °F	455		865		
	36	BACK PRESSURE: CONSTANT, PSIG	0		0		
	37	ADDITIONAL BUILD-UP, PSIG	0		0		
	38	ALLOWABLE OVERPRESSURE, %	10		10		
	39	LATENT HEAT OF VAPOR					
	40	RATIO OF SPECIFIC HEATS					
	41	VISCOSITY FACTOR					
	42	LIQUID VISCOSITY, Cp					
	43	CORROSIVE/EROSIVE DUE TO					
SELECTION	44	COMPRESSIBILITY FACTOR					
	45	MAXIMUM VALVE CAPACITY	1104 #/hr.		5196 #/hr.		
	46	CALCULATED AREA, SQ. IN.	.189		.734		
	47	SELECTED AREA, SQ. IN.	.196		.785		
	48	ORIFICE DESIGNATION	E		H		
	49	Manufacturer (TYPICAL)	Consolidated		Consolidated		
	50	MODEL NUMBER	1906 ET		1910 HT		

NOTES:

D.O.E. No. 401700217L

Stearns-Roger

SELF-ACTUATED PRESSURE CONTROL VALVES

DATA SHEET PV
PAGE 7
S-R PROJECT C-21700
ACCOUNT
DATE 4-25-80 REV 1
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 0 BY ___ 2 ___ BY ___ 3 ___ BY ___ 4 ___ BY ___
MANUFACTURER ___ SOURCE: QUOTE OF ___

FORM NO. N-722 REV. 11/77
BASED ON ISA S20

GENERAL	1	TAG NUMBER			PV-1105								
	2	SERVICE			SEAL WTR TO RECR								
	3				FEED PP CONTROL								
	4	FLOW SHEET			P3-2 (40P7005/133/4L1)								
	5	LINE: SIZE, NUMBER			SCE CCS-3412-3/4-L								
BODY	6	TYPE OF BODY			GLOBE								
	(7)	BODY SIZE	PORT SIZE										
	(8)	GUIDING	NO. OF PORTS			1							
	9	END CONN. & RATINGS			150# SCRD								
	10	PIPE SCHEDULE OR BORE			SCH 80								
	11	BODY MATERIAL			304 SS								
	(12)	PACKING MATERIAL											
	~~13~~	~~LUBRICATOR~~	~~GD VALVE~~										
	14	BONNET TYPE			MFR STD								
	(15)	TRIM FORM											
	16	TRIM MATERIAL			MFR STD								
	17	SEAT LEAKAGE CLASS (3)			YES								
ACTUATOR	18	TYPE OF ACTUATOR			DIAPHRAGM								
	19	SELF CONT.	EXT. CONN.		YES								
	(20)	DIAPHRAGM MATERIAL											
	(21)	DIAPHRAGM RATING											
	(22)	SPRING RANGE											
	23	SET POINT			80 PSIG (OUTLET PRESS)								
	24												
ACCESSORIES	25	EXTERNAL PILOT			NO								
	26	LINE STRAINER			NO								
	27	HOUSING VENT			YES								
	28	INTERNAL RELIEF			NO								
	29												
FLUID DATA	30	ON PROCESS INCREASE · VALVE TO			CLOSE								
	31	FLUID (1)			CONDENSATE								
	32	NORM FLOW (1)	INLET PRESS	ΔP	6	97.69	17.7						
	33	MAX FLOW (1)	INLET PRESS	ΔP	22	141.93	61						
	34	MIN FLOW (1)	INLET PRESS	ΔP	6	97.69	17.7						
	(35)	CALC CV (3)	VALVE CV										
	36	MAXIMUM SHUTOFF Δ			170								
	37	TEMP °F OPER.	MAXIMUM		109	135							
	38	SP GR AT: 60 °F	O.T.		1.0	0.97							
	39	VISC, CP AT OPER. TEMP.			0.61								
	40	PERCENT FLASH	PERCENT SOLIDS		0	NEGLIGIBLE							
	(41)	SOUND LEVEL: dB ALLOW	PRED		90								
	(42)	MODEL NUMBER											

NOTES: (1) FLOW UNITS: LIQUID GPM, STEAM ___, GAS ___.
(2) CORRESPONDS TO NORMAL FLOW UNLESS OTHERWISE NOTED.
(3) IN ACCORDANCE WITH ANSI 316.104 - 1976
4. ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.

D.O.E.# 401700217I

Stearns-Roger

SELF-ACTUATED PRESSURE CONTROL VALVES

DATA SHEET SV
PAGE 8
S-R PROJECT C-21709
ACCOUNT
DATE 4-30-80 REV 5/ 6-3-80 REV 5
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 10 MAR 82 BY RSB 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-722 REV. 11/77
BASED ON ISA S20

GENERAL	1	TAG NUMBER			SV-1409							
	2	SERVICE			AIR SUPPLY TO							
	3				BCS SHUTTERS							
	4	FLOW SHEET			P3-8 (40P7005/331/47)							
	5	LINE: SIZE, NUMBER			3/4"-SA-11-ABA							
BODY	(6)	TYPE OF BODY			GLOBE							
	(7)	BODY SIZE	PORT SIZE									
	(8)	GUIDING	NO. OF PORTS			1						
	9	END CONN. & RATINGS			SCREWED / CLASS 125							
	10	PIPE SCHEDULE OR BORE			SCH. 80							
	11	BODY MATERIAL			CARBON STEEL							
	(12)	PACKING MATERIAL										
	~~13~~	~~LUBRICATOR~~	~~ISO VALVE~~									
	14	BONNET TYPE			MFR STD							
	(15)	TRIM FORM										
	16	TRIM MATERIAL			MFR STD							
	17	SEAT LEAKAGE CLASS (3)			CLASS IV							
ACTUATOR	18	TYPE OF ACTUATOR			DIAPHRAGM							
	19	SELF CONT.	EXT. CONN.		YES							
	(20)	DIAPHRAGM MATERIAL										
	(21)	DIAPHRAGM RATING										
	(22)	SPRING RANGE										
	23	SET POINT			25 PSIG (OUTLET PRESS)							
	24											
ACCESSORIES	25	EXTERNAL PILOT			NO							
	26	LINE STRAINER			NO							
	27	HOUSING VENT			YES							
	28	INTERNAL RELIEF			NO							
	29											
FLUID DATA	30	ON PROCESS INCREASE - VALVE TO			CLOSE							
	31	FLUID (1)			SERVICE AIR							
	32	NORM FLOW (1)	INLET PRESS	ΔP	1.0	100 PSIG	80 PSI					
	33	MAX FLOW (1)	INLET PRESS	ΔP	4.0	125 PSIG	105 PSI					
	34	MIN FLOW (1)	INLET PRESS	ΔP	0	100 PSIG	0					
	(35)	CALC CV (3) MAX/NOR	VALVE CV		0.048/0.045							
	36	MAXIMUM SHUTOFF Δ			125 PSI							
	37	TEMP °F OPER.	MAXIMUM		110°	150°						
	38	SP GR AT: 60 °F	O.T.									
	39	VISC. CP AT OPER. TEMP.										
	40	PERCENT FLASH	PERCENT SOLIDS		0	NEGLIGIBLE						
	(41)	SOUND LEVEL: dB ALLOW	PRED		90							
	(42)	MODEL NUMBER										

NOTES:
(1) FLOW UNITS: LIQUID ____, STEAM ____, GAS SCFM.
(2) CORRESPONDS TO NORMAL FLOW UNLESS OTHERWISE NOTED.
(3) IN ACCORDANCE WITH ANSI 316.104 - 1976
4. ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.

D.O.E. NO. 40I7002171

Stearns-Roger

CONTROL VALVES (SPECIAL)

DATA SHEET PV
PAGE 9
S-R PROJECT C-21700
ACCOUNT
DATE 4-23-80 REV P
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT CALIFORNIA
REVISIONS 1 0 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-721A 12/71
BASED ON ISA S20

	No.	Item	Value		
GENERAL	1	TAG NUMBER	PV-1703		
	2	SERVICE	RAW/SERVICE WTR PPS		
	3		P703 & P704 RECIRC CONTROL		
	4	LINE: SIZE, NUMBER	3" SW-2-ABA		
BODY & TRIM	5	TYPE OF BODY	GLOBE		
	(6)	BODY SIZE / PORT SIZE			
	(7)	GUIDING / NO. OF PORTS			
	8	END CONN & RATING			
	9	PIPE SCHEDULE OR BORE	SCH 40		
	10	BODY MATERIAL	CARBON STEEL		
	(11)	PACKING MATERIAL			
	~~12~~	~~LUBRICATOR / ISO VALVE~~			
	13	BONNET TYPE	BOLTED		
	14	TRIM FORM	LINEAR		
	15	TRIM MATERIAL	HARDENED		
	16	TIGHT SHUTOFF REQD	CLASS IV		
ACTUATOR	17	TYPE OF ACTUATOR	DIAPHRAGM		
	(18)	MODEL NO. & SIZE			
	19	CLOSE AT / OPEN AT	30 PSIG	0 PSIG	
	(20)	PUSH DOWN TO / FLOW ACTION TO			
	21	FAIL POSITION	OPEN		
	22	HANDWHEEL & LOCATION	YES & TOP		
	23	AIR SUPPLY PRESSURE	80 ~ 100 PSIG		
	24	TRAVEL INDICATOR	YES		
POSIT.	~~25~~	~~MODEL NO.~~	NO		
	26	FILTER REG / GAUGES / ~~BYPASS~~	YES	YES	—
	~~27~~	~~INPUT SIGNAL~~			
	~~28~~	~~OUTPUT SIGNAL~~			
PILOT	~~29~~	~~MODEL NO. / ACTION~~			
	~~30~~	~~CONTROL MODES~~			
	~~31~~	~~MOUNTING / OUTPUT~~			
	~~32~~	~~ELEMENT: TYPE / RANGE~~			
	~~33~~	~~MATERIAL~~			
	~~34~~	~~FILTER REG / MOUNTING~~			
ACCESS.	35	SOLENOID (3)	SOV-1703		
	36	LIMIT SWITCHES / TAG NO./REF	—		
	37				
FLUID DATA	38	FLUID (1)	SERVICE WATER		
	39	FLOW MAX / DES / MIN	700	180	0
	40	TEMP °F MAX / DES / MIN	100°F	70°F	32°F
	41	△ PRESS MAX / DES / MIN	56.32	96.88	NO
	42	INLET PRESS MAX / DES / MIN	96.38	100	NO
	43	MAXIMUM SHUTOFF △P	100 PSI		
	(44)	CAL. CV MAX / DES / MIN			
	(45)	VALVE CV MAX / DES / MIN			
	46	VALVE VEL. MAX / DES / MIN			
	47	PERCENT FLASH / PERCENT SOLIDS	0	NEGLIGIBLE	
	(48)	MODEL NUMBER			

NOTES: (1) FLOW UNITS: LIQUID GPM, STEAM ____, GAS ____

(2) [illegible]

(3) REFER TO DATA SHEET SV PAGE [illegible]

TAG NO.

Stearns-Roger

SELF-ACTUATED PRESSURE CONTROL VALVES

DATA SHEET PV
PAGE 10
S-R PROJECT C 21700
ACCOUNT
DATE 6-9-80
BY RDB

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT [illegible]
LOCATION DAGGETT, [illegible]

REVISIONS 1 [illegible] BY ADB 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____

MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-722 REV. 11/77
BASED ON ISA S20

GENERAL	1	TAG NUMBER			PV-1704								
	2	SERVICE			WATER TO PACKAGE MAKE-UP DEMINERALIZER								
	3												
	4	FLOW SHEET			40P7005133150								
	5	LINE: SIZE, NUMBER			2"-SW-25-ABA								
BODY	6	TYPE OF BODY											
	7	BODY SIZE	PORT SIZE										
	8	GUIDING	NO. OF PORTS										
	9	END CONN. & RATINGS			FLANGED 150#								
	10	PIPE SCHEDULE OR BORE			SCH 80								
	11	BODY MATERIAL			CARBON STEEL								
	(12)	PACKING MATERIAL											
	~~13~~	~~LUBRICATOR~~	~~ISO VALVE~~										
	14	BONNET TYPE			MFR STD								
	(15)	TRIM FORM											
	16	TRIM MATERIAL			MFR STD								
	17	SEAT LEAKAGE CLASS (3)			CLASS II ANSI								
ACTUATOR	18	TYPE OF ACTUATOR			DIAPHRAGM								
	19	SELF CONT.	EXT. CONN.		YES	1/4"							
	(20)	DIAPHRAGM MATERIAL											
	(21)	DIAPHRAGM RATING											
	(22)	SPRING RANGE											
	23	SET POINT			60PSIG								
	24												
ACCESSORIES	25	EXTERNAL PILOT			NO								
	26	LINE STRAINER			NO								
	27	HOUSING VENT			YES								
	28	INTERNAL RELIEF			NO								
	29												
FLUID DATA	30	ON PROCESS INCREASE · VALVE TO			CLOSE								
	31	FLUID (1)											
	32	NORM FLOW (1)	INLET PRESS	ΔP	50	100	20						
	33	MAX FLOW (1)	INLET PRESS	ΔP	75	150	69						
	34	MIN FLOW (1)	INLET PRESS	ΔP	10	80	15						
	(35)	CALC CV (3)	VALVE CV										
	36	MAXIMUM SHUTOFF Δ			150PSI								
	37	TEMP °F OPER.	MAXIMUM		80°F	150°F							
	38	SP GR AT: 60 °F	O.T.		.997	.99							
	39	VISC. CP AT OPER. TEMP.			1.12								
	40	PERCENT FLASH	PERCENT SOLIDS		0								
	(41)	SOUND LEVEL: dB ALLOW	PRED		90								
	(42)	MODEL NUMBER											

NOTES: (1) FLOW UNITS: LIQUID GPM, STEAM ____, GAS ____.

(2) CORRESPONDS TO NORMAL FLOW UNLESS OTHERWISE NOTED.

(3) IN ACCORDANCE WITH ANSI 316.104 - 1976

D.O.E. # 4DI 7002171

Stearns-Roger

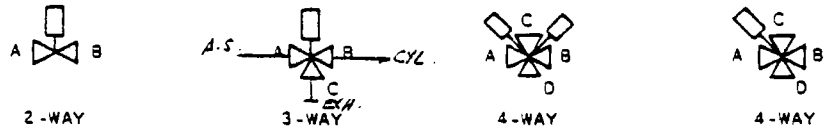
SOLENOID VALVES

DATA SHEET SOV
PAGE 1
S-R PROJECT C-21700
ACCOUNT
DATE 4-21-80 REV 2
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT CALIFORNIA
REVISIONS: 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

GENERAL	1	TAG NUMBER	SOV-1010			SOV-1011	
	2	SERVICE	USED W/ LV-1010 (4" HT-1-KES			USED W/ LV-1011 (6"HC-6-	
	3		ORN POT LVL CONTR			OEB ORN POT LVL CONTR	
	4	LOCATION	MTD ON LV-1010			MTD ON LV-1011	
VALVE BODY	5	TYPE	3-WAY NORMALLY CLOSED			3 WAY NORMALLY CLOSED	
	6	SIZE: BODY / PORT	1/4"			1/4"	
	7	RATING & TYPE CONN.	300# FNPT			300# FNPT	
	8	MATERIAL: BODY	BRASS			BRASS	
	9	SEAT	BUNA N			BUNA N	
	10	OPERATION: DIRECT/PILOT	DIRECT			DIRECT	
	11	PACKLESS OR PACKED	PACKLESS			PACKLESS	
	12	MANUAL RESET	NO			NO	
	13	MANUAL OVERRIDE	NO			NO	
	14						
SOLENOID	15	ENCLOSURE	NEMA 4			NEMA 4	
	16	VOLTAGE / HZ ~~OR DC~~	120 / 60			120 / 60	
	17	STYLE OF COIL (1)	HT			HT	
	18	SINGLE OR DUAL COIL	SINGLE			SINGLE	
	(19)	VA: INRUSH / HOLDING (2)					
	(20)	WATTS (2)					
	21	APPROVAL REQ. -UL, FM, CSA	U.L.			U.L.	
	22						
FLUID DATA	23	FLUID	AIR			AIR	
	24	MAXIMUM FLOW	AS REQUIRED			AS REQUIRED	
	25	PRESSURE: INLET / DIFF	30 PSIG			30 PSIG	
	(26)	ALLOW DIFF: MIN / MAX (2)	80			22	
	27	OPER TEMPERATURE, °F	100°F			100°F	
	28	SP GR @ O.T. OR MOL. WT.					
	29	VISCOSITY @ CP AT O.T.					
	30	REQUIRED Cv					
	(31)	VALVE Cv					
	32						
ACTION	33	PRESSURE AT PORT	A			A	
	34	ENERG. COIL CONNECTS PORTS	A-B			A-B	
	35	DEENERG. COIL CONNECTS PORTS	B-C			B-C	
	36	ACTUATES	LV-1010			LV-1011	
	(37)	MODEL NUMBER					

NOTES: (1) COILS TO BE DESIGNED FOR CONTINUOUS DUTY.
(2) THIS INFORMATION TO BE FURNISHED BY VENDOR.



2-WAY 3-WAY 4-WAY DUAL COIL 4-WAY SINGLE COIL

(3) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER
(4) SOL. VALVE TO BE FURNISHED WITH MOUNTING BRACKET FOR [illegible]

TAG NO.

Form no. N-726 12/71
Based on ISA S20

D.O.E. # 40I700217I

Stearns-Roger

SOLENOID VALVES

DATA SHEET SOV
PAGE 2
S-R PROJECT C-21700
ACCOUNT
DATE 4-21-80 REV D
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS: 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

GENERAL	1	TAG NUMBER	SOV-1012	SOV-1013	
	2	SERVICE	USED W/ LV-1012 (6" ANS	USED W/ LV-1013 (6" ANS	
	3		7-FEA ORN POT LVL CONTR	3-CES ORN POT LVL CONTR)	
	4	LOCATION	MTD ON LV-1012	MTD ON LV-1013	
VALVE BODY	5	TYPE	3-WAY NORMALLY CLOSED	3-WAY NORMALLY CLOSED	
	6	SIZE: BODY / PORT	1/4" /	1/4" /	
	7	RATING & TYPE CONN.	300# FNPT	300 # FNPT	
	8	MATERIAL: BODY	BRASS	BRASS	
	9	SEAT	BUNA N	BUNA N	
	10	OPERATION: DIRECT/PILOT	DIRECT	DIRECT	
	11	PACKLESS OR PACKED	PACKLESS	PACKLESS	
	12	MANUAL RESET	NO	NO	
	13	MANUAL OVERRIDE	NO	NO	
	14				
SOLENOID	15	ENCLOSURE	NEMA 4	NEMA 4	
	16	VOLTAGE / HZ ~~OR DC~~	120 / 60	120 / 60	
	17	STYLE OF COIL (1)	HT	HT	
	18	SINGLE OR DUAL COIL	SINGLE	SINGLE	
	(19)	VA: INRUSH / HOLDING (2)	/	/	
	(20)	WATTS (2)			
	21	APPROVAL REQ. -UL, FM, CSA	UL.	U.L	
	22				
FLUID DATA	23	FLUID	AIR	AIR	
	24	MAXIMUM FLOW	AS REQUIRED	AS REQUIRED	
	25	PRESSURE: INLET / DIFF	30 PSIG /	30 PSIG /	
	(26)	ALLOW DIFF: MIN / MAX (2)	80 /	80 /	
	27	OPER TEMPERATURE, °F	100°F	100°F	
	28	SP GR @ O.T. OR MOL. WT.			
	29	VISCOSITY @ CP AT O.T.			
	30	REQUIRED Cv			
	(31)	VALVE Cv			
	32				
ACTION	33	PRESSURE AT PORT	A	A	
	34	ENERG. COIL CONNECTS PORTS	A-B	A-B	
	35	DEENERG. COIL CONNECTS PORTS	B-C	B-C	
	36	ACTUATES	LV-1012	LV-1013	
	(37)	MODEL NUMBER			

NOTES: (1) COILS TO BE DESIGNED FOR CONTINUOUS DUTY.
(2) THIS INFORMATION TO BE FURNISHED BY VENDOR.

(3) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.
(4) SOL. VALVE TO BE [illegible] BRACKET FOR MOUNTING [illegible] VALVE.

TAG NO.

Form no. N-726 12/71
Based on ISA S20

D.O.E. # 40I7002171

Stearns-Roger

SOLENOID VALVES

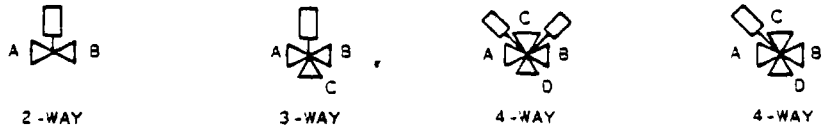
DATA SHEET SOV
PAGE 3
S-R PROJECT C-21700
ACCOUNT
DATE 4-21-80 REV P1
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT CALIFORNIA
REVISIONS: 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

GENERAL	1	TAG NUMBER	SOV-1015		SOV-1016		SOV-1203	
	2	SERVICE	USED W/ LV-1015 (2"-MS-		USED W/ LV-1016 (6"-MS		USED W/ LV-1203 (DEMIN	
	3		8-QEB DRN POT LVL CONTR		9-FEA DRN POT LVL CONTR		WTR STOR. TK LVL. CONTR	
	4	LOCATION	MTD ON LV-1015		MTD ON LV-1016		MTD ON LV-1203	
VALVE BODY	5	TYPE	3-WAY NORMALLY CLOSED		3-WAY NORMALLY CLOSED		3-WAY NORMALLY CLOSED	
	(6)	SIZE: BODY / PORT	1/4"		1/4"		1/4"	
	7	RATING & TYPE CONN.	300 # FNPT		300 # FNPT		300 # FNPT	
	8	MATERIAL: BODY	BRASS		BRASS		BRASS	
	9	SEAT	BUNA N		BUNA N		BUNA N	
	10	OPERATION: DIRECT/PILOT	DIRECT		DIRECT		DIRECT	
	11	PACKLESS OR PACKED	PACKLESS		PACKLESS		PACKLESS	
	12	MANUAL RESET	NO		NO		NO	
	13	MANUAL OVERRIDE	NO		NO		NO	
	14							
SOLENOID	15	ENCLOSURE	NEMA 4		NEMA 4		NEMA 4	
	16	VOLTAGE / HZ ~~OR DC~~	120	60	120	60	120	60
	17	STYLE OF COIL (1)	HT		HT		HT	
	18	SINGLE OR DUAL COIL	SINGLE		SINGLE		SINGLE	
	(19)	VA: INRUSH / HOLDING (2)						
	(20)	WATTS (2)						
	21	APPROVAL REQ. -UL, FM, CSA	U.L		U.L		U.L.	
	22							
FLUID DATA	23	FLUID	AIR		AIR		AIR	
	24	MAXIMUM FLOW	AS REQUIRED		AS REQUIRED		AS REQUIRED	
	25	PRESSURE: INLET / DIFF	80PSIG		80PSIG		80PSIG	
	(26)	ALLOW DIFF: MIN / MAX (2)						
	27	OPER TEMPERATURE, °F	100°F		100°F		100°F	
	28	SP GR @ O.T. OR MOL. WT.						
	29	VISCOSITY @ CP AT O.T.						
	30	REQUIRED Cv						
	(31)	VALVE Cv						
	32							
ACTION	33	PRESSURE AT PORT	A		A		A	
	34	ENERG. COIL CONNECTS PORTS	A-B		A-B		A-B	
	35	DEENERG. COIL CONNECTS PORTS	B-C		B-C		B-C	
	36	ACTUATES	LV-1015		LV-1016		LV-1203	
	(37)	MODEL NUMBER						

Form no. N-726 12/71
Based on ISA S20

NOTES: (1) COILS TO BE DESIGNED FOR CONTINUOUS DUTY.
(2) THIS INFORMATION TO BE FURNISHED BY VENDOR.



(3) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER
#1 SOL. VALVE TO BE FURNISHED WITH MOUNTING BRACKET FOR MOUNTING ON VALVE

TAG NO.

D.O.E. #DE-700217-1

Stearns-Roger

SOLENOID VALVES

DATA SHEET SOV
PAGE 1
S-R PROJECT C-21700
ACCOUNT
DATE 4-24-80 REV (1)
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MW SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS: 1 ADDED BY PSB 2 BY 3 BY 4 BY
MANUFACTURER SOURCE: QUOTE OF

Form no. N-726 12/71
Based on ISA S20

GENERAL	1	TAG NUMBER	SOV-1410				SOV-1411	
	2	SERVICE	SOUTH TARGET SHUTTER				WEST TARGET SHUTTER	
	3							
	4	LOCATION	LOCAL				LOCAL	
VALVE BODY	5	TYPE	3-WAY				3 WAY	
	(6)	SIZE: BODY / PORT	1/4"	3/32"			1/4"	3/32"
	7	RATING & TYPE CONN.	300# FNPT				300# FNPT	
	8	MATERIAL: BODY	BRASS				BRASS	
	9	SEAT	BUNA N				BUNA N	
	10	OPERATION: DIRECT/PILOT	DIRECT				DIRECT	
	11	PACKLESS OR PACKED	PACKLESS				PACKLESS	
	12	MANUAL RESET	NO				NO	
	13	MANUAL OVERRIDE	NO				NO	
	14							
SOLENOID	15	ENCLOSURE	NEMA 4				NEMA 4	
	16	VOLTAGE / HZ ~~OR DC~~	120V	60HZ			120 V	60 HZ
	17	STYLE OF COIL (1)	HT				HT	
	18	SINGLE OR DUAL COIL	SINGLE				SINGLE	
	(19)	VA: INRUSH / HOLDING (2)						
	(20)	WATTS (2)						
	21	APPROVAL REQ. -UL, FM, CSA	U.L				U.L	
	22							
FLUID DATA	23	FLUID	SERVICE AIR				SERVICE AIR	
	24	MAXIMUM FLOW / NORMAL FLOW	1 SCFM / 0.25 SCFM				1 SCFM / 0.35 SCFM	
	25	PRESSURE: INLET / DIFF	20 PSIG	1 PSI			20 PSIG	1 PSI
	26	ALLOW DIFF: MIN / MAX (2)	—	1 PSI			—	1 PSI
	27	OPER TEMPERATURE, °F	110°F				110°F	
	28	SP GR @ O.T. OR MOL. WT.						
	29	VISCOSITY @ CP AT O.T.						
	30	REQUIRED Cv						
	(31)	VALVE Cv	0.15				0.15	
	32							
ACTION	33	PRESSURE AT PORT	A				A	
	34	ENERG. COIL CONNECTS PORTS	A-B				A-B	
	35	DEENERG. COIL CONNECTS PORTS	B-C				B-C	
	36	ACTUATES	TARGET SHUTTER				TARGET SHUTTER	
	(37)	MODEL NUMBER (4)	ASCO 8320A89 OR ENGR APPD. EQUAL				ASCO 8320 APP OR ENGR APPD. EQUAL	

NOTES: (1) COILS TO BE DESIGNED FOR CONTINUOUS DUTY.
(2) THIS INFORMATION TO BE FURNISHED BY VENDOR.

2-WAY 3-WAY 4-WAY DUAL COIL 4-WAY SINGLE COIL

(3) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER
(4) SOLENOID VALVES TO BE FURNISHED WITH MOUNTING BRACKET & HARDWARES

TAG NO.

D.O.E. # 401 700217 I

Stearns-Roger

SOLENOID VALVES

DATA SHEET SOV
PAGE 8
S-R PROJECT C-21700
ACCOUNT
DATE 4-24-80 REV P1
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS Co.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS: 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

GENERAL	1	TAG NUMBER	SOV - 1412				SOV - 1413	
	2	SERVICE	NORTH TARGET SHUTTER				EAST TARGET SHUTTER	
	3							
	4	LOCATION	LOCAL				LOCAL	
VALVE BODY	5	TYPE	3-WAY				3-WAY	
	6	SIZE: BODY / PORT	1/4"	3/32"			1/4"	3/32"
	7	RATING & TYPE CONN.	300 # FNPT				300 # FNPT	
	8	MATERIAL: BODY	BRASS				BRASS	
	9	SEAT	BUNA N				BUNA N	
	10	OPERATION: DIRECT/PILOT	DIRECT				DIRECT	
	11	PACKLESS OR PACKED	PACKLESS				PACKLESS	
	12	MANUAL RESET	NO				NO	
	13	MANUAL OVERRIDE	NO				NO	
	14							
SOLENOID	15	ENCLOSURE	NEMA 4				NEMA 4	
	16	VOLTAGE / HZ ~~OR DC~~	120 V	60 HZ			120 V	60 HZ
	17	STYLE OF COIL (1)	HT				HT	
	18	SINGLE OR DUAL COIL	SINGLE				SINGLE	
	(19)	VA: INRUSH / HOLDING (2)						
	(20)	WATTS (2)						
	21	APPROVAL REQ. -UL, FM, CSA	U.L				U.L	
	22							
FLUID DATA	23	FLUID	SERVICE AIR				SERVICE AIR	
	24	MAXIMUM FLOW / NORMAL FLOW	1 SCFM / 0.25 SCFM				1 SCFM / 0.25 SCFM	
	25	PRESSURE: INLET / DIFF	20 PSIG	1 PSI			20 PSIG	1 PSI
	26	ALLOW DIFF: MIN / MAX (2)	—	1 PSI			-	1 PSI
	27	OPER TEMPERATURE, °F	110°F				110°F	
	28	SP GR @ O.T. OR MOL. WT.						
	29	VISCOSITY @ CP AT O.T.						
	30	REQUIRED Cv						
	(31)	VALVE Cv	0.15				0.15	
	32							
ACTION	33	PRESSURE AT PORT	A				A	
	34	ENERG. COIL CONNECTS PORTS	A-B				A-B	
	35	DEENERG. COIL CONNECTS PORTS	B-C				B-C	
	36	ACTUATES	TARGET SHUTTER				TARGET SHUTTER	
	(37)	MODEL NUMBER	ASCO # 8320A89 OR ENGR APPD EQUAL				ASCO 8320A87 OR ENGR APPD. EQUAL	

Form no. N-726 12/71
Based on ISA S20

NOTES: (1) COILS TO BE DESIGNED FOR CONTINUOUS DUTY.
(2) THIS INFORMATION TO BE FURNISHED BY VENDOR.

(3) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER
(4) SOL. VALVE TO BE FURNISHED WITH MOUNTING BRACKET & HARDWARE.

TAG NO.

DOE NO. 401700217

Stearns-Roger

SOLENOID VALVES

DATA SHEET SOV
PAGE 11
S-R PROJECT 21700
ACCOUNT
DATE 2-18-81
BY REB

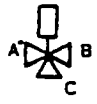
CUSTOMER MDAC
PROJECT SOLAR ONE
LOCATION DAGGETT, CA
REVISIONS: 1 Δ 2-18-81 BY REB 2 BY 3 BY 4 BY
MANUFACTURER SOURCE: QUOTE OF

GENERAL	1	TAG NUMBER	SOV 1418			
	2	SERVICE	USED W/TV 1418			
	3					
	4	LOCATION	MTD ON TV 1418			
VALVE BODY	5	TYPE	3 WAY			
	6	SIZE: BODY / PORT	1/4"			
	7	RATING & TYPE CONN.	300 # FNPT			
	8	MATERIAL: BODY	BRASS			
	9	SEAT	BUNA N			
	10	OPERATION: DIRECT/PILOT	DIRECT			
	11	PACKLESS OR PACKED	PACKLESS			
	12	MANUAL RESET	NO			
	13	MANUAL OVERRIDE	NO			
	14					
SOLENOID	15	ENCLOSURE	NEMA 4			
	16	VOLTAGE / HZ ~~OR DC~~	120 / 60			
	17	STYLE OF COIL (1)	HT			
	18	SINGLE OR DUAL COIL	SINGLE			
	(19)	VA: INRUSH / HOLDING (2)				
	(20)	WATTS (2)				
	21	APPROVAL REQ.-UL,FM,CSA	UL			
	22					
FLUID DATA	23	FLUID	AIR			
	24	MAXIMUM FLOW	AS REQUIRED			
	(25)	PRESSURE: INLET / DIFF				
	(26)	ALLOW DIFF: MIN / MAX (2)	0 PSIG			
	27	OPER TEMPERATURE, °F	100 F			
	28	SP GR @ O.T. OR MOL.WT.				
	29	VISCOSITY @ CP AT O.T.				
	30	REQUIRED Cv				
	(31)	VALVE Cv				
	32					
ACTION	33	PRESSURE AT PORT	A			
	34	ENERG. COIL CONNECTS PORTS	A-B			
	35	DEENERG. COIL CONNECTS PORTS	B-C			
	36	ACTUATES	TV 1418			
	(37)	MODEL NUMBER				

Form no. N-726 12/71
Based on ISA S20

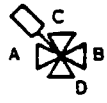
NOTES:
1. COILS TO BE DESIGNED FOR CONTINUOUS DUTY.
2. THIS INFORMATION TO BE FURNISHED BY VENDOR.
3. ENCIRCLED ITEMS TO BE COMPLETED BY BIDDER.

2-WAY



3-WAY

4-WAY
DUAL COIL



4-WAY
SINGLE COIL

TAG NO.

O.O.E. # 40E700217I

Stearns-Roger

SOLENOID VALVES

DATA SHEET SOV
PAGE 9
S-R PROJECT C-21700
ACCOUNT
DATE 4-24-80 REV'D.
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS: 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

GENERAL	1	TAG NUMBER	SOV-1602			SOV-1	
	2	SERVICE	SERVICE WTR TO SEP WASTE			USED W/ LV-1	
	3		WTR PPS P-711 & P-712				
	4	LOCATION	IN LINE (2" SW-CW-AQ01			MTD ON LV-1	
VALVE BODY	5	TYPE	2 WAY NORMALLY OPEN			3-WAY NORMALLY OPEN	
	(6)	SIZE: BODY / PORT				1/4"	
	(7)	RATING & TYPE CONN.				3000# FNPT	
	8	MATERIAL: BODY	STAINLESS STEEL			BRASS	
	9	SEAT	TEFLON			BUNA N	
	10	OPERATION: DIRECT/PILOT	DIRECT			DIRECT	
	11	PACKLESS OR PACKED	PACKLESS			PACKLESS	
	12	MANUAL RESET	NO			NO	
	13	MANUAL OVERRIDE	NO			NO	
	14						
SOLENOID	15	ENCLOSURE	NEMA 4			NEMA 4	
	16	VOLTAGE / HZ ~~OR DC~~	120 V	60 HZ		120	60
	17	STYLE OF COIL (1)	HT			LT	
	18	SINGLE OR DUAL COIL	SINGLE			SINGLE	
	(19)	VA: INRUSH / HOLDING (2)					
	(20)	WATTS (2)					
	21	APPROVAL REQ.-UL,FM,CSA	U.L.			U.L.	
	22						
FLUID DATA	23	FLUID	WATER			AIR	
	24	MAXIMUM FLOW / NORMAL FLOW	50 GPM / 2 GPM			AS REQUIRED	
	25	PRESSURE: INLET / DIFF	60 PSI	30 PSI			
	(26)	ALLOW DIFF: MIN / MAX (2)					
	27	OPER TEMPERATURE, °F	80°F			120°F	
	28	SP GR @ O.T. OR MOL.WT.	.99				
	29	VISCOSITY @ CP AT O.T.	1.1				
	30	REQUIRED Cv	0.45				
	(31)	VALVE Cv					
	32						
ACTION	33	PRESSURE AT PORT				A	
	34	ENERG. COIL CONNECTS PORTS	A (ENERGIZE TO CLOSE)			A-3	
	35	DEENERG. COIL CONNECTS PORTS	A-3			S-C	
	36	ACTUATES	NONE			LV-1	
	(37)	MODEL NUMBER					

Form no. N-726 12/71
Based on ISA S20

NOTES: (1) COILS TO BE DESIGNED FOR CONTINUOUS DUTY.
(2) THIS INFORMATION TO BE FURNISHED BY VENDOR.

(3) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

TAG NO.

D.O.E. # 49-7002171

Stearns-Roger

SOLENOID VALVES

DATA SHEET SOV
PAGE 10
S-R PROJECT C-21700
ACCOUNT
DATE 4-21-80 REV #1
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS Co
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS: 1 0 6/25/80 BY PAE 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

Form no. N-726 12/71
Based on ISA S20

GENERAL	1	TAG NUMBER	SOV-1702				SOV-1703	
	2	SERVICE	USED W/ LV-1702 (WTR TO				USED W/ PV-1703 (RAW SEC.	
	3		RAW WTR STOR TK-701)				WTR PP P-703 & P-704 RECY	
	4	LOCATION	MTD ON LV-1702				MTD ON PV-1703	
VALVE BODY	5	TYPE	3-WAY NORMALLY CLOSED				3-WAY NORMALLY CLOSED	
	(6)	SIZE: BODY / PORT	1/4"				1/4"	
	7	RATING & TYPE CONN.	300# FNPT				300# SWPT	
	8	MATERIAL: BODY	BRASS				BRASS	
	9	SEAT	BUNA N				BUNA N	
	10	OPERATION: DIRECT/PILOT	DIRECT				DIRECT	
	11	PACKLESS OR PACKED	PACKLESS				PACKLESS	
	12	MANUAL RESET	NO				NO	
	13	MANUAL OVERRIDE	NO				NO	
	14							
SOLENOID	15	ENCLOSURE	NEMA 4				NEMA 4	
	16	VOLTAGE / HZ ~~OR DC~~	120 V	60 HZ			120 V	60 HZ
	17	STYLE OF COIL (1)	HT				HT	
	18	SINGLE OR DUAL COIL	SINGLE				SINGLE	
	(19)	VA: INRUSH / HOLDING (2)						
	(20)	WATTS (2)						
	21	APPROVAL REQ.-UL,FM,CSA	U.L				U.L	
	22							
FLUID DATA	23	FLUID	AIR				AIR	
	24	MAXIMUM FLOW	AS REQUIRED				AS REQUIRED	
	25	PRESSURE: INLET / DIFF	30PSIG				30PSIG	
	(26)	ALLOW DIFF: MIN / MAX (2)						
	27	OPER TEMPERATURE, °F	100°F				100°F	
	28	SP GR @ O.T. OR MOL.WT.						
	29	VISCOSITY @ CP AT O.T.						
	30	REQUIRED Cv						
	31	VALVE Cv						
	32							
ACTION	33	PRESSURE AT PORT	A				A	
	34	ENERG. COIL CONNECTS PORTS	A-B				A-B	
	35	DEENERG. COIL CONNECTS PORTS	B-C				B-C	
	36	ACTUATES	LV-1702				PV-1703	
	(37)	MODEL NUMBER						

NOTES: (1) COILS TO BE DESIGNED FOR CONTINUOUS DUTY.
(2) THIS INFORMATION TO BE FURNISHED BY VENDOR.

(3) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.
(4) SOL VALVE TO BE FURNISHED WITH MOUNTING BRACKETS FOR MOUNTING ON VALVE

TAG NO.

4070021 7I

Stearns-Roger — TEMPERATURE INSTRUMENTS

DATA SHEET TC
PAGE 2
S-R PROJECT 21700
ACCOUNT
DATE 2-20-81
BY RGB

CLIENT MDAC
PROJECT SOLAR ONE
LOCATION DAGGETT, CA.
REVISIONS 1 @ 2-20-81 BY RGB 2 BY 3 BY 4 BY
MANUFACTURER ACTION PAK SOURCE: QUOTE OF

FORM NO. N-717a 12/77
BASED ON ISA S20

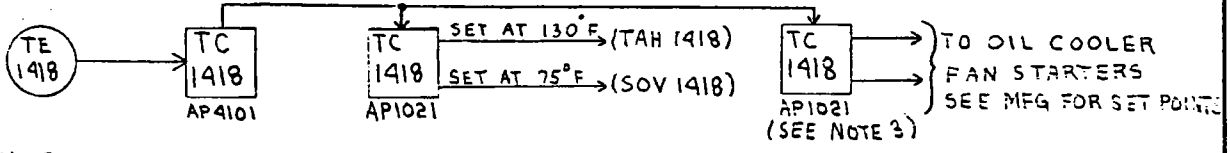
	1	TAG NUMBER TC 1418	FLOW SHEET SERVICE P3-13
GENERAL	2	FUNCTION	☐ RECORD ☐ INDICATE ■ CONTROL ■ BLIND ■ TRANS OTHER TRANSMITTER WITH 2 DUAL VOLTAGE ALARMS (3)
	3	CASE	■ MFR STD NOM SIZE ____ COLOR: ☐ MFR STD OTHER ____
	4	MOUNTING	☐ FLUSH ■ SURFACE ☐ YOKE OTHER ____
	5	ENCLOSURE CLASS	■ GEN PUR ☐ WTH PROOF ☐ EXP PROOF CLASS ____ GROUP ____ DIVISION ____ ☐ FOR USE IN INTRIN SAFE SYSTEM OTHER ____
	6	POWER SUPPLY	■ 117V 60 HZ OTHER ____ AC ____ DC ____ VOLTS
	7	CHART	☐ 12" CIRC OTHER ____ RANGE ____ NO. ____
	8	CHART DRIVE	☐ 24 HR OTHER ____ ☐ ELEC ☐ SPRING OTHER ____
	9	SCALE	TYPE ____ RANGE 1 ____ 2 ____ 3 ____
XMTR	10	TRANSMITTER OUTPUT	☐ 4-20 MA ☐ 10-50 MA ☐ 3-15 PSIG OTHER 0-10 VDC FOR RECEIVER SEE DATA SHEET ____
CONTROLLER	11	CONTROL MODES	P - PROP (GAIN), I - INTEGRAL (AUTO RESET), D - DERIVATIVE (RATE) ☐ P ☐ PI ☐ PID OTHER ON-OFF SWITCH ACTION — SEE BELOW
	12	ACTION	ON MEAS. INCREASE OUTPUT: ☐ INCREASES ☐ DECREASES
	~~13~~	~~AUTO-MAN SWITCH~~	☐ NONE ☐ MFR STD OTHER ____
	14	SET POINT ADJ	■ MANUAL ☐ EXTERNAL ☐ REMOTE OTHER ____
	~~15~~	~~MANUAL REG~~	☐ NONE ☐ MFR STD OTHER ____
	16	OUTPUT	☐ 4-20 MA ☐ 10-50 MA ☐ 3-15 PSIG OTHER CONTACT CLOSURE
ELEMENT	~~17~~	~~FILL~~	SAMA CLASS ____ COMPENSATION ____
	~~18~~	~~PROCESS DATA~~	TEMP: NORMAL ____ MIN. ____ MAX. ____ MAX. PRESS ____ CORROSIVE/EROSIVE DUE TO ____
	~~19~~	~~RANGE~~	☐ FIXED ADJ. RANGE ____ SET AT ____
	~~20~~	~~BULB~~	TYPE ____ MAT'L ____ EXTENSION: LENGTH ____ TYPE ____ SIZE: DIAMETER ____ LENGTH ____ INSERTION ____ CONN: ____ LOCATION: ____ FT ☐ ABOVE ☐ BELOW INSTR
	~~21~~	~~CAPILLARY~~	☐ MFR STD LENGTH ____ MATERIAL ____ ARMOR ____
	~~22~~	~~WELL~~	MAT'L ____ INSERTION ____ LAG EXT ____ CONN ____ CONST. ☐ DRILLED ☐ BUILT-UP OTHER ____
ALARM	23	ALARM SWITCHES	QUANTITY 4 FORM ____ RATING 1 AMP @ 120 VAC
	24	FUNCTION	☐ TEMP ☐ DEVIATION CONTACTS TO ____ ON TEMP INCREASE
ACCES	25	ACCESSORIES	☐ FILT-REG ☐ SUP GAGE ☐ OUTPUT GAGE ☐ MTG YOKE ____ CHARTS OTHER MOUNT IN NEMA 4 JUNCTION BOX
	26	MODEL NO.	

NOTES:

1. REQUIRES: 1 EA ACTION PAK AP 4101 THERMOCOUPLE TRANSMITTER WITH BTS 8 BASE
   0-200°F TYPE TC INPUT
   0-10VDC OUTPUT

   2 EA ACTION PAK AP 1021 VOLTAGE SWITCH WITH BTS 11 BASE WITH DUAL SPDT SWITCH OUTPUTS, CALIBRATED DIAL SET POINTS AND 0-10VDC INPUT

2. ACTION



3. OIL COOLER FAN CONTROL MAY BE DELETED IF NOT REQUIRED. THIS WILL DELETE ONE AP1021 VOLTAGE SWITCH.

D.O.E. # 401700317I

Stearns-Roger

TEMPERATURE INSTRUMENTS (FILLED SYSTEM)

DATA SHEET TC
PAGE 1
S-R PROJECT C-2175-3
ACCOUNT
DATE 4-28-80 REV P.
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 O [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-717a 12/77
BASED ON ISA S20

	1	TAG NUMBER	TC - 1420 FLOW SHEET SERVICE THERMAL STOR BLOWDN TK V-60 OUTLET TEMP
GENERAL	2	FUNCTION	☐ RECORD ■ INDICATE ■ CONTROL ☐ BLIND ☐ TRANS OTHER ____
	3	CASE	■ MFR STD NOM SIZE ____ COLOR: ■ MFR STD OTHER ____
	4	MOUNTING	☐ FLUSH ☐ SURFACE ■ YOKE OTHER ____
	5	ENCLOSURE CLASS	☐ GEN PUR ■ WTH PROOF ☐ EXP PROOF CLASS ____ GROUP ____ DIVISION ____ ☐ FOR USE IN INTRIN SAFE SYSTEM OTHER ____
	~~6~~	~~POWER SUPPLY~~	☐ 117V 60 HZ OTHER ____ AC ____ DC ____ VOLTS
	~~7~~	~~CHART~~	☐ 12" CIRC OTHER ____ RANGE ____ NO. ____
	~~8~~	~~CHART DRIVE~~	☐ 24 HR OTHER ____ ☐ ELEC ☐ SPRING OTHER ____
	9	SCALE	TYPE HR/Z (SEC) RANGE 1 ____ 2 ____ 3 ____
XMTR	~~10~~	~~____~~	☐ 4-20 MA ☐ 10-50 MA ☐ 3-15 PSIG OTHER ____
		~~OUTPUT~~	FOR RECEIVER SEE DATA SHEET ____
CONTROLLER	11	CONTROL MODES	P - PROP (GAIN), I - INTEGRAL (AUTO RESET), D - DERIVATIVE (RATE) ☐ P ■ PI ☐ PID OTHER ____
	12	ACTION	ON MEAS. INCREASE OUTPUT: ☐ INCREASES ■ DECREASES
	13	AUTO-MAN SWITCH	☐ NONE ■ MFR STD OTHER ____
	14	SET POINT ADJ	■ MANUAL ☐ EXTERNAL ☐ REMOTE OTHER ____
	15	MANUAL REG	■ NONE ☐ MFR STD OTHER ____
	16	OUTPUT	☐ 4-20 MA ☐ 10-50 MA ■ 3-15 PSIG OTHER ____
ELEMENT	17	FILL	SAMA CLASS 3B COMPENSATION CASE
	18	PROCESS DATA	TEMP: NORMAL 225°F MIN. AMB MAX. 445°F MAX. PRESS 100 psig CORROSIVE/EROSIVE DUE TO ____
	19	RANGE	☐ FIXED ADJ. RANGE YES SET AT 140°F
	(20)	BULB	TYPE ____ MAT'L ____ EXTENSION: LENGTH ____ TYPE ____ SIZE: DIAMETER ____ LENGTH ____ INSERTION ____ CONN: ____ LOCATION: ____ FT ☐ ABOVE ■ BELOW INSTR
	21	CAPILLARY	■ MFR STD LENGTH 20' MATERIAL 30-SS ARMOR ____
	22	WELL	MAT'L 304 SS INSERTION ____ LAG EXT 2" CONN 3/4" NPT CONST. ☐ DRILLED ☐ BUILT-UP OTHER ____
ALARM	~~23~~	~~ALARM SWITCHES~~	QUANTITY ____ FORM ____ RATING ____
	~~24~~	~~FUNCTION~~	☐ TEMP ☐ DEVIATION CONTACTS TO ____ ON TEMP INCREASE
ACCES	25	ACCESSORIES	■ FILT-REG ☐ SUP GAGE ■ OUTPUT GAGE ☐ MTG YOKE ____ CHARTS OTHER ____
	(26)	MODEL NO.	

NOTES: (1) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.

D.O.E. # 40I 700217I

Stearns-Roger

THERMOCOUPLES

DATA SHEET TE
PAGE 1A
S-R PROJECT C-17200
ACCOUNT
DATE 4-18-80 REV 2,
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ⚠ 10-27-80 BY [illegible] 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

1 ☒ COMPLETE ASSEMBLY OTHER 3

ELEMENT

2 TYPE ☐ BEADED INSULATORS
☒ SHEATHED O.D., MATL 1/4"
☐ PKD CONN NPT, MATL
☐ FIXED ☐ ADJ
3 HOLDDOWN: ☐ STD ☒ SPG LOAD
4 NO T/C: ☐ SINGLE ☒ DUPLEX
5 JUNCTION TYPE:
☐ EXP ☐ GROUND ☒ UNGROUND ☐ ENCLSD

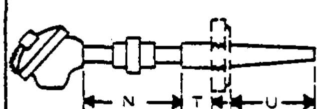
(6) MODEL NO.

HEAD

(7) ☒ SCREWED COVER OTHER
8 MATERIAL ALUMINUM CONDUIT CONN 3/4" NPT
9 NIPPLE SIZE 1/2" DIM "N" 6" ☒ UNION

WELL

10 MATERIAL: ☐ 304SS ☐ 316SS
OTHER 2 1/4 % CHROME MOLY ASTM 182 F22
(11) CONSTR: ☒ TAPERED ☐ STRAIGHT ☐ RED. TIP
☐ DRILLED ☐ BUILT-UP ☐ CLSD END
(12) DIMENSIONS: ☐ MFR STD O.D. ____ I.D. ____
13 CONN PROCESS: ☐ SCRD ____ NPT
☒ WELD IN FOR 1/2" I.D. SOCKET
FLANGE: SIZE ____ RATING & TYPE
MATERIAL



REV	TAG NO.	T_M (2)	WELL DIM. "U"	WELL DIM. "T"	ELEM. LENGTH	ISA TYPE	GAUGE	SERVICE (NOTE CORROSIVE AND EROSIVE SERVICE)	NOTES
	TE-1001 [6]	SCH XXS	2 1/2"	3"	17 1/4"	K (CR-AL)	#16	MAIN STM BYPASS TO CONDENSER	
	TE-1002 [10]	SCH 40	2 1/2"	3"	17 1/4"	K (CR-AL)	#16	AUX STEAM CONDENSATE TO DS-901 DESUPERHTR CONTR	
	TE-1022 [6]	SCH XXS	2 1/2"	3"	17 1/4"	K (CR AL)	#16	MAIN STM TO TURBINE TEMP	
	TEX-1102	4" SCH 160	2 1/2"	3"	15 1/4"	K (CR-AL)	#16	FN PRES. AFTER 1st [illegible]	⚠

NOTES: 1. ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.
2. T_M - MINIMUM PIPE WALL THICKNESS
3. THERMOWELL BY SPECIFICATION 40P700206. ⚠

FORM NO. N-718a 12/77
BASED ON ISA S20

DIVISION USAGE					
MM	P	PP	SH	FI	SP

Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
DN 00.5

APPROVALS
Des. Sect.
Sect. Supv.
Div.

DATA SHEET TE
PAGE 18
ISSUED 6-20-80 REV C
REVISED

THERMOWELL INSTALLATION STANDARD DETAIL

MINIMUM PIPE WALL THICKNESS Tm	TOT. LGTH. "A"	STRENGTH W. "B"	INSERT LGTH. "C"	LAG EXT. "D"
1. SMALLER THAN 0.625	7.000	0.406	2.719	3.875
2. FROM 0.626 to 0.750	7.000	0.487	2.773	3.750
3. FROM 0.751 to 0.875	7.000	0.568	2.807	3.625
4. FROM 0.876 to 1.000	7.000	0.650	2.850	3.500
5. FROM 1.001 to 1.125	7.000	0.731	2.894	3.375
6. FROM 1.126 to 1.312	8.000	0.825	2.960	4.188
7. FROM 1.313 to 1.437	8.000	0.934	3.003	4.063
8. FROM 1.438 to 1.562	8.000	1.015	3.047	3.938
9. FROM 1.563 to 1.750	8.000	1.133	3.112	3.750
10. FROM 1.751 to 2.000	8.000	1.300	3.200	3.500
11. FROM 2.001 to 2.250	9.000	1.462	3.288	4.250
12. FROM 2.251 to 2.500	9.000	1.750	3.250	4.000
13. FROM 2.501 to 2.750	9.000	1.930	3.320	3.750
14. FROM 2.751 to 3.000	9.000	2.100	3.400	3.500
15. FROM 3.001 to 3.250	10.000	2.275	3.475	4.250
16. FROM 3.251 to 3.500	10.000	2.450	3.550	4.000
17. FROM 3.501 to 3.750	10.000	2.625	3.625	3.750
18. FROM 3.751 to 4.000	11.000	2.800	3.700	4.500
19. FROM 4.001 to 4.250	11.000	2.975	3.775	4.250

NOTES:

1. Thermowell material shall be 2-1/4% chrome moly, ASTM 182 F22, with a carbon content not to exceed 0.12%.

2. All welding and stress relieving shall be done in accordance with Section I of the ASME Power Boiler Code and the ANSI 31.1 Power Piping Code.

3. The tag number of each thermowell shall be inscribed at the top end of the thermowell above the weld area.

4. Each thermowell shall be cleaned, and all dirt, metal chips, or other foreign material shall be removed; and a 1/2"-square head carbon steel plug shall be installed to protect the thermowell until the thermocouple element is installed.

DIVISION USAGE					
MM	P	PP	SH	FI	SP

APPROVALS
Des. Sect. [signature]
Sect. Supv. [signature]
Div. [signature]

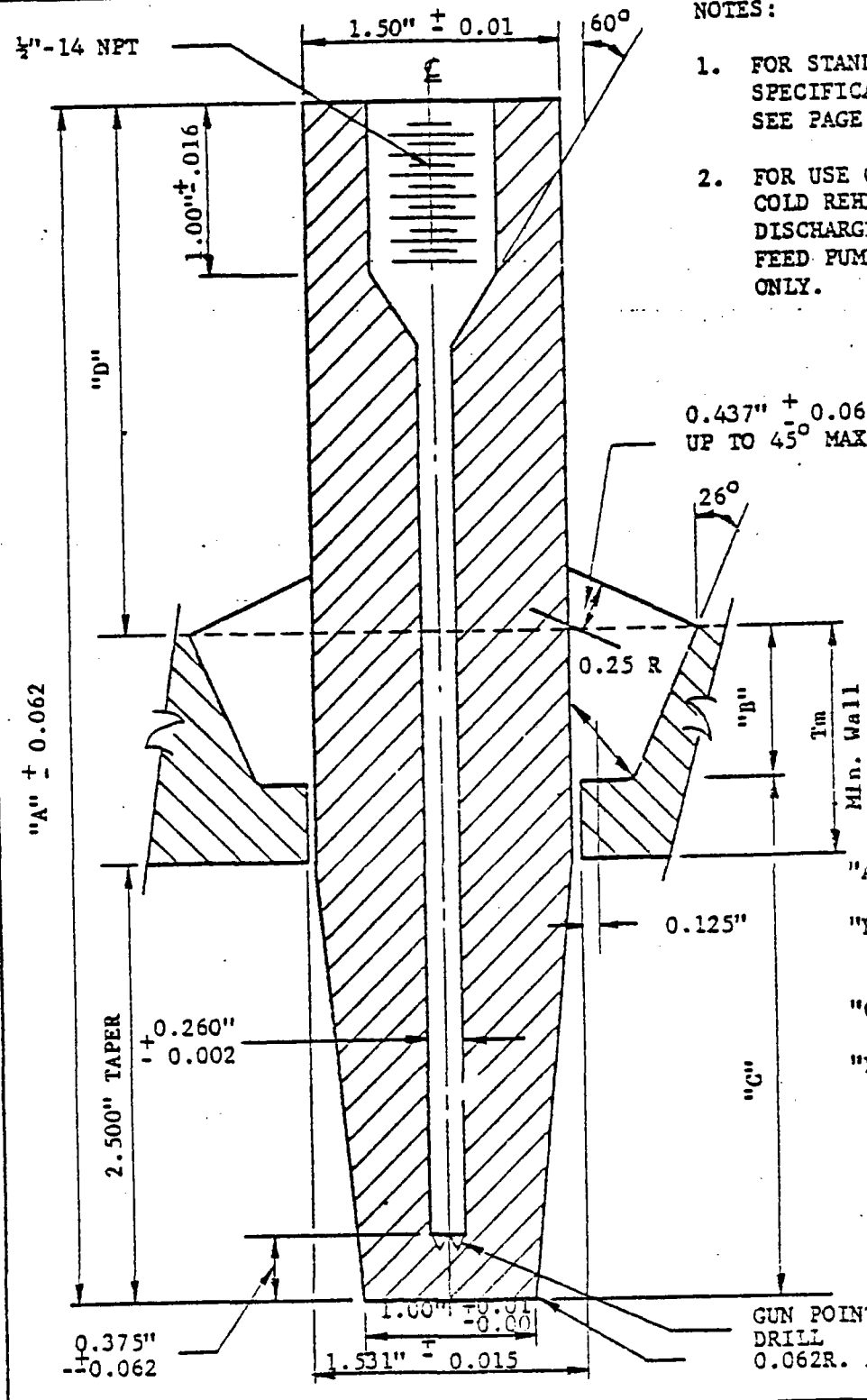
Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

THERMOWELL INSTALLATION STANDARD DETAIL

STANDARD NUMBER
DN 00.5

DATA SHEET TE
PAGE 1C

ISSUED 6-20-80 REV 0
REVISED



NOTES:

1. FOR STANDARD THERMOWELL SPECIFICATIONS AND DIMENSIONS SEE PAGE 1B
2. FOR USE ON MAIN STEAM HOT REHEAT, COLD REHEAT, BOILER FEED PUMP DISCHARGE, AUX. STEAM & BOILER FEED PUMP TURBINE DRIVE SYSTEMS ONLY.

"A" = SEE TABLE

"B" = .65 x Tm < 2.25"
= .7 x Tm > 2.25"

"C" = 2.50 + (Tm-"B")

"D" = "A"-2.50-Tm

D.O.E. # 401700217

Stearns-Roger

THERMOCOUPLES

DATA SHEET TE
PAGE 2
S-R PROJECT C-21700
ACCOUNT
DATE 4-18-80 REV 1, 7-27-80
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ⚠ 7-27-80 BY PEB 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-718a 12/77
BASED ON ISA S20

1 ■ COMPLETE ASSEMBLY OTHER ____

ELEMENT

2 TYPE ☐ BEADED INSULATORS
■ SHEATHED O.D., MATL ____
☐ PKD CONN NPT, MATL ____
☐ FIXED ☐ ADJ
3 HOLDDOWN: ☐ STD ■ SPG LOAD
4 NO T/C: ■ SINGLE ☐ DUPLEX
5 JUNCTION TYPE:
☐ EXP ■ GROUND ☐ UNGROUND ☐ ENCLSD

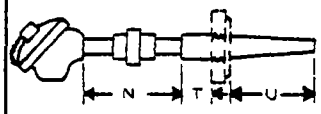
(6) MODEL NO. ____

HEAD

(7) ■ SCREWED COVER OTHER ____
8 MATERIAL ALUMINUM CONDUIT CONN 3/4" NPT
9 NIPPLE SIZE 1/2" DIM "N" 6" ■ UNION

WELL

10 MATERIAL: ☐ 304SS ■ 316SS
OTHER ____
(11) CONSTR: ■ TAPERED ☐ STRAIGHT ☐ RED.TIP
☐ DRILLED ☐ BUILT-UP ☐ CLSD END
12 DIMENSIONS: ☐ MFR STD O.D. ____ I.D. ____
13 CONN PROCESS: ■ SCRD 3.4" NPT ⚠
☐ WELD IN FOR ____ I.D. SOCKET
FLANGE: SIZE ____ RATING & TYPE
MATERIAL ____



REV	TAG NO.	T_W (2)	WELL DIM. "U"	WELL DIM. "T"	ELEM. LENGTH	ISA TYPE	GAUGE	SERVICE (NOTE CORROSIVE AND EROSIVE SERVICE)	NOTES
	TE-1004 6"	SCH 40	2½"	3"	17½"	K (CC-AL)	#16	CONDENSATE TO OS-9=2	
								OE SUPERHEATER (6"AS-10-BBA)	
	TE-1025 6"	SCH 40	2½"	3"	17¼	K (CR-AA)	#16	TSS STM TEMPERATURE TEMP	
									2 ⚠

NOTES: 1. ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.
2. SEE DATA SHEET TE PAGE 1A.

DIVISION USAGE					
MM	P	PP	SH	FI	SP
	X				

APPROVALS
Des. Sect.
Sect. Supv.
Div.

Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

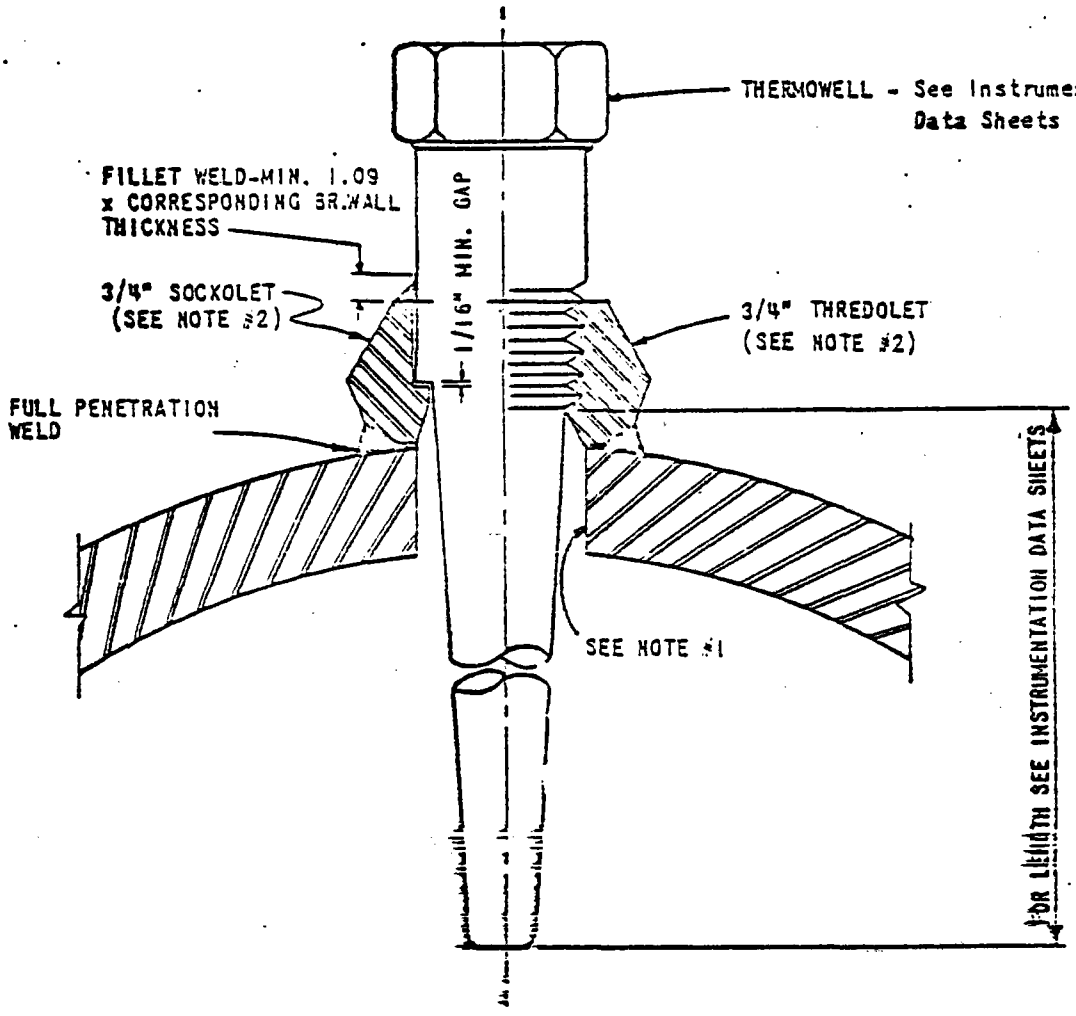
STANDARD NUMBER
DN 00.5

DATA SHEET TE
PAGE 2A

ISSUED
REVISED

THERMOWELL INSTALLATION STANDARD DETAIL

DO NOT USE FOR MAIN STEAM, HOT REHEAT OR COLD REHEAT



NOTES:

1. DRILL PIPE WALL TO MATCH I.D. OF WELDOLET.
2. USE 3/4" FITTINGS WHICH CONFORM TO STEARNS-ROGER SPECIFICATION, "PIPING MATERIALS".
3. SEE STANDARD DNCO.5, PAGE 2, FOR INSTALLATION IN 2-1/2" AND SMALLER PIPES.
4. SEE STANDARD DNCO.5, PAGES 3 AND 4 OF 5 FOR THERMOWELL INSTALLATION IN MAIN STEAM, HOT REHEAT AND COLD REHEAT.
5. DO NOT USE THREADED FITTING FOR SERVICE CONDITIONS WHICH EXCEED EITHER 900 PSI OR 800°F.

40I700217I

6

Stearns-Roger

THERMOCOUPLES

DATA SHEET TE
PAGE 3
S-R PROJECT 21700
ACCOUNT
DATE 2-21-81
BY RGB

CLIENT MDAC
PROJECT SOLAR ONE
LOCATION DAGGETT, CA
REVISIONS 1 2-20-81 BY RGB 2 BY 3 BY 4 BY
MANUFACTURER INSTRUMENT SERVICE CO. SOURCE: QUOTE OF

FORM NO. N-718a 12/77
BASED ON ISA S20

1 ■ COMPLETE ASSEMBLY OTHER

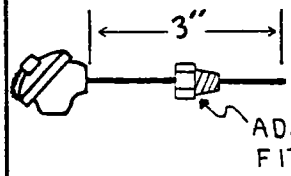
ELEMENT

2 TYPE ☐ BEADED INSULATORS
■ SHEATHED O.D., MATL 1/8 "
☐ PKD CONN NPT, MATL
☐ FIXED ■ ADJ
3 HOLDDOWN: ■ STD ☐ SPG LOAD
4 NO T/C: ■ SINGLE ☐ DUPLEX
5 JUNCTION TYPE:
☐ EXP ☐ GROUND ■ UNGROUND ☐ ENCLSD

6 MODEL NO. C2J9-R3-H-MGSC521

HEAD

7 ■ SCREWED COVER OTHER
8 MATERIAL ALUMINUM CONDUIT CONN
~~9 NIPPLE SIZE~~ DIM "N" ☐ UNION
~~WELL~~ SHEATH
10 MATERIAL: ■ 304SS ☐ 316SS
OTHER
~~11 CONSTR.~~ ☐ TAPERED ☐ STRAIGHT ☐ RED.TIP
☐ DRILLED ☐ BUILT-UP ☐ CLSD END
12 DIMENSIONS: ☐ MFR STD O.D. 1/8 " I.D.
13 CONN PROCESS: ■ SCRD 1/8 " NPT
☐ WELD IN FOR I.D. SOCKET
FLANGE: SIZE RATING & TYPE
MATERIAL



REV	TAG NO.	ACCT. NO.	WELL DIM. "U"	WELL DIM. "T"	ELEM. LENGTH	ISA TYPE	GAUGE	SERVICE (NOTE CORROSIVE AND EROSIVE SERVICE)	NOTES
	TE 1418				3"	J			

NOTES:

D.O.E. No. 40I 70C2171

Stearns-Roger

BIMETAL THERMOMETERS

DATA SHEET T1
PAGE 1
S-R PROJECT C-21700
ACCOUNT
DATE 4-30-80 REV P1
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS Co
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ______ BY ______ 3 ______ BY ______ 4 ______ BY ______
MANUFACTURER ______ SOURCE: QUOTE OF ______

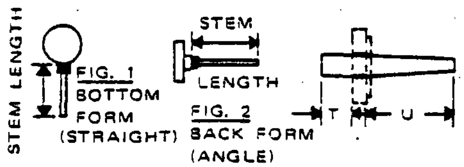
FORM NO. N-720a 12/77
BASED ON ISA S20

THERMOMETER

1 STEM: ☒ THREADED ☐ PLAIN ☐ UNION
MATERIAL ______
2 STEM CONN: ☒ 1/2" NPT OTHER ______
3 STEM DIA: ☐ MF STD ☒ 0.250 ☐ 0.375
4 CASE MATERIAL: ☒ SS OTHER ______
5 DIAL SIZE 5" COLOR BLACK ON WHITE
6 FORM: ☐ BOTTOM ☐ BACK ☒ ADJ
7 ☒ EXT CALIBRATOR HERM SEALED CASE
(8) MODEL NUMBER ______

WELL

9 ☐ NONE ☒ INCLUDED ☐ BY OTHERS
10 MATERIAL: ☐ 304SS ☒ 316SS
OTHER ______
(11) CONSTR: ☐ DRILLED ☐ BUILT-UP
OTHER ______
12 CONN. PROCESS: ☒ SCRD 3/4" NPT
☐ WELD IN FOR ______ "I.D. SOCKET
FLANGE: SIZE ______ RATING & TYPE ______
MATERIAL ______



REV	TAG NO.	ACCT. NO.	RANGE °F	OP TEMP	STEM LENGTH	WELL DIM "U"	WELL DIM "T"	SERVICE (NOTE CORROSIVE & EROSIVE SERVICE)	NOTES
	TI-1102		50°F – 500°F	400°F	4"	2½	2"	FW PRESS AFTER 1ST PT HTR TEMP	

NOTES: 1. ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

FORM NO. N-717a 12/77
BASED ON ISA S20

Stearns-Roger

TEMPERATURE INSTRUMENTS (FILLED SYSTEM)

DATA SHEET TS 1
PAGE
S-R PROJECT C-21700
ACCOUNT
DATE 5-20-80 REV P,
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA

REVISIONS 1 O'head BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____

MANUFACTURER ____ SOURCE: QUOTE OF ____

	1	TAG NUMBER	TS-1002 FLOW SHEET SERVICE DESUPER-HEATER OUTLET TEMP.
GENERAL	2	FUNCTION	☐ RECORD ☐ INDICATE ☒ CONTROL ☐ BLIND ☐ TRANS OTHER
	3	CASE	■ MFR STD NOM SIZE ____ COLOR: ■ MFR STD OTHER
	4	MOUNTING	☐ FLUSH ■ SURFACE ☐ YOKE OTHER
	5	ENCLOSURE CLASS	☐ GEN PUR ■ WTH PROOF ☐ EXP PROOF CLASS ____ GROUP ____ DIVISION ____ ☐ FOR USE IN INTRIN SAFE SYSTEM OTHER
	6	POWER SUPPLY	■ 117V 60 HZ OTHER ____ AC ____ DC ____ VOLTS
	~~7~~	~~CHART~~	☐ 12" CIRC OTHER ____ RANGE ____ NO.
	~~8~~	~~CHART DRIVE~~	☐ 24 HR OTHER ____ ☐ ELEC ☐ SPRING OTHER
	9	SCALE	TYPE ____ RANGE 1 ____ 2 ____ 3 ____
XMTR	~~10~~	~~TRANSMITTER OUTPUT~~	☐ 4-20 MA ☐ 10-50 MA ☐ 3-15 PSIG OTHER FOR RECEIVER SEE DATA SHEET
CONTROLLER	~~11~~	~~CONTROL MODES~~	P - PROP (GAIN), I - INTEGRAL (AUTO RESET), D - DERIVATIVE (RATE) ☐ P ☐ PI ☐ PID OTHER
	~~12~~	~~ACTION~~	ON MEAS. INCREASE OUTPUT: ☐ INCREASES ☐ DECREASES
	~~13~~	~~AUTO-MAN SWITCH~~	☐ NONE ☐ MFR STD OTHER
	~~14~~	~~SET POINT ADJ~~	☐ MANUAL ☐ EXTERNAL ☐ REMOTE OTHER
	~~15~~	~~MANUAL REG~~	☐ NONE ☐ MFR STD OTHER
	~~16~~	~~OUTPUT~~	☐ 4-20 MA ☐ 10-50 MA ☐ 3-15 PSIG OTHER
ELEMENT	(17)	FILL	SAMA CLASS ____ COMPENSATION
	18	PROCESS DATA	TEMP: NORMAL 338 °F MIN. 960 °F MAX. 960°F MAX. PRESS 98 PSIG CORROSIVE/EROSIVE DUE TO
	19	RANGE	☐ FIXED ADJ. RANGE YES SET AT > 375°F
	(20)	BULB	TYPE ____ MAT'L ____ EXTENSION: LENGTH ____ TYPE ____ SIZE: DIAMETER ____ LENGTH ____ INSERTION ____ CONN: ____ LOCATION: ____ FT ☐ ABOVE ☐ BELOW INSTR
	21	CAPILLARY	■ MFR STD LENGTH 25 FT MATERIAL SS ARMOR YES
	(22)	WELL	MAT'L 316 SS INSERTION ____ LAG EXT ____ CONN ____ CONST. ☐ DRILLED ■ BUILT-UP OTHER
ALARM	23	ALARM SWITCHES	QUANTITY 1 FORM DPDT RATING 120 V 60 HZ
	24	FUNCTION	■ TEMP ☐ DEVIATION CONTACTS TO CLOSE ON TEMP INCREASE
ACCES	25	ACCESSORIES	☐ FILT-REG ☐ SUP GAGE ☐ OUTPUT GAGE ☐ MTG YOKE ____ CHARTS OTHER
	(26)	MODEL NO.	

NOTES:
(1.) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY SUPPLIER.

D.O.E. No. 40I 7002 17I

Stearns-Roger

RECEIVER INSTRUMENTS

DATA SHEET TT
PAGE 1A
S-R PROJECT C-21700
ACCOUNT
DATE 4-30-80 REV P.
BY CAM

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT SOLAR ONE
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 (1) 6-17-80 BY PJS 2 (2) 9-30-80 BY REB 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-701a 12/77
BASED ON ISA S20

	1	TAG NO.	SEE PAGE 1B FLOW SHEET SERVICE SEE PAGE 1B
GENERAL	2	FUNCTION	☐RECORD ☐INDICATE ☐CONTROL ☐BLIND ☐INTEG OTHER TRANSMITTER
	3	CASE	■MFR STD ☐NOM SIZE COLOR: ■MFR STD OTHER ____
	4	MOUNTING	☐FLUSH ■SURFACE ☐RACK ☐MULTI-CASE OTHER ____ FOR MULTIPLE CASE SEE DATA SHEET ____
	5	ENCLOSURE CLASS	■GEN PUR ☐WTH PROOF EXP PROOF: CLASS ____ GROUP ____ DIVISION ____ ☐FOR USE IN INTRIN SAFE SYSTEM OTHER ____
	6	POWER SUPPLY	☐117V 60 HZ OTHER ____ ☐AC ■DC 24 VOLTS
	~~7~~	~~CHART~~	____"STRIP ____"CIRC ☐TIME MARKS RANGE ____ NO ____ NON-STANDARD CHART DRIVE ____ SPEED ____
	8	SCALE	TYPE NONE RANGE 1 ____ 2 ____ 3 ____ 4 ____
TRANSMITTER ~~CONTROLLER~~	~~9~~	~~CONTROL MODES~~	P-PROP (GAIN), I-INTEGRAL (AUTO RESET), D-DERIVATIVE (RATE, SUB: S-SLOW, F-FAST ☐P ☐PIS ☐PIF ☐PIFDF ☐PISDS ☐IF OTHER ____
	~~10~~	~~ACTION~~	ON MEASURE INCREASE OUTPUT: ☐INCREASES ☐DECREASES
	~~11~~	~~AUTO-MAN SWITCH~~	☐NONE ☐MFR STD OTHER ____
	~~12~~	~~SET POINT ADJ~~	☐MANUAL ☐EXTERNAL ☐REMOTE OTHER ____
	~~13~~	~~MANUAL REG~~	☐NONE ☐MFR STD OTHER ____
	14	OUTPUT	■4-20 MA ☐10-50 MA ☐3-15 PSIG OTHER ____
INPUTS	15	INPUT SIGNALS	☐4-20 MA ☐10-50 MA ☐3-15 PSIG OTHER MV (CHROMEL-ALUMEL THERMOCOUPLE)
	16	NO OF INPUTS	■1 ☐2 ☐3 ☐4
	17	POWER FOR XMTRS	■EXTERNAL ☐THIS INST NO OF INDEPENDENT SUPPLIES 1 FOR TRANSMITTERS, SEE DATA SHEET ____
ALARMS	~~18~~	~~ALARM SWITCHES~~	QUANTITY ____ FORM ____ RATING ____
	~~19~~	~~FUNCTIONS~~	☐MEAS VAR ☐DEVIATION ☐CONTACTS TO ____ ON INC MEAS
	20	ACCESSORIES	☐FILTER REG ☐SUP GAGE ____ CHARTS ☐INT ILLUMINATION OTHER MOUNTING BRACKET
	(21)	MODEL NO	ROSEMOUNT MODEL 444 OR ENGINEER APPROVED EQUAL (1)

NOTES: 1. ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER
2. TRANSMITTER TO INCLUDE THERMOCOUPLE REFERENCE JUNCTION

O.O.E. No. 401 70C 2171

Stearns-Roger

RECEIVER INSTRUMENTS

DATA SHEET TT
PAGE 13
S-R PROJECT C-21700
ACCOUNT
DATE 4-30-90 REV P
BY CAM

CLIENT MCDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT SOLAR ONE
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 1 8-25-90 BY REB 3 2 9-30-80 BY REB 4 BY
MANUFACTURER SOURCE: QUOTE OF

FORM NO. N701b 12/77
BASED ON ISA S20

REV	TAG NO	ACC'T NO.	OPER/DESIGN TEMP °F	SCALE RANGE	MEAS'M'T INCR OUTPUT INCR	MEAS'M'T INCR OUTPUT DECR	FLOW SHEET	SERVICE	NOTES
	TT-1002		338/960°/960°	0-1000°F	✓		40P7005133140	CONDENSATE TO DS-901 TEMP	
	TT-1004		345°/345°	0-600°F	✓		40P7005133140	CONDENSATE TO DS-902 TEMP	
1	TT-1001		960°/1010°	0-1000°F	✓		40P7005133140	MAIN STEAM TO DS-901	
1	TT-1022		960°/1010°	0-1000°F	✓		40P7005133140	MAIN STEAM TO TURBINE	
1	TT-1025		525°/580°	0-600°F	✓		40P7005133140	ADMISSION STEAM TO TURBINE	
2	TT-1102		398°/440°	0-600°F	✓		40P7005133141	FW TEMP TO DAS	

NOTES:

Temperature Transmitter Data
Sheet TT (Page 2A) Deleted

Temperature Transmitter Data
Sheet (Page 2B) deleted

D.O.E. # 40I700217I

FORM NO. N-721A 12/71 BASED ON ISA S20

Stearns-Roger

CONTROL VALVES (SPECIAL)

DATA SHEET TV
PAGE 2
S-R PROJECT C-21700
ACCOUNT
DATE 4-23-80 REV B
BY CAM

CUSTOMER McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ______ BY ______ 3 ______ BY ______ 4 ______ BY ______
MANUFACTURER ______ SOURCE: QUOTE OF ______

Section	No.	Item				
GENERAL	1	TAG NUMBER	TV-1420			
	2	SERVICE	SERVICE WTR TO THERMAL			
	3		STOR. BLOWDOWN TK V-309			
	4	LINE: SIZE, NUMBER	2½"-SW-5-ABA			
BODY & TRIM	5	TYPE OF BODY	GLOBE			
	(6)	BODY SIZE / PORT SIZE				
	(7)	GUIDING / NO. OF PORTS				
	8	END CONN & RATING	SCREWED 600#			
	9	PIPE SCHEDULE OR BORE	SCH. 80			
	10	BODY MATERIAL	CARBON STEEL			
	(11)	PACKING MATERIAL				
	~~12~~	~~LUBRICATOR / ISO VALVE~~				
	13	BONNET TYPE	BOLTED			
	14	TRIM FORM	LINEAR			
	(15)	TRIM MATERIAL				
	16	TIGHT SHUTOFF REQD	YES CLASS 4			
ACTUATOR	17	TYPE OF ACTUATOR	DIAPHRAGM			
	(18)	MODEL NO. & SIZE				
	(19)	CLOSE AT / OPEN AT				
	(20)	PUSH DOWN TO / FLOW ACTION TO				
	21	FAIL POSITION	OPEN			
	22	HANDWHEEL & LOCATION	YES & TOP			
	23	AIR SUPPLY PRESSURE	80~100 PSIG			
	24	TRAVEL INDICATOR	YES			
POSIT.	(25)	MODEL NO.				
	26	FILTER REG / GAUGES / BYPASS	YES	YES	YES	
	27	INPUT SIGNAL	3-15 PSIG			
	(28)	OUTPUT SIGNAL				
~~PILOT~~	~~29~~	~~MODEL NO. / ACTION~~				
	~~30~~	~~CONTROL MODES~~				
	~~31~~	~~MOUNTING / OUTPUT~~				
	~~32~~	~~ELEMENT TYPE / RANGE~~				
	~~33~~	~~MATERIAL~~				
	~~34~~	~~FILTER REG / MOUNTING~~				
ACCESS.	35	SOLENOID / TAG NO./REF	NO			
	36	LIMIT SWITCHES / TAG NO./REF	NO			
	37					
FLUID DATA	38	FLUID (1)	SERVICE WATER			
	39	FLOW MAX DES MIN	64,254	64,254	883	
	40	TEMP °F MAX DES MIN	70°	70°	60°	
	41	△PRESS MAX DES MIN	81.4	81.4	83.4	
	42	INLET PRESS MAX DES MIN	88	88	90	
	43	MAXIMUM SHUTOFF △P		100		
	44	CAL. CV MAX DES MIN	14.24	14.24	0.19	
	(45)	VALVE CV MAX DES MIN				
	46	VALVE VEL. MAX DES MIN	8.6	8.6	0.12 ft/sec	
	47	PERCENT FLASH / PERCENT SOLIDS	0	NEGLIGIBLE		
	(48)	MODEL NUMBER				

NOTES: (1) FLOW UNITS: LIQUID #/HR, STEAM ______, GAS ______
(2) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER

TAG NO.

DOE NO. 4OI7002171

Stearns-Roger

CONTROL VALVES (SPECIAL)

DATA SHEET TV
PAGE 3
S-R PROJECT 21700
ACCOUNT
DATE 6-26-80
BY SDM

CUSTOMER MDAC
PROJECT SOLAR ONE
LOCATION DAGGETT, CA
REVISIONS 1 △ 12-3-90 BY SDM 2 △ 2-18-91 BY REB 3 ______ BY ______ 4 ______ BY ______
MANUFACTURER JORDAN SOURCE: QUOTE OF

FORM NO. N-721A 12/71 BASED ON ISA S20

Section	No.	Item		Value			
GENERAL	1	TAG NUMBER		TV 1418			
	2	SERVICE		50/50 ETHYLENE GLYCOL /WATER			
	3	FLOW SHEET		P3-13			
	4	LINE: SIZE, NUMBER		1/2"-EW-8-ZSD			
BODY & TRIM	5	TYPE OF BODY		GLOBE			
	(6)	BODY SIZE	PORT SIZE				
	(7)	GUIDING	NO. OF PORTS		1		
	8	END CONN & RATING		NPT			
	9	PIPE SCHEDULE OR BORE		1/2" O.D. 0.065" WALL			
	10	BODY MATERIAL		STAINLESS STEEL			
	(11)	PACKING MATERIAL					
	(12)	LUBRICATOR	ISO VALVE				
	13	BONNET TYPE		SCREWED			
	14	TRIM FORM		LINEAR			
	(15)	TRIM MATERIAL					
	16	TIGHT SHUTOFF REQD		NO/ SEE NOTE 3 △			
ACTUATOR	17	TYPE OF ACTUATOR		DIAPHRAM			
	(18)	MODEL NO. & SIZE					
	(19)	CLOSE AT	OPEN AT				
	(20)	PUSH DOWN TO	FLOW ACTION TO				
	21	FAIL POSITION		OPEN			
	22	HANDWHEEL & LOCATION		NONE			
	23	AIR SUPPLY PRESSURE		80 ~ 100 PSIG			
	24	TRAVEL INDICATOR		YES			
POSIT.	~~25~~	~~MODEL NO.~~					
	~~26~~	~~FILTER REG~~	~~GAUGES~~ ~~BYPASS~~				
	~~27~~	~~INPUT SIGNAL~~					
	~~28~~	~~OUTPUT SIGNAL~~					
PILOT	~~29~~	~~MODEL NO.~~	~~ACTION~~				
	~~30~~	~~CONTROL MODES~~					
	~~31~~	~~MOUNTING~~	~~OUTPUT~~				
	~~32~~	~~ELEMENT: TYPE~~	~~RANGE~~				
	~~33~~	~~MATERIAL~~					
	~~34~~	~~FILTER REG~~	~~MOUNTING~~				
ACCESS.	35	SOLENOID	TAG NO./REF	YES	SEE SHEET SOV PG 11 △		
	~~36~~	~~LIMIT SWITCHES~~	~~TAG NO./REF~~				
	(37)	TOTAL VALVE WEIGHT					
FLUID DATA	38	FLUID (1)		50% ETHYLENE GLY / 50% WATER			
	39	FLOW	MAX DES MIN	2	1.6	NOTE 3 △	
	40	TEMP OF	MAX DES MIN	130°F	125°F	60°F	
	41	△ PRESS	MAX DES MIN	10	10	0	psi
	42	INLET PRESS	MAX DES MIN	22	22	0	psig
	43	MAXIMUM SHUTOFF △P		25 psi			
	(44)	CAL. CV	MAX DES MIN	0.632	0.506		
	(45)	VALVE CV	MAX DES MIN				
	46	VALVE VEL.	MAX DES MIN		2.73		
	47	PERCENT FLASH	PERCENT SOLIDS	0/0			
	(48)	MODEL NUMBER		JORDAN MARK 76 △			

NOTES: (1) FLOW UNITS: LIQUID GPM . STEAM ______ . GAS ______

(2) ENCIRCLED ITEM NOS. INDICATE DATA TO BE COMPLETED BY BIDDER.

(3) VALVE TO HAVE ORIFICE SIZED FOR PUMP MINIMUM FLOW WHEN VALVE IS CLOSED. △

TAG NO.

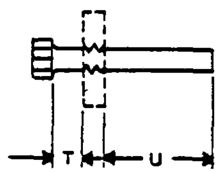
D.O.E. # 40I700217I

Stearns-Roger — TEST WELLS

DATA SHEET TW
PAGE 1A
S-R PROJECT C-21700
ACCOUNT
DATE 4-21-80 REV P,
BY CAN

CLIENT MCDONNELL DOUGLAS ASTRONAUTICS CO
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 △ 10-27-80 BY RGA 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

1	MATERIAL:	☐ 304SS	☐ 316SS	OTHER 2 1/4 % CHROME MOLY ASTM A182 F22	
(2)	TYPE:	☐ DRILLED	☐ BUILT-UP	CONSTR: ■ TAPERED	☐ STRAIGHT
3	CONN. PROCESS:	☐ SCRD ____ NPT; WELD IN CONN.	FLANGE: SIZE ____	RATING & TYPE ____	MATERIAL ____
4	INTERNAL	1/2" NPT	BORE:	☐ MFG. STD.	OTHER 0.260"
5	PLUG & CHAIN	■ YES	☐ NO		
	MATERIAL:				
6	PLUG:	■ BRASS	☐ ALUM	☐ S.S.	☐ STEEL
7	CHAIN:	■ BRASS	☐ ALUM	☐ S.S.	☐ STEEL



SEE PAGES 1B & 1C ALSO

REV.	TAG NO.	TM (1)	WELL DIM. "U"	WELL DIM. "T"	SERVICE	NOTES
	TW-1022		2 1/2"		MAIN STEAM TO TURBINE TEMP. WELL	2 △
	TW-1026		2 1/2"		TSS STEAM TO TURBINE TEMP. WELL	

NOTES: 1. TM IS MINIMUM PIPE WALL THICKNESS
2. TW-1022 SUPPLIED BY SPECIFICATION 40P700205, CONTRACTOR TO FURNISH PLUG AND CHAIN ONLY.

FORM NO. N-744 12/77

DIVISION USAGE					
MM	P	PP	SH	FI	SP

APPROVALS
Des. Sect. [signature]
Sect. Supv. [signature]
Div. [signature]

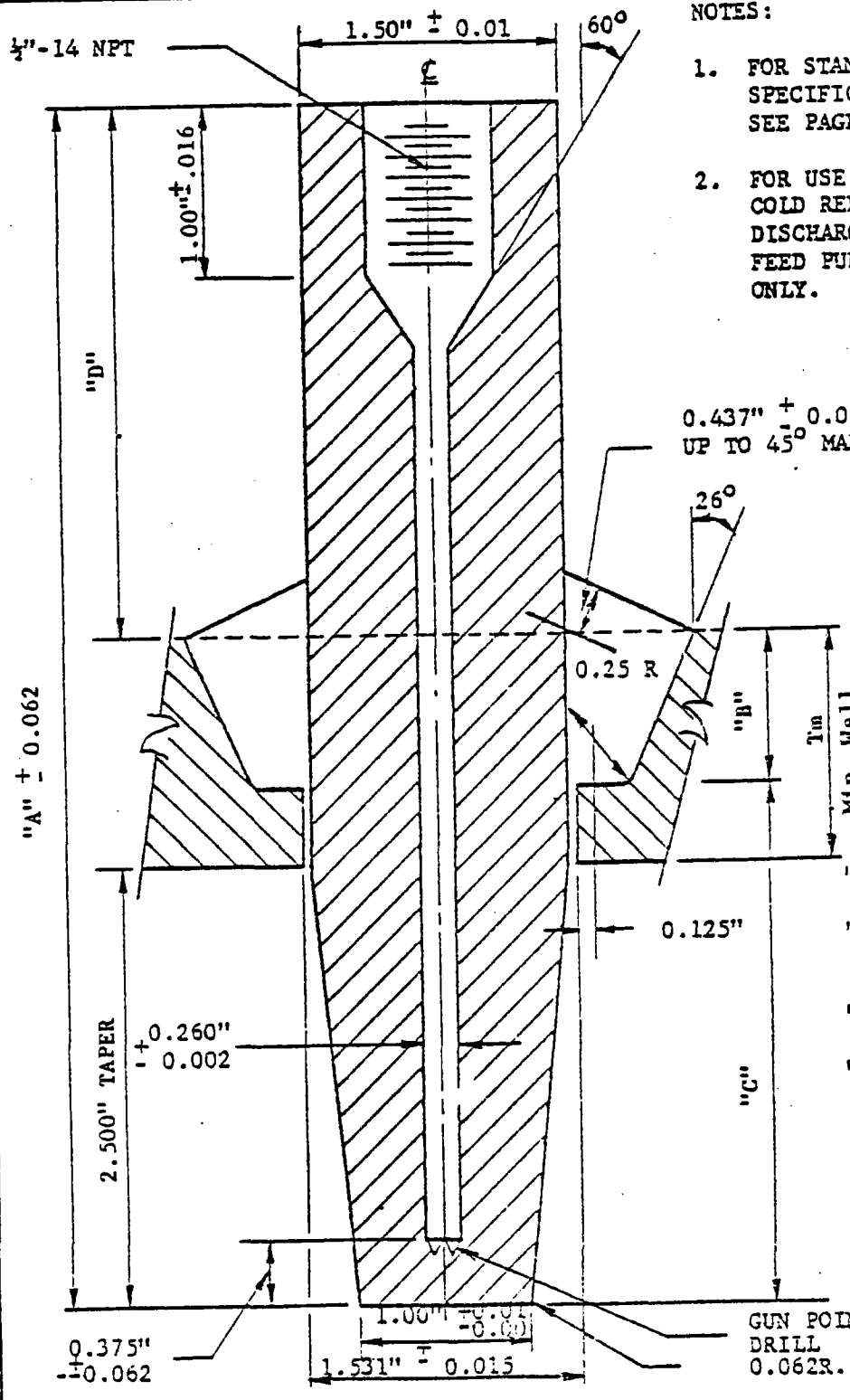
Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
DN 00.5

DATA SHEET TW
PAGE 18

ISSUED 6-22-80 REV 0
REVISED

THERMOWELL INSTALLATION STANDARD DETAIL



NOTES:

1. FOR STANDARD THERMOWELL SPECIFICATIONS AND DIMENSIONS SEE PAGE 3 of 5.
2. FOR USE ON MAIN STEAM HOT REHEAT, COLD REHEAT, BOILER FEED PUMP DISCHARGE, AUX. STEAM & BOILER FEED PUMP TURBINE DRIVE SYSTEMS ONLY.

"A" = SEE TABLE

"B" = .65 x Tm < 2.25"
= .7 x Tm > 2.25"

"C" = 2.50 + (Tm-"B")

"D" = "A"-2.50-Tm

DIVISION USAGE					
MM	P	PP	SH	FI	SP

Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
DN 00.5

APPROVALS
Des. Sect.
Sect. Supv.
Div.

DATA SHEET TW
PAGE 1C

THERMOWELL INSTALLATION STANDARD DETAIL

ISSUED 6-2080 REV C
REVISED

MINIMUM PIPE WALL THICKNESS Tm	TOT. LGTH. "A"	STRENGTH W. "B"	INSERT LGTH. "C"	LAG EXT. "D"
1. SMALLER THAN 0.625	7.000	0.406	2.719	3.875
2. FROM 0.626 to 0.750	7.000	0.487	2.773	3.750
3. FROM 0.751 to 0.875	7.000	0.568	2.807	3.625
4. FROM 0.876 to 1.000	7.000	0.650	2.850	3.500
5. FROM 1.001 to 1.125	7.000	0.731	2.894	3.375
6. FROM 1.126 to 1.312	8.000	0.825	2.960	4.188
7. FROM 1.313 to 1.437	8.000	0.934	3.003	4.063
8. EROM 1.438 to 1.562	8.000	1.015	3.047	3.938
9. FROM 1.563 to 1.750	8.000	1.133	3.112	3.750
10. FROM 1.751 to 2.000	8.000	1.300	3.200	3.500
11. FROM 2.001 to 2.250	9.000	1.462	3.288	4.250
12. FROM 2.251 to 2.500	9.000	1.750	3.250	4.000
13. FROM 2.501 to 2.750	9.000	1.930	3.320	3.750
14. FROM 2.751 to 3.000	9.000	2.100	3.400	3.500
15. FROM 3.001 to 3.250	10.000	2.275	3.475	4.250
16. FROM 3.251 to 3.500	10.000	2.450	3.550	4.000
17. FROM 3.501 to 3.750	10.000	2.625	3.625	3.750
18. FROM 3.751 to 4.000	11.000	2.800	3.700	4.500
19. FROM 4.001 to 4.250	11.000	2.975	3.775	4.250

NOTES:

1. Thermowell material shall be 2-1/4% chrome moly, ASTM 182 F22, with a carbon content not to exceed 0.12%.

2. All welding and stress relieving shall be done in accordance with Section I of the ASME Power Boiler Code and the ANSI 31.1 Power Piping Code.

3. The tag number of each thermowell shall be inscribed at the top end of the thermowell above the weld area.

4. Each thermowell shall be cleaned, and all dirt, metal chips, or other foreign material shall be removed; and a 1/2"-square head carbon steel plug shall be installed to protect the thermowell until the thermocouple element is installed.

DIVISION USAGE					
MN	P	PP	SH	FI	SP
	X				

APPROVALS
Des. Sect.
Sect. Supv.
Div.

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

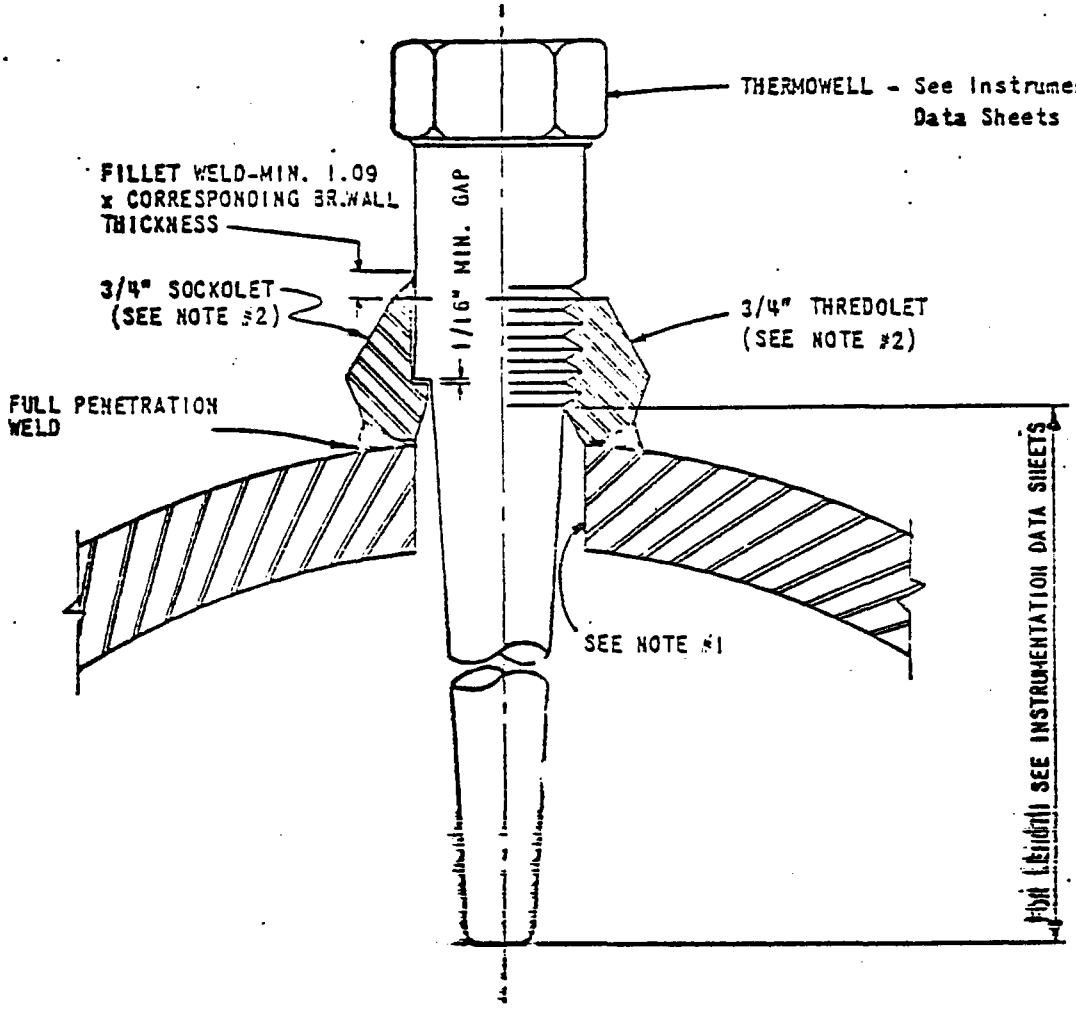
STANDARD NUMBER
DN 00.5

THERMOWELL INSTALLATION STANDARD DETAIL

DATA SHEET TW
PAGE 1D

ISSUED 10-27-80
REVISED

DO NOT USE FOR MAIN STEAM, HOT REHEAT OR COLD REHEAT



NOTES:

1. DRILL PIPE WALL TO MATCH I.D. OF WELDOLET.
2. USE 3/4" FITTINGS WHICH CONFORM TO STEARNS-ROGER SPECIFICATION, "PIPING MATERIALS".
3. SEE STANDARD DN00.5, PAGE 2, FOR INSTALLATION IN 2-1/2" AND SMALLER PIPES.
4. SEE STANDARD DN00.5, PAGES 3 AND 4 OF 5 FOR THERMOWELL INSTALLATION IN MAIN STEAM, HOT REHEAT AND COLD REHEAT.
5. DO NOT USE THREADED FITTING FOR SERVICE CONDITIONS WHICH EXCEED EITHER 900 PSI OR 800°F.

Stearns-Roger

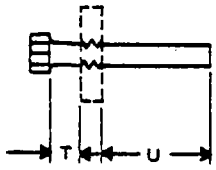
TEST WELLS

DATA SHEET TW
PAGE 3
S-R PROJECT [illegible]
ACCOUNT
DATE [illegible]
BY [illegible]

CLIENT McDONNELL DOUGLAS ASTRONAUTICS CO.
PROJECT 10 MWe SOLAR PILOT PLANT
LOCATION DAGGETT, CALIFORNIA
REVISIONS 1 [illegible] BY [illegible] 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-744 12/77

1	MATERIAL:	☐ 304SS	☒ 316SS	OTHER ____		
2	TYPE:	☒ DRILLED	☐ BUILT-UP	CONSTR:	☒ TAPERED	☐ STRAIGHT
3	CONN. PROCESS:	☒ SCRD 3/4" NPT	FLANGE: SIZE ____	RATING & TYPE ____	MATERIAL ____	
4	INTERNAL 1/2" NPT	BORE:	☐ MFG. STD.	OTHER ____		
5	PLUG & CHAIN MATERIAL:	☒ YES	☐ NO			
6	PLUG:	☐ BRASS	☐ ALUM	☒ S.S.	☐ STEEL	
7	CHAIN:	☐ BRASS	☐ ALUM	☒ S.S.	☐ STEEL	



REV.	TAG NO.	ACCT. NO.	WELL DIM. "U"	WELL DIM. "T"	SERVICE	NOTES
	TW 59		2½		TSS FEEDWATER	

NOTES:

CONTRACTOR-FURNISHED EQUIPMENT
(TEMPORARY-STEAM BLOW AND FLUSH)

5

DOE NO 40I700217 I

Stearns-Roger

PRESSURE GAUGES

DATA SHEET PI
PAGE 1T
S-R PROJECT C 21700
ACCOUNT
DATE 1-12-31
BY RGB

CLIENT MDAC
PROJECT SOLAR ONE
LOCATION DAGGETT, CA.
REVISIONS 1 0 1-12-31 BY RGB 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-716a REV. 11/77
BASED ON ISA S20

GENERAL

1 TYPE: ☒ DIRECT RDG ☐ 3-15# RECEIVER
OTHER ____
2 MTG: ☐ SURFACE ,, ☒ LOCAL ☐ FLUSH
3 DIAL: DIAMETER 4½ COLOR ____
4 CASE: ☐ CAST IRON ☐ ALUMINUM ☒ PHENOL
OTHER ____
5 RING: ☒ SCREWED ☐ HINGED ☐ SLIP ☐ SNAP OTHER ____
6 BLOW-OUT: ☐ NONE ☐ BACK ☒ DISC
OTHER ____
7 LIQ.FIL: ☐ GLYCERINE ☐ SILICONE
OTHER ____
8 WINDOW: ☒ GLASS ☐ PLASTIC
OTHER ____
9 MODEL NUMBER ____

ELEMENT

10 PRESS ELEMENT: ☒ BOURDON ☐ BELLOWS
OTHER ____
11 ELEM MTL: ☒ BRONZE ☐ STEEL ____ SS
OTHER
12 SOCK MTL: ☒ BRASS ☐ STEEL ____ SS
OTHER ____
13 CONN: NPT ☐ 1/4" ☒ 1/2" OTHER ____ ☐ BOTTOM ☐ BACK
14 MOVEMENT: ☐ BRONZE ☒ SS ☐ NYLON
OTHER ____
15 ZERO ADJUSTMENT YES
16 ACCURACY: ☐ 1/4% ☐ 1/2% ☐ 1% ☒ 2%

REV	TAG NO	NO REQD	ACCT NO	RANGE PSIG	OP PRES PSIG	SERVICE	ACCESSORIES	NOTES
	PI 80B	1		0-15	10	STEAM BLOWING	COIL SYPHON	
	PI 80C	1		0-15	10	↓	↓	
	PI 80D	1		0-15	10	↓	↓	
	PI 80E	1		0-15	10	↓	↓	

NOTES:

Stearns-Roger

RELIEF VALVES

DATA SHEET PSV
PAGE 1T
S-R PROJECT Solar One
ACCOUNT C-21700
DATE 11/11/80
BY SDM

CLIENT MDAC
PROJECT Solar One
LOCATION Daggett California
REVISIONS 1 ~~10/13/80~~ BY SDM 2 ____ BY ____ 3 ____ BY ____ 4 ____ BY ____
MANUFACTURER ____ SOURCE: QUOTE OF ____

FORM NO. N-724 12/77
BASED ON ISA S20

GENERAL	1	TAG NUMBER	PSV-BOA			
	2	SERVICE	Steam			
	3	ACCOUNT NO.				
	4	LINE NO./VESSEL NO.	6"-SP-25-F8A			
	5	FULL NOZZLE/SEMI-NOZZLE	Full			
	6	CONV, BELLOWS, PILOT OPER.	Conventional			
	7	BONNET: OPEN/CLOSED				
	8	FLOW SHEET	P3-12B			
CONN.	9	SIZE: INLET / OUTLET	4" / 6"			
	10	FLANGE RATING OR SCREWED	ANSI 300lb / ANSI 150lb			
	11	TYPE OF FACING	RF / RF			
MATERIALS	12	BODY	ASTM A216 Grade WCB	Carbon Steel		
	13	SEAT AND DISC	ASTM A565 Grade	410 SS		
	14	RESILIENT SEAT SEAL				
	15	GUIDE AND RINGS	ASTM B149 Alloy	118		
	16	SPRING	Tungsten Steel			
	17	BELLOWS	N.A.			
	18					
ACCESS.	19	CAP: SCREWED OR BOLTED	Screwed			
	20	LEVER: PLAIN OR PACKED	Plain			
	21	TEST GAGE	N.A.			
	22					
	23					
BASIS	24	CODE				
	25	SIZING BASIS	Full Relief			
	26	RELIEVES TO	Atmosphere			
	27					
FLUID DATA	28	FLUID	Saturated Steam			
	29	REQUIRED CAPACITY	82500 lb/hr			
	30	SP GR @ 60°F / O.T.	1 / 0.00188			
	31	MOLECULAR WEIGHT	18			
	32	OPER. PRESSURE, PSIG	50			
	33	SET PRESSURE, PSIG	500			
	34	OPER. TEMPERATURE, °F				
	35	RELIEVING TEMPERATURE, °F	468°F			
	36	BACK PRESSURE : CONSTANT, PSIG	0			
	37	ADDITIONAL BUILD-UP, PSIG	0			
	38	ALLOWABLE OVERPRESSURE, %	10%			
	39	LATENT HEAT OF VAPOR.				
	40	RATIO OF SPECIFIC HEATS				
	41	VISCOSITY FACTOR				
	42	LIQUID VISCOSITY, ~~cps~~				
	43	CORROSIVE/EROSIVE DUE TO				
SELECTION	44	COMPRESSIBILITY FACTOR				
	45	MAXIMUM VALVE CAPACITY	97471 lb/hr			
	46	CALCULATED AREA, SQ. IN.	3.0			
	47	SELECTED AREA, SQ. IN.	3.6			
	48	ORIFICE DESIGNATION	M			
	49	Manufacturer (Typical)	Consolidated			
	50	MODEL NUMBER	1910 M±			

NOTES: CONTRACTOR SHALL INSURE RENTAL BOILER OUTPUT DOES NOT EXCEED PSV-BOA DESIGN CONDITION.

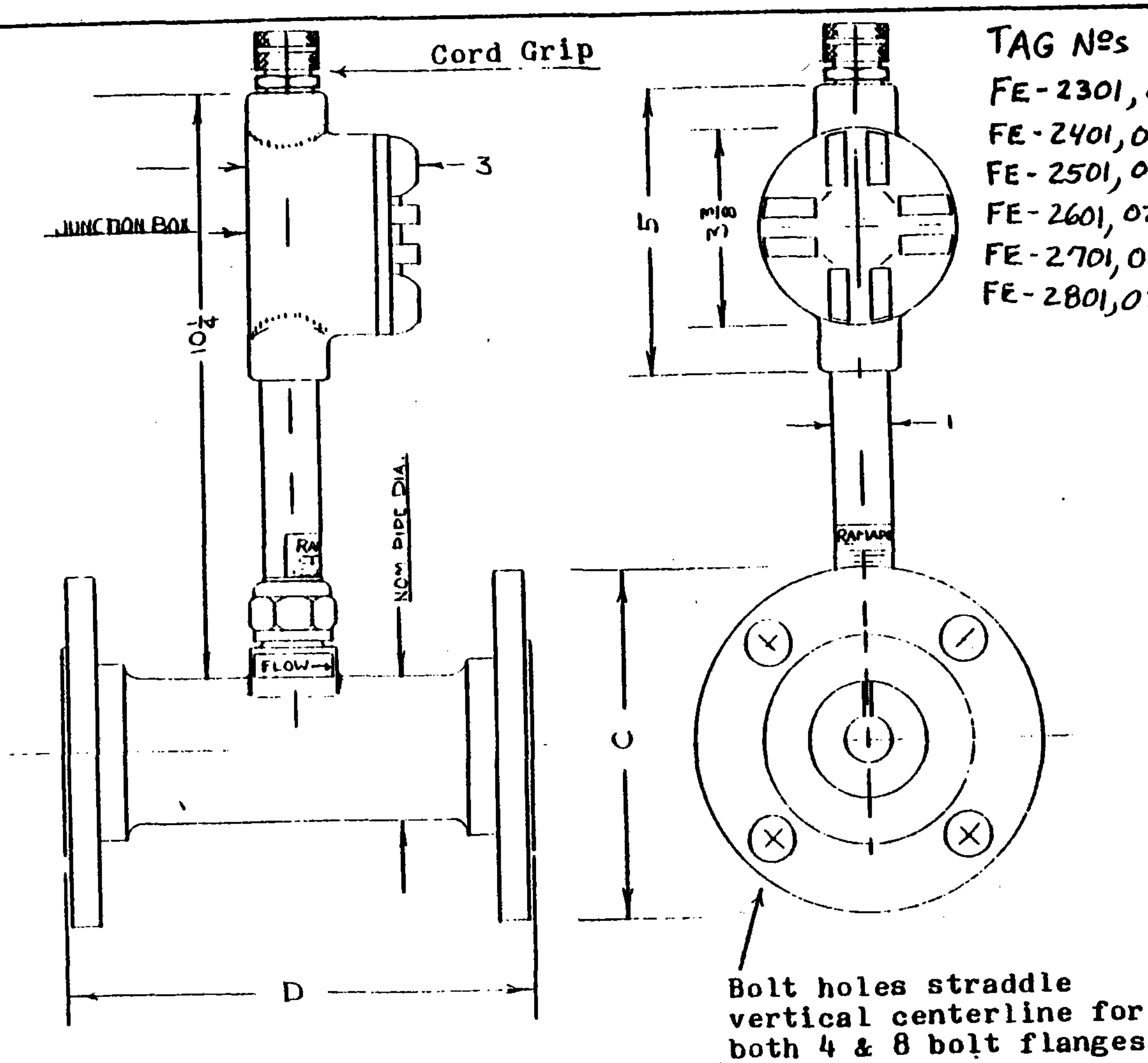
5

Flow elements requiring temporary spools for steam flush and steam blow are as follows: 5

FE-2301, 02, 03	FE-3105
FE-2401, 02, 03	FE-3504
FE-2501, 02, 03	
FE-2601, 02, 03	FEX-2230
FE-2701, 02, 03	FEX-2231
FE-2801, 02, 03	FEX-2232

Spools shall be fabricated per dimensions on data sheets. Reference Figures 1 thru 4. 5

For additional Contractor Furnished Equipment refer to Appendix D Vol. I - Temporary Flush and Steam Blow Data Sheets. (Page D-1) 6



TAG Nos:
FE-2301, 02, 03
FE-2401, 02, 03
FE-2501, 02, 03
FE-2601, 02, 03
FE-2701, 02, 03
FE-2801, 02, 03

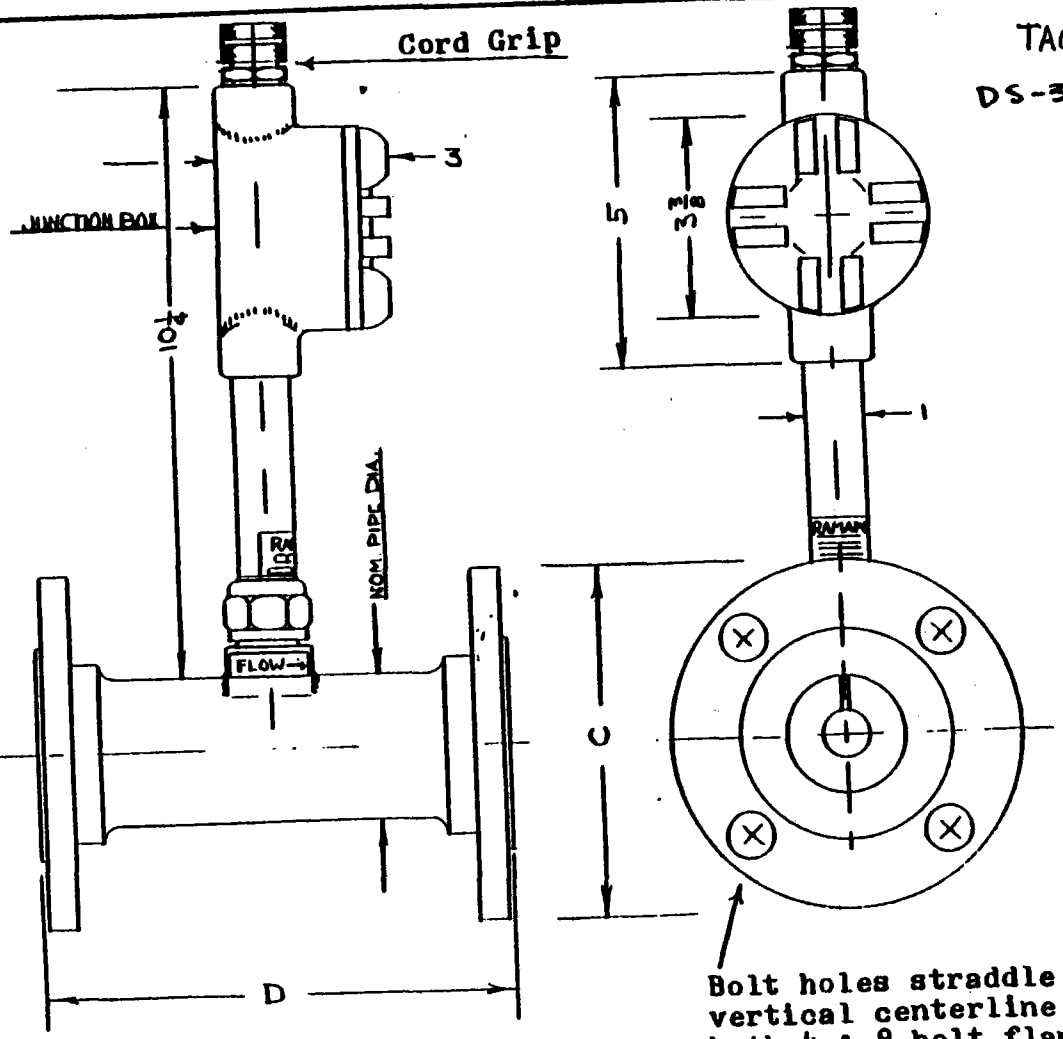
DATE	SYM	REVISION RECORD	AUTH	DR	CK
	A	REDRAWN		✓	✓

MODEL: MARK V-1-CFR7D
SERIAL NO.:
APPLICATION:

LINE SIZE: 1"
SCHEDULE: 80 PIPE
FLOW RATE:
FLANGE: 1"-2500# ANSI WELD NECK
MATERIALS
FLANGE: CARBON STEEL
SENSING ELEMENT: 17-4PH S.S.
OTHER: CARBON STL & T303&304 S.S.
DIM. "C": 6¼"
DIM. "D": 10"
JUNCTION BOX RATING:

TOLERANCES (EXCEPT AS NOTED)	RAMAPO INSTRUMENT COMPANY, INC.		
DECIMAL ±		SCALE NO	DRAWN BY HZ / APPROVED BY WMS
FRACTIONAL ± 1/8	TITLE OUTLINE MARK V FLOWMETER - FLANGED PIPE		
ANGULAR ±	DATE 3-18-64	DRAWING NUMBER 31030	

FIGURE 1



TAG № FE-3105

DS-301 WATER FLOW

DATE	BY	REVISION RECORD	AUTH	DR	CK
3-18-64	A	REDRAWN	JAA	✓	✓

MODEL: Mark V-1½-CFT6D

SERIAL NO.: 7836

APPLICATION: Rocketdyne Div.
Rockwell International

LINE SIZE: 1½"

SCHEDULE: 160 Pipe

FLOW RATE: 1,300 - 25,000#/Hr.

FLANGE: 1½"-1500# ANSI

MATERIALS

FLANGE: Carbon Steel

SENSING ELEMENT: 17-4 PH

OTHER: T304 S.S.

DIM. "C": 7"

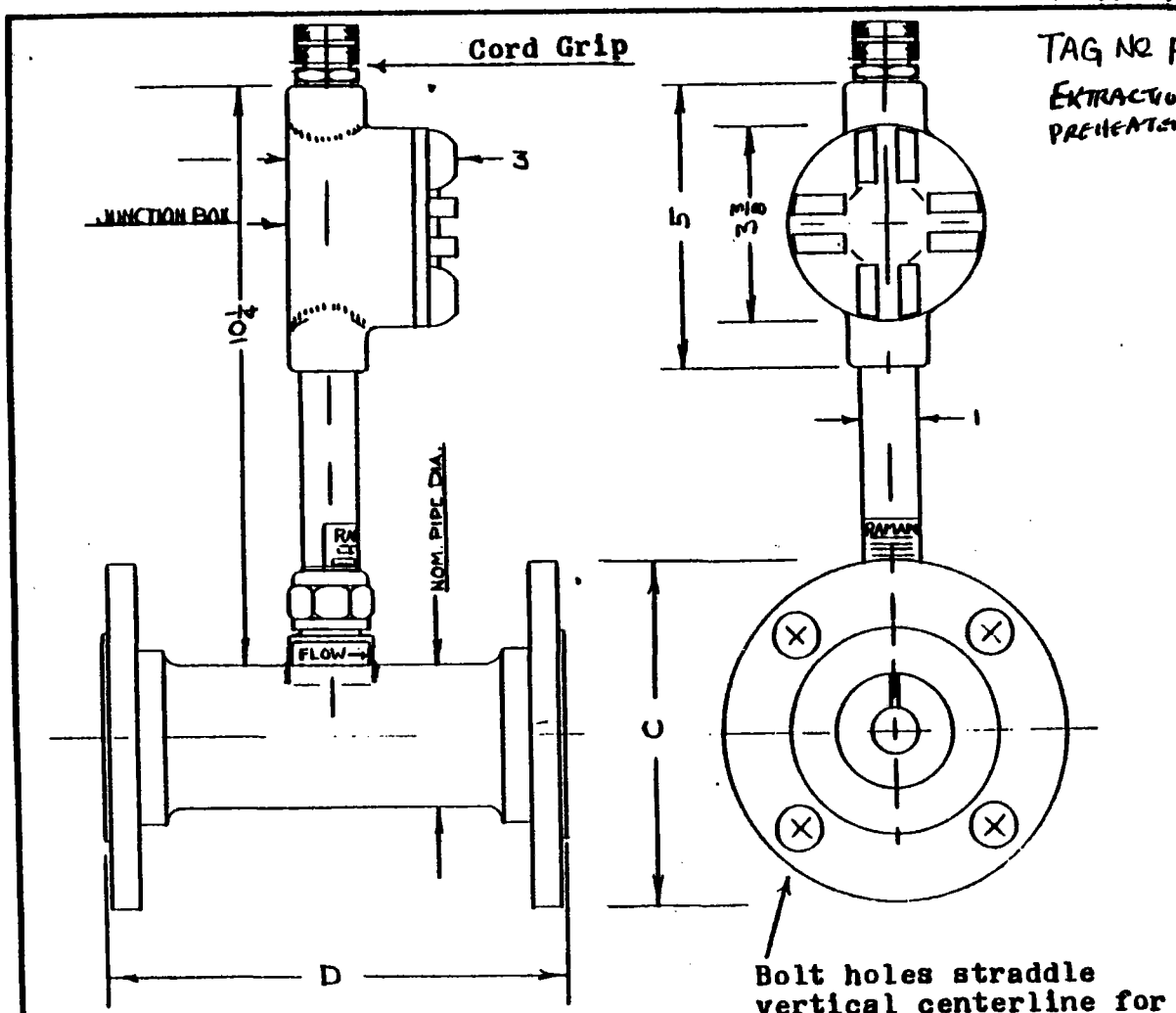
DIM. "D": 9"

JUNCTION BOX RATING: Class I, Groups C & D, Class II, Groups E, F, & G

TOLERANCES (UNLESS AS NOTED)	RAMAPO INSTRUMENT COMPANY, INC.		
DECIMAL ±		SCALE No	DRAWN BY HZ
FRACTIONAL ± 1/8	TITLE OUTLINE MARK V FLOWMETER - FLANGED PIPE		APPROVED BY WMS
ANGULAR ±	DATE 3-18-64	DRAWING NUMBER 31030	

FIGURE 2

TAG NO FE-3604



TAG NO FE-3504
EXTRACTION WATER PREHEATER FLOW

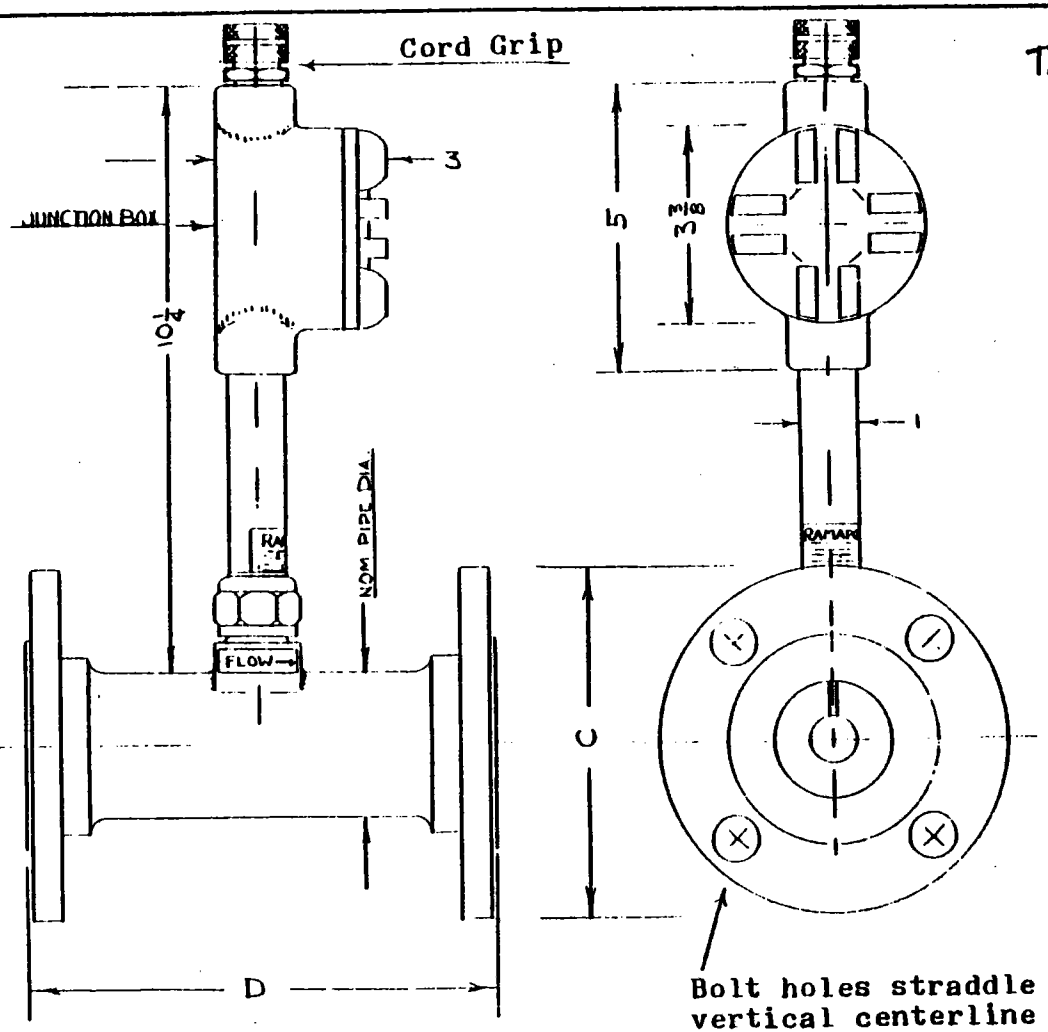
DATE	BY	REVISION RECORD	AUTH	DR.	CK.
5-7-74	A	REDRAWN	SAA	✓	✓

MODEL: Mark V-2½-CFT2
SERIAL NO.: 7831
APPLICATION: Rocketdyne Div. of Rockwell International
LINE SIZE: 2½"
SCHEDULE: 40 Pipe
FLOW RATE: 5,500 - 63,250 #/Hr.
FLANGE: 2½" - 300# ANSI
MATERIALS
FLANGE: Carbon Steel
SENSING ELEMENT: 17-4PH
OTHER: Carbon Steel & T304 S.S.
DIM. "C": 7½"
DIM. "D": 9"
JUNCTION BOX RATING: Class I, Groups C & D, Class II, Groups E, F, & G

TOLERANCES (UNLESS AS NOTED)	RAMAPO INSTRUMENT COMPANY, INC.		
DECIMAL ±		SCALE NO	DRAWN BY HB / APPROVED BY WMS
FRACTIONAL ± 1/8	TITLE OUTLINE MARK V FLOWMETER - FLANGED PIPE		
ANGULAR ±	DATE 3-18-64	DRAWING NUMBER 31030	

5

FIGURE 3



TAG NOs FEX-2230
FEX-2231
FEX-2232

DATE	SYM	REVISION RECORD	AUTH	DR	CK
6-7-74	A	REDRAWN	SAH	✓	✓

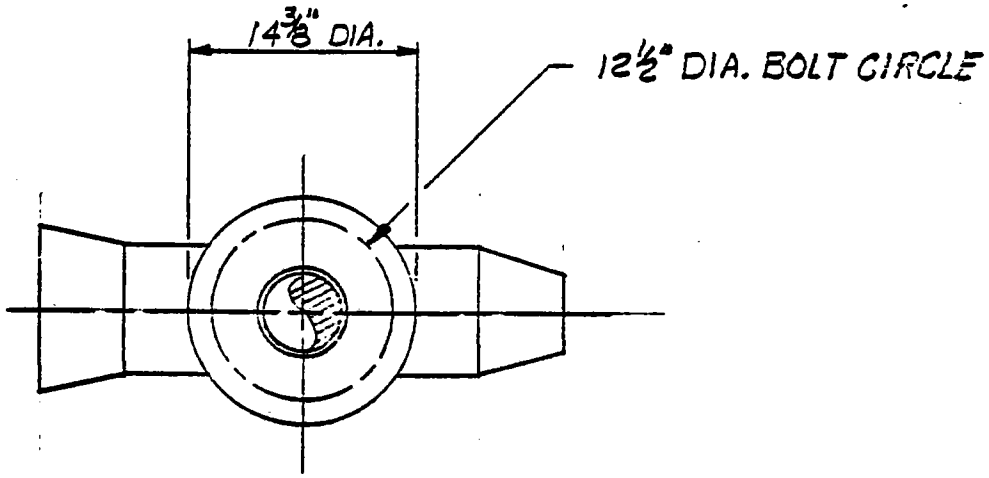
MODEL: MARK V - 2½ - CFT7D
SERIAL NO.:
APPLICATION:

LINE SIZE: 2½"
SCHEDULE: 80 PIPE
FLOW RATE: 15-150 GPM
FLANGE: 2½" - 2500# ANSI
MATERIALS
FLANGE: CARBON STEEL
SENSING ELEMENT: 17-4PH S.S
OTHER: CARBON STL & T304 S.S.
DIM. "C": 10½"
DIM. "D": 14½"
JUNCTION BOX RATING:

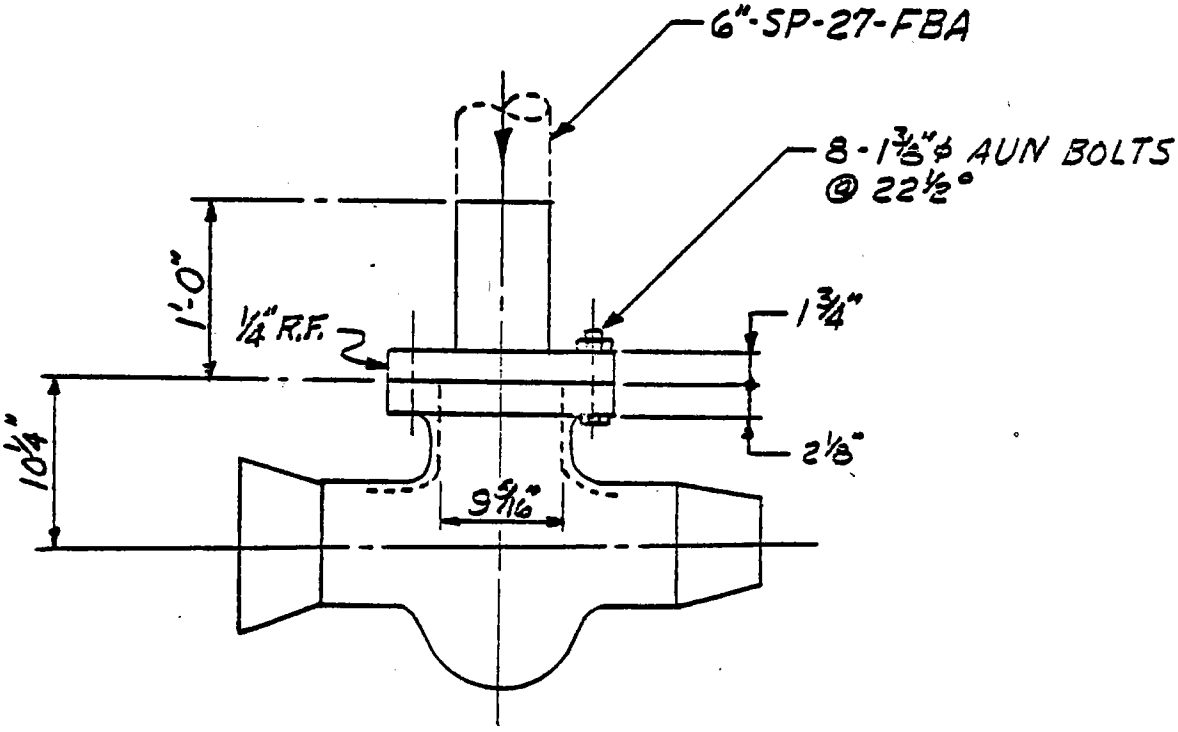
TOLERANCES (EXCEPT AS NOTED)	RAMAPO INSTRUMENT COMPANY, INC.		
DECIMAL ±		SCALE NO	DRAWN BY HZ APPROVED BY WMS
FRACTIONAL ± 1/8	TITLE OUTLINE MARK V FLOWMETER - FLANGED PIPE		
ANGULAR ±	DATE 3-18-64	DRAWING NUMBER 31030	

5

FIGURE 4



PLAN



ELEVATION

PV-1000

TEMPORARY FLUSHING
CONNECTION

1-26-81 BDR

SK-P74

APPENDIX 5

DETAILED SPECIFICATION FOR FIRE PROTECTION SYSTEMS

Area 700 (PSS)

DETAILED SPECIFICATION FOR FIRE PROTECTION SYSTEMS

1.0 SCOPE

The work shall consist of designing, furnishing, delivering, unloading, storing, removing from storage and installing at the jobsite complete fire protection systems for the facilities at the Solar 10 MW Pilot Plant. Systems shall include all piping, pipe hangers and supports, controls and associated components and services as specified herein.

2.0 SUPPLEMENTS

2.1. DRAWINGS

Drawing Number	S-R Dwg. No.	Sheet	Rev.	Title
40P7005133148	L-22934	P3-9	P_4	P&ID Fire Protection PSS Area
40P7005133247	L-22934	P7-1	0	Composite Drawing-Fire Protection System

2.2. Engineering Standards

Standard No.	Date	Title
E1 (DOE40P700-28S)	12/17/79	Piping Material Specification

2.3. Appendices as follows:

Appendix A - Portable Fire Extinguisher Schedule - Table I.

Appendix B - Fire Protection System Acceptance Forms.

A.1 Contractor's Material and Test Certificate - Sprinkler Systems/Water Spray Systems, 2 pages.

A.2 Foam System Acceptance Test Report, 3 pages.

A.3 Halon 1301 Fire Suppression System - Installation Acceptance Test Report, 4 pages.

A.4 Fire Detection System - Installation Acceptance Test Report, 3 pages.

Appendix C - Fire Protection Systems Bid Data Sheets.

2.4. Construction Schedule, to be provided by the Construction Manager.

3.0. EQUIPMENT AND SERVICES TO BE FURNISHED

The Contractor shall design, furnish, deliver, unload, store, remove from storage and install all materials and equipment necessary to provide complete fire protection systems shown on Drawings 40P7005133148 and 40P7005133247 as indicated: "by FPV" (Fire Protection Vendor) including, but not limited to, the following:

3.1. Wet Pipe Sprinkler/Fire Hose System. (Diesel Fire Pump Building) This system shall be furnished and installed complete with piping, pipe hangers and pipe supports, sprinklers, hose station and accessories as specified elsewhere herein.

3.2. Dry Standpipe System. (Warehouse Building - BL-703) This system shall be furnished and installed complete with automatic and manual control valves, piping, pipe hangers and supports, fittings, hose stations, pushbutton stations, wall fire hydrant and accessories as specified elsewhere herein.

3.3. Semi-Automatic Foam Monitor System. This system is to provide protection for the yard area TSS equipment and shall be furnished and installed complete with piping (both above and below ground), pipe hangers and supports, nozzles, four (4) monitor nozzles, detectors, pushbutton stations, controls and accessories as specified elsewhere herein. 2

3.4. Automatic Total Flooding Halon 1301 Systems. These systems shall provide protection for the Thermal Storage control Buildings (BL 709 & 710) and the Primary Electronics Rooms in the Receiver Tower. Systems shall consist of all piping, hangers and supports, agent storage containers, Halon 1301 gas plus 100 percent reserve, Freon 122 test gas, nozzles, detectors, controls and all other accessories as specified elsewhere herein. 2 2

3.5. Fire Detection Systems. These systems shall provide detection for the Warehouse Building (BL-703), Cooling Tower Remote MCC Building, Electrical Equipment Building (BL-712) and TSS Pump/Heat Exchanger Areas, and shall consist of detectors, control panels and accessories as specified elsewhere herein.

3.6. Fire Extinguishers. Furnish and install fire extinguishers as shown on APPENDIX A, PORTABLE FIRE EXTINGUISHER SCHEDULE.

3.7. All fire detection, instrumentation, control panels required to form complete fire protection and detection systems, including all detection devices, voltage transformers, rectifiers and regulating equipment, relays, logic equipment and terminal box materials.

3.8. Electrical drawings for all instruments and controls associated with components supplied under this Specification.

3.9. All fire alarm horns and audio-visual alarms.

3.10. All pressure gages and waterflow alarm indicators on piping and equipment furnished by Contractor.

3.11. All other accessories or components required to form complete operating units, but which are not specifically called for herein, shall also be furnished as part of the work.

3.12. Furnishing only of pressure sensitive tape for use in marking of wall or column identification for both fire hose stations and portable fire extinguishers.

3.13. Labor and supervision for unloading, storing, erection and start-up of all equipment comprising the Fire Protection Systems as specified herein.

3.14. Spare parts, maintenance and repair tools, and devices as specified herein.

3.15. Metal support posts for Foam Monitor System pushbutton stations.

3.16. Core drilling of all concrete for installation of all associated piping.

3.17. Core drilling and sleeves in masonry walls, where required, and cutting and flashing of openings in metal walls.

3.18. Concrete foundations of adequate size to properly anchor and support all piping, valves, and any other component associated with the Fire Protection Systems, as and where necessary.

3.19. Primer finish on all pipe, fittings, hangers and auxiliary steel, as well as touch-up of all damaged galvanized pipe.

3.20. Field testing as specified elsewhere herein.

3.21. Fire Protection Systems Proposal Drawings. Included as part of the proposal shall be conceptual drawings of all protection and detection to be provided. These drawings shall be on standard 30 inch by 42 inch sheets, and shall show valving (from Contractor's interface), general pipe routing, and nozzle and detector placement for all systems.

4.0. EQUIPMENT AND SERVICES TO BE FURNISHED BY OTHERS

4.1. The following equipment and services will be furnished and installed by others:

4.1.1. One (1) 1000 gpm at 125 psi diesel engine driven fire pump and controller.

4.1.2. One (1) 1000 gpm at 125 psi electric motor driven fire pump and controller.

4.1.3. One (1) 25 gpm at 125 psi pressure maintenance pump and controller.

4.1.4. All underground water supply piping to Contractor's interface points, as specified elsewhere herein.

4.1.5. All required heat tracing and insulation.

4.1.6. All required heated and lighted valve houses.

4.1.7. Electrical wiring and equipment as follows:

4.1.7.1. Installation, wiring and connection of all power, control and instrumentation wire and cable that connects to the fire protection system's electrical equipment and devices, or interconnects the fire protection system electrical equipment and devices to associated fire protection electrical control panels, detectors and all other electrical equipment which is a part of the fire protection system, except internal wiring of electrical equipment, devices and panels provided under this Specification.

4.1.7.2. Deleted. 2,3

4.1.7.3. Connection of the Fire Protection Systems to the Core Area electrical grounding system. 2,3

4.1.8. Fire Protection Supervisory Panel.

4.1.9. Finish painting of all piping and equipment; furnishing and installation of pipe identification signs for all fire protection pipe; and installation of all pressure sensitive tape on columns for identification of fire hose stations and portable fire extinguishers.

4.1.10. Remote alarms.

4.1.11. Concrete valve pit for Fire Department Pumper connection.

4.1.12. Concrete pads for fire hydrant hose houses and cabinet.

5.0. OPERATING CONDITIONS

5.1. Environmental. Equipment shall be designed, fabricated and installed at a plant with the following environmental conditions:

5.1.1. Plant elevation above mean sea level: 1940 feet.

5.1.2. Ambient temperature ranges:

(1) Indoors: 55°F to 110°F.

(2) Outdoors: 16°F to 113°F.

5.1.3. Barometric pressure: 13.72 psia.

5.1.4. Plant is located in Uniform Building code Seismic 3. Earthquake design criteria as specified in the latest issue of NFPA Standard No. 13, Section A3-9.2.3.

5.2. Service Conditions.

5.2.1. One (1) diesel driven and one (1) electric motor driven centrifugal fire pump, each rated at 1000 gpm flow and 125 psig discharge pressure will supply water to the automatic fire protection systems. System pressure will be maintained by one (1) pressure maintenance pump, rated at 25 gpm flow and 125 psig discharge pressure. A total water flow of approximately 1000 gpm at 100 psig from the fire pump will be available at all specified Contractor's interfaces located at plant ground elevations.

5.2.2. Each system shall deliver the minimum flow requirements specified in the applicable paragraph herein; or if not specifically specified, water flow shall be in accordance with the applicable NFPA Standard as specified.

Note: No single system shall exceed the rated pump capacity of one pump without prior approval of the Construction Manager.

6.0. DESIGN AND CONSTRUCTION REQUIREMENTS

6.1 Design Documentation. Plans and calculations are required for approval for all systems supplied hereunder. The quantities and addresses for submittal of Contractor's approval drawings are specified in Documentation Requirements, FJ60.60, and Construction Test Checklist as contained in Section 7 of this Specification. One (1) sepia and 4 print copies of each plan and calculation shall also be transmitted to the SFDI. 2

6.1.1. Upon receipt of approved copies, the Construction Manager will forward one (1) set of stamped and/or signed drawings, calculations and associated correspondence to the Contractor.

6.1.2. Include as part of this work all City, County, State and other permits and supervision fees required relative to this installation. Forward two (2) certified copies of all Permits and Certificates of Inspection to the Construction Manager immediately upon receipt.

6.1.3. The word "Approved," where used in this Part of the Specification, shall require the approval or acceptance from the Authority Having Jurisdiction - SFDI. The Contractor shall design and install the fire protection systems to conform to the requirements, for the occupancy designated, and shall obtain the approval or acceptance via the Construction Manager. 2

6.1.4. Contractor shall respond to questions placed on drawings by the Construction Manager during drawing review which require no action on the part of the Contractor. This response should be made in letter transmittal form accompanying the resubmitted drawings. Response should state reason(s) why no action on the part of the Contractor is necessary, and reference the associated drawing number and issue which had the comment. 2

6.2. Codes, Standards and Regulations.

6.2.1. Design and installation of all systems furnished hereunder shall be in accordance with the latest Editions of applicable Standards of the National Fire Protection Association (NFPA) as specified elsewhere herein.

6.2.2. All devices and materials shall bear Factory Mutual Research Corporation (FM) approval or Underwriters' Laboratory (UL) listing. FM approved and UL listed items shall be identified on the submitted drawings for review by the Engineer.

6.2.3. The work of this Specification shall also be in compliance with the latest issues of all applicable provisions of other Codes and Standards referenced or applicable to the work. These include, but are not necessarily limited to, the following:

(1) AISC - American Institute of Steel Construction.
(2) ANSI - American National Standards Institute.
(3) ASME - American Society of Mechanical Engineers.
(4) ASTM - American Society for Testing and Materials.
(5) AWS - American Welding Society.
(6) IEEE - Institute of Electrical and Electronics Engineers.
(7) NEC - National Electrical Code.
(8) NEMA - National Electrical Manufacturers Association.
(9) NFPA - National Fire Protection Association.
(10) OSHA - Occupational Safety and Health Act of 1970, as amended.
(11) UBC - Uniform Building Code.
(12) UL - Underwriters' Laboratories Incorporated.
(13) All Federal, State, County or Municipal Codes, Laws or Ordinances of the place of installation.

6.2.4. If there is an overlapping in or a conflict between the requirements of these Standards, or a conflict between the requirements of these Standards and this Specification, then that requirement which is considered most stringent by the Construction Manager shall take precedence, unless directed otherwise by him.

6.3. General.

6.3.1. The Contractor shall design, furnish, deliver and install all pipe, valves, fittings, pipe hangers and supports, strainers. fire department pumper connections, foam monitor nozzles, wall fire hydrant, fire hose houses, hose racks, hoses, detectors, controls, local alarms, manual pushbutton stations, identification tags and labels, concrete foundations and supports, and other accessories required for complete operation of the specified systems.

6.3.2. The Contractor shall design systems for the water supply flows and pressures specified in Paragraphs 5.2.1. and 5.2.2.

6.3.3. It shall be the Contractor's responsibility to calculate all hydraulic flow and pressure requirements from the fire pumps to all Contractor's system water inlet terminals to determine if the specified water supply and pressure is hydraulically adequate for the system's operation and to so advise the Construction Manager. Contractor shall submit all calculations to the Construction Manager at time of drawing submittal for review. Submittal of these calculations to the Construction Manager will in no way relieve the Contractor of his responsibilities for complete and proper design of the specified fire protection systems.

6.3.4. The exact number, size, style and orientation of sprinklers, discharge nozzles, and detectors without interference with or obstruction of existing objects and passage ways shall be established by the Contractor.

6.3.5. It shall be the Contractor's responsibility to design the systems so that no interferences exist between the fire protection piping and equipment, and systems designed and installed by others.

6.3.6. In order that proper coordination can be achieved with respect to electrical drawings, all electrical drawings shall be submitted a minimum of one (1) month prior to submittal of associated mechanical drawings.

6.3.7. The design and construction of equipment specified herein is clarified by the naming of a specific acceptable manufacturer and model number of the equipment and the statement: "or SFDI-approved equivalent." Bidder shall be required to supply data to support his equipment selection with his bid. The bidder shall show that alternate equipment is of equal design and quality or shall supply the specified equipment. A determination that the manufacturer and equipment selected by the Bidder is or is not an approved equal will be made by the SFDI.

6.3.8. Concrete work (when required) shall be in accordance with Paragraph 17.3., Concrete Work.

6.4. Piping.

6.4.1. General.

6.4.1.1. All piping, valves and fittings shall conform to the latest issue of applicable NFPA Standard for each individual type of system. 2

6.4.1.2. National Standard threads shall be used throughout on fire hose valves or other fittings for the purpose of connecting plant and Barstow Fire Department fire protection equipment.

6.4.1.3. All underground piping (including Foam system) shall be comparable to Engineering Standard No. SE00.CQA. 2

6.4.1.4. Foam and Halon system (except underground piping) piping shall be comparable to Engineering Standard No. SE00.C8B. 2

Note: All Halon system piping greater than 3/4-inch in diameter shall be provided with 300 pound only class fittings.

6.4.1.5. All other piping shall be comparable to Engineering Standard No. SE00.C8D.

6.4.1.6 Drain Lines.

6.4.1.6.1. All low points in pipelines shall be provided with automatic or manual drain valves connected to drain lines when possible, or other approved means for complete drainage.

6.4.1.6.2. All deluge valve and system main and/or auxiliary drains shall be provided with the appropriate size valve per NFPA, or manufacturer's recommendation.

6.4.1.6.3. Sight glasses shall be provided on all drain lines where discharge cannot be seen.

6.4.1.6.4. Ultimate discharge points for all drain lines shall be coordinated with the SFDI during drawing approval submittal.

6.4.1.6.5. Drain lines discharging to open hub or funnel floor drains shall be provided with tight sealing cover plate (1/8-inch thick) should full flow installation acceptance tests produce splashing of water on the floor.

6.4.1.6.6. Concrete splash blocks shall be provided beneath all discharge drain lines which discharge to atmosphere at grade level. 2

6.4.1.6.7. Underground foam system supply piping shall be provided with low point french drain with 2-1/2 inch control valve and post indicator operator. Drain shall be located at base of the supply riser which runs up to the pipe rack. Valve shall be in accordance with Engineering Standard No. SE00.CQA.

6.4.2. Hangers and Supports.

6.4.2.1. The Contractor shall provide hangers of the design and shape required for the specific installation and location, with all necessary supporting members and structures, where none now exist, to properly support and accommodate pipe hangers. The Contractor shall provide anchors and restraints as required to prevent misalignment or vibration of the piping caused by water hammer or pump pulsations. Pipe hangers, supports, anchors and restraints shall be in accordance with the latest issues of applicable NFPA Standards with locations subject to the Construction Manager's approval.

6.4.2.2. Attachment of hangers and supports shall be by beam clamps, mounting plates, brackets or clips bolted to the support steel. The drilling of, or welding to, structural members for attachment of hangers and supports shall be subject to prior approval by the SFOI. Cutting or burning of any structural steel will not be permitted.

6.4.2.3. Hangers, bolts and supports located outdoors or in a corrosive atmosphere shall be galvanized.

6.4.3. Installation.

6.4.3.1. When installed, the piping shall not create obstructions, shall provide acceptable clearances from other work, and shall, in general, be parallel to other piping in accordance with the existing plant piping grid system and parallel to the building structural members.

6.4.3.2. Trenching and backfill shall be in accordance with Article 12.0 EARTHWORK.

6.4.3.3. Where drainage is required, care shall be taken to slope the pipe downward toward the point of drain.

6.4.3.4. Any completed construction or construction work in progress which is not part of the work of this Specification and which is damaged during installation shall be repaired, replaced or restored to its original condition at no additional expense. All such damaged areas which are repaired shall be subject to the Construction Manager's approval.

6.4.3.5. The Contractor shall coordinate the installation of his material with that of other contractors to ensure the required sequence and to eliminate delays in the completion of the work. All pipe, valves, fittings and other pipeline material delivered to the job shall be stored and protected as necessary to prevent damage, and to miminize the entry of foreign matter. All piping shall be cleaned and kept clean and free of foreign matter before and during erection. This shall include careful removal of dirt, scale, welding icicles or beads, cuttings, burrs, etc. Following erection, waterlines shall be flushed out with water in accordance with information contained in attached Form No. 85 "Contractor's Material and Test Cetificate," to the satisfaction of the Construction Manager.

6.4.3.6. All connections and pipelines shall be installed in a neat and workmanlike manner with materials and construction as specified for the pipeline to which connection is made.

6.4.3.7. Any pipelines, fittings, valves, etc., requiring maintenance or replacement shall be installed with unions and flanged connections and isolating valves to permit easy removal, whether specifically indicated on the drawings or not.

6.4.3.8. All valve glands shall be tightened as the pipelines are erected. Additional valve gland packing rings shall be added to all valve glands if necessary to provide a seal and assure tight working conditions after valves are placed in service. Packing supplied with all valves shall be as required for the design service conditions.

6.4.3.9. Attachments to concrete shall be of a design acceptable to the SFDI.

6.4.3.10. All pipelines with screwed construction shall be made up with as few joints as possible. Threads for all screwed fittings shall be American Standard Pipe Threads in accordance with ANSI Specification B2.1-1968. Screwed joints shall have clean machine-cut threads and shall be made up with a piping compound, the threads shall be cleaned and new piping compound applied before remaking the joint.

6.4.3.11. Flange bolts shall be evenly tightened with wrenches only. Hammering or bumping is not permitted. In tightening joints, care shall be taken to assure uniform pressure on the gasket and to avoid overstressing the bolts or dishing or breaking the flanges. Flanged joints that have been made up and broken shall be made with new, unused gaskets supplied at no additional cost.

6.4.3.12. Floor and wall sleeves shall be provided by the Contractor, as necessary, for the installation for all pipelines, whether or not specifically called for on the drawings. The sleeves shall be set and aligned to receive pipelines and shall provide a 2-inch minimum annular space between the pipe and the sleeve. Pipe sleeves through floors shall extend 4 inches above finished floor. The installation of and any damage to existing work resulting from installation of sleeves shall be repaired by the Contractor to the satisfaction of the Construction Manager and at no additional expense. All voids between pipe and sleeve shall be filled with a noncombustible watertight material (Silicone RTV Foam) in floor openings and a noncombustible material in wall openings. Fire wall penetrations shall be sealed with Silicone RTV Foam - Dow Corning 3-6548 Silicone RTV Foam.

6.4.3.13. Welding of pipe shall be permitted. However, shop or field shop fabrication shall be performed for all pipe under 20 feet in length and shall be conducted outside of buildings. Final welding of pipe shall not take place inside without first obtaining permission from the Construction Manager, after assurance is made that no combustibles exist in the area, and a fire watch outfitted with fire hose and extinguisher will be present.

6.4.3.13.1. All welding shall be in accordance with ANSI Standard B31.1-1973 and Supplements where applicable.

6.4.3.13.2. Welded flanged fittings shall conform to ANSI Standard B16.9 "Wrought Steel Buttwelding Fittings" and Standard B16.25 "Buttwelding Ends for Pipe, Valves, Flanges and Fittings."

6.4.3.13.3. Welded sections of pipe shall not exceed 20 feet.

6.4.3.13.4. Piping 2 inch and smaller shall be screwed.

6.4.3.14. After erection, all galvanized surfaces that are damaged shall be touched-up as specified in Article 8.

6.4.3.15. Flashing, rain-tight hoods and caps shall be provided for all pipelines passing through roofs. Flashing or noncombustible seals shall also be provided for all pipelines passing through exterior walls in accordance with Paragraph 6.4.3.12.

6.4.4. Gate Valves. A manual shut-off OS and Y gate valve shall be provided for each wet sprinkler system, dry standpipe and foam monitor system. Gate valves shall be in accordance with applicable Engineering Standards No. SE00.CBB, No. SE00.CBD, and No. SE00.CQA (E1 - Piping Specification). 2

All manual system control valves, whether or not supplied by the Contractor, not within reach from floor level or platforms shall be provided with a chain operator. 2

6.4.5. Strainers. Strainer(s) shall be provided to protect the semi-automatic foam monitor system. The strainer(s) shall be approved for use in fire protection systems, provided with Monel baskets, and shall be self-cleaning with blow off valve. This valve shall be provided with a 2-1/2 inch male outlet with NST and cap. 2

6.4.6. Identification Tags and Labels.

(1) All shut-off, drain, test and alarm valves or devices, alarms, pushbutton stations and manual pull stations and all other accessories supplied under this Contract shall have an identification tag with all pertinent operating information clearly inscribed thereon.

(2) Each identification tag shall be durable for the specified environmental conditions (metal, i.e., nonferrous or stainless steel, or phenolic plastic) and permanently attached (banding straps or screws) in a conspicuous place on or adjacent to each piece of equipment. Self tapping screws are not acceptable.

6.4.7. Sprinklers. Sprinklers shall be standard 1/2-inch orifice sprinkler (upright or pendent) fusible link type rated at 286 F or quartzoid bulb type rated at 250 F.

6.5. Electrical Equipment.

6.5.1. All Contractor-furnished electrical equipment or devices shall be furnished complete (internally wired) and ready for installation and connection.

6.5.2. All fire protection, pressure switches furnished shall have DPDT contacts rated for 120 volts ac with the ampere ratings specified in Paragraph 6.5.6.

6.5.3. Power Supplies.

6.5.3.1. Unregulated commercial-grade ac power source will be provided for all control panels.

6.5.3.2. This source will consist of single-phase, two (2) wire, grounded, 60 hertz, 120 volts nominal, plus or minus 10 percent normal fluctuation; aproximately one (1) minute duration dips to 80 percent of nominal voltage, infrequently.

6.5.4. All electrical equipment furnished shall be designed for supervision. In the event a ground fault or break occurs in the line, a trouble signal shall sound both locally and at the Fire Protection Supervisory Panel (by others).

6.5.5. All electrical equipment shall be designed for ordinary electrical installations for all areas with the exception of the TSS Area which shall be designed for Class I, Division 2, Group D hazardous electrical locations.

6.5.6. Electrical Contact Ratings.

6.5.6.1. Contacts which are associated with fire protection system electrical components, shall have fire protection industry recognized ratings.

6.5.6.2. All contacts furnished as part of this Specification, for use by others, shall be Form "C" type and have a minimum rating of three amperes continuous and 0.5 inductive amperes make and break at 125 volt ac. Higher contact ratings shall be furnished when specified or required.

6.5.6.3. Where a Contractor's standard subassembly or modular design is used and these do not provide the specified minimum contact ratings, auxiliary devices that provide the specified ratings shall be furnished integrally mounted and wired within an adjacent panel.

6.5.7. Control Panels.

6.5.7.1. Panels shall be provided for the following areas:

6.5.7.1.1. Semi-Automatic Foam Monitor System (TSS Pump/Exchanger Areas) 2

6.5.7.1.2. Detection System (Warehouse Building - BL-703)

6.5.7.1.3. Cooling Tower Sub-Station. 2,3

6.5.7.1.4. Detection System (Electrical Equipment W/BL-709 Building - BL-712) 2

Panels shall be K-F Universal Panel as manufactured by King-Fisher Co., Des Plaines, Ill., or SFDI-approved equivalent.

6.5.7.2. Each panel shall be provided with internal 24 amp/hour battery backup and with the required sets of contacts for remote indication of system operating status ("Trouble," and "Alarm") at the Fire Protection Supervisory Panel (by others). In addition to the above, the exterior of the panel shall be equipped with "Trouble" (white) and "Alarm" (red) lights indicating each system's status. A common "Trouble" Silence and "Alarm" Silence switch (indication shall be provided for both normal and silence positions) shall also be provided. Upon restoration of either "Trouble" or "Alarm" condition which caused the alarm, the panel's internal buzzer shall again sound (ring back) until the "Trouble" Silence or "Alarm" Silence switch is returned to the Normal position.

6.5.7.3. System interlock and shutdown shall be by spare contacts located within the panel. 2

6.5.7.4. A common externally mounted local audible alarm horn shall be provided at each control panel and arranged to sound on "Alarm" conditions. 2

6.5.7.5. Where multiple fire protection systems are located adjacent to one another, a single multiple zone control panel shall be provided. 2

6.5.7.6. All Contractor-furnished control panels shall be shown on drawings and located adjacent to the associated system. 2

6.5.7.7. NEMA enclosures (when required) and housing control panels shall have Light Emitting Diodes (LED's) remoted to the front cover panel. 2

6.5.7.8. Contractor Supervision. 2

6.5.7.8.1. Prior to shipment of these panels to the jobsite, the Contractor shall notify the Construction Manager in order that factory shop tests and crating procedures (for shipping and storage) can be witnessed by the Construction Manager or his designee. Failure on the part of the Construction Manager or his designee to witness these tests shall in no way relieve the Contractor from witnessing these tests and crating procedures. The Contractor shall furnish a written statement signed by both the Contractor's and Vendor's witnessing and testing personnel as to tests conducted and status of test with reference to each panel's serial number, and general condition of each panel as crated. 2

6.5.7.8.2. Immediately after external wiring (by others) and prior to powering these panels, the Vendor's representative shall check out these panels in the presence of the Construction Manager to verify panels are properly wired and ready for service. Any damage to panel shall be corrected by the Vendor's representative with expenses backcharged to the responsible party. 2

2

6.5.8. Detection Systems.

6.5.8.1. Photoelectric detectors shall be Model Photo-Beta as manufactured by Gamewell, or SFDI-approved equivalent.

6.5.8.2. Ultraviolet (U/V) detector system shall be AOi as manufactured by Detector Electronics Corporation.

6.5.9. Waterflow switch. When required, switches shall be Model F-620 for ordinary electrical locations as manufactured by Grinnell Fire Protection Systems Company, Incorporated, or SFDI-approved equivalent. 2

6.5.10. Pressure Switches.

6.5.10.1. Deluge valve pressure switches shall be Model 8-2 for ordinary hazard electrical locations as manufactured by Grinnell Fire Protection Systems Company, Inc., or SFDI-approved equivalent.

6.5.10.2 Pressure switches shall be used for "alarm only" features. No system shutdown features shall be controlled by pressure switches. 2

6.6. Alarm Horns and Audio-Visual Alarms.

6.6.1. All specified local fire alarm horns shall be furnished by Contractor.

6.6.2. All alarms shall be surface mounted.

6.6.3. The local fire alarm horns shall be Model 450N for ordinary electrical locations, or Model 450W for outside locations. All horns shall be mounted in the vicinity of the system's associated control panel or waterflow alarm switch, except where noted and in order to comply with Paragraph 6.6.4., below.

6.6.4. Fire alarm horns associated with actuated system(s) shall be heard when plant is in operation. As a result, Contractor shall test all horns during plant operations along with start-up personnel. If during these tests, horns cannot be heard, additional horns shall be added to those systems to meet this requirement at no additional cost.

6.6.5. One (1) electric siren for installation at exterior of the Diesel Fire Pump House (for pump used during construction) shall be provided. Siren shall be Federal Sign and Signal Corporation, Model No. 55.

6.6.6. Alarm model numbers which indicate voltage type, method of attachment and location suitability will be called out in each section. Alarms referenced (except where noted) are manufactured by Federal Sign and Signal Corporation; however, SFDI-approved equivalents are acceptable.

6.6.7. Audio-visual alarms shall be Model No. AV-32 as manufactured by Space-Age Electronics, or SFDI-approved equivalent.

6.7. Wet Pipe Sprinkler/Fire Hose System. Contractor's interface for sprinkler system and hose station for the Diesel Fire Pump House shall be as shown on Drawings 40P7005133148 and 40P7005133247.

6.7.1. System shall be hydraulically designed in accordance with the latest issue of NFPA Standard No. 13.

6.7.2. System design shall ensure coverage over the entire Diesel Fire Pump House. Sprinkler coverage shall not exceed 80 square feet per sprinkler and shall provide a 0.20 density (gpm/sq ft) throughout. Contractor shall provide shields on the sprinklers or use directional spray nozzles to ensure no water discharge is directed onto the pump's electric controller.

6.7.3. Sprinklers shall be as referenced in Paragraph 6.4.7., while waterflow switch shall be as referenced in Paragraph 6.5.9.

6.7.4. Operation of sprinkler system shall result in the waterflow switches actuation of the local alarm horn and remote annunciation to the Fire Protection Supervisory Panel (by others).

6.7.5. Pressure for hose stations shall be restricted at the angle valve to 100 psi with pressure restricting disc - Elkhart No. 35, or SFDI-approved equivalent.

6.7.6. Hose Station.

6.7.6.1. 1-1/2 inch Angle valve shall be Elkhart Brass No. U-20 or SFDI-approved equivalent.

6.7.6.2. Hose rack shall consist of the following Elkhart Brass components, or SFDI-approved equivalent.

(1) Hose rack, 1-1/2 inch S-41-R.

(2) 1-1/2 inch steel supporting nipple No. 46-8.

6.7.7. Hose shall be 75 feet long, 1-1/2 inch, lightweight synthetic wrap, single jacket, rubber lined, 300 psi test with National Standard Thread with Rocker Lug couplings, as manufactured by B.F. Goodrich 300 AP, or SFDI-approved equivalent.

6.7.8. Hose station shall be equipped with standard Elkhart Brass Model HN-4-LE, 1-1/2 inch Lexan "Electric Nozzle," or SFDI-approved equivalent.

6.7.9. Each fire hose station shall be clearly marked for its location within the plant. Marking furnished by Contractor shall be red vinyl tape, a minimum of 2 inches wide and pressure sensitive. Attachment as follows will be by others:

6.7.9.1. Columns. Tape around entire column, 9 feet above finished floor or walking surface. In areas where ceiling height is less than 9 feet, place tape at 7 foot level.

6.7.9.2. Walls. Place 1-foot long strip of tape directly above fire hose station with mounting height same as above.

6.8. Pushbutton Stations. Dual unit surface mount "start - stop" pushbutton stations with momentary contact red (start) and black (stop) buttons for operation of automatic deluge valves for the Foam System Monitor nozzles and Warehouse Building (BL-703) fire hose station/wall fire hydrant system shall be as follows:

(1) Hazardous Locations (Class I, Division 2, Group D)
Catalog No. CR 2941/NA102B

(2) Interior Locations (Ordinary Electrical Installations)
Catalog No. CR 2943/AA102H

(3) Exterior Locations (Ordinary Electrical Installations)
Catalog No. CR 2943/NJ202A

All stations referenced above are manufactured by General Electric or SFDI-approved equivalent.

6.9. Fire Hose Stations/Wall Fire Hydrant (Dry Standpipe-Warehouse Building (BL-703).

6.9.1. This building's standpipe system shall be controlled by an electrically operated automatic master valve. Valve shall be located immediately downstream of the Contractor's interface as shown on Drawing No. 40P7005133148. Valve shall be Model 100 G with Electric Operator both as manufactured by Cla-Val Co. All other associated valve trim shall also be provided. Valve shall open on being de-energized.

6.9.2. This standpipe shall be supplied from the main underground fire service water supply line.

6.9.3. An automatic riser drain (ball drip) shall be provided on the downstream side of the Clayton valve and piped to a nearby floor drain.

6.9.4. Fire hose stations shall be designed for Class III service. All components shall be as follows: 2

6.9.4.1. Pressure restricting disc as referenced in Paragraph 6.7.5.

6.9.4.2. Hose station angle valves shall be 2-1/2 inch Model No. U-20.

6.9.4.3. Hose racks shall consist of the following components:

(1) Hose rack, 2-1/2 inch S-41-R.

(2) 2-1/2 inch steel supporting nipple No. 46-B.

(3) 2-1/2 inch female to 1-1/2 inch male adapter No. A-327.

(4) Hose shall be as referenced in Paragraph 6.7.7. 2

(5) 1-1/2 inch combination straight stream/spray No. HN-4-LB Lexan nozzle.

(6) Identification marking as referenced in Paragraph 6.7.9.

All model numbers referenced are Elkhart Brass, or SFDI-approved equivalent.

6.9.5. Each fire hose station shall be equipped with an electrical pushbutton station to actuate the system. Pushbutton stations shall be mounted adjacent to the hose station either on the standpipe, wall or column.

6.9.6. Pushbutton stations shall be as specified in Paragraph 6.8.

6.9.7. Power supply for the fire hose pushbutton stations and Clayton valve shall be supplied from a nearby control panel as described in Paragraph 6.5.7.

6.9.8. In addition to the fire hose stations, a wall fire hydrant with 4 inch standard non-rising stem gate valve shall also be supplied by this system. This hydrant shall be located as shown. Hydrant shall be Elkhart Brass Model No. 153 (2-1/2 inch by 2-1/2 inch by 4 inch) with standard finish, while valve control shall be Elkhart Brass Model No. 164 with standard finish or SFDI-approved equivalent. A pushbutton station shall be provided for exterior mounting adjacent to the valve operator.

6.10. Semi-Automatic Foam Monitor System.

6.10.1. General.

6.10.1.1. Protection shall extend over all TSS equipment (Storage Tank/ Pump Area/Heat Exchanger Area) in the form of foam monitor nozzle area coverage.

6.10.1.2. System shall consist of a diaphragm balanced pressure foam proportioning tank containing 3 percent AFFF concentrate. System and liquid concentrate shall be as manufactured by Feecon Corporation, or SFDI-approved equivalent.

6.10.1.3. Diaphragm tank location and Contractor's water supply terminal will be inside the Raw/Service Water Pump Building (BL-702) as shown on Drawings No. 40P7005133148 and 40P7005133247.

6.10.1.4. The Thermal Storage Tank and all associated equipment will contain Caloria HT-43 at an operating temperature of 575 F.

6.10.1.5. System specified herein shall be designed in accordance with the latest issue of NFPA Standard No. 11. Demands shall be as follows:

6.10.1.5.1. Simultaneous flows of two 2-1/2-inch foam monitor nozzles each discharging approximately 100 gpm of foam concentrate with a nozzle inlet pressure of approximately 100 psi. Flow times shall be 35 minutes.

6.10.1.5.2. Simultaneous flows of two 1-1/2 inch foam hose stations each discharging approximately 60 gpm of foam concentrate with a nozzle inlet pressure of approximately 100 psi. Flow times shall be 15 minutes.

6.10.1.6. A common strainer shall be provided as shown on Drawing No. 40P7005133148. Strainer shall be as specified in Paragraph 6.4.5. 2

6.10.2. System components shall include, but not necessarily be limited to the following:

6.10.2.1. Vertical balanced pressure foam proportioning tank (containing 100% reserve), automatic and manual valves, pressure gages, associated piping and foam concentrate, and sufficient foam concentrate for system testing.

6.10.2.2. All above ground and buried piping, low point drains, French drains, control valves and operators, pipe supports, pressure reducing devices, controls and isolation valves to tanks, deluge valve, and associated accessories.

6.10.2.3. Manual start pushbutton stations for operation of the system from each monitor nozzle. Pushbutton stations shall be mounted on concrete embedded posts furnished and installed by the Contractor and mounted adjacent to the monitor nozzles. All stations shall be as specified in Paragraph 6.8.

6.10.2.4. One (1) local system operation alarm located on the outside of the Raw/Service Water Pump Building. Alarm shall be single projector weatherproof Model 451W.

6.10.2.5. One (1) control panel shall be as specified by Paragraph 6.5.7.

6.10.2.6. Deleted. 2

6.10.2.7. Four (4) foam monitor nozzles located as shown on Drawing No. 40P7005133247. Monitors shall be 4-inch units with flange connections, whereas nozzles shall be Model JS-10 both as manufactured by National Foam System, Inc. or SFDI-approved equivalent.

6.10.2.8. Fire hose foam nozzles are covered in Paragraph 8.2.9.2. in Section 4 - IFB, Technical Information - Fire Protection. 2 2

6.10.3. The control panel for this system, in addition to performing those functions specified in Paragraph 6.5.7., shall provide a dry contact to actuate an adjacent mounted relay which and shall shut down all TSS pumps and associated equipment. A total of twelve (12) N.C. contacts shall be provided off the relay for this purpose. 2

6.10.4. Deluge Valve.

6.10.4.1. Deluge valve furnished shall be automatically operated by an electric signal from the U/V detection system covered in Paragraph 6.12.2. and pushbutton stations when required. A manual pull box (hydraulic type) with handle shall be furnished with each valve which will also fully open the valve independently of U/V detection and pushbutton stations. 2 2

6.10.4.2. Deluge valves shall be Multimatic, as manufactured by Grinnell Fire Protection Systems Company, Incorporated, or SFDI-approved equivalent.

6.10.5. Sequence of operating shall be as follows:

6.10.5.1. Operation of any U/V detector shall cause both local and remote alarms to sound, all TSS pumps and associated equipment to shut down and foam system to be activated.

6.10.5.2. Manual operation at the liquid foam storage tank or via any monitor nozzle pushbutton station shall cause system operation similar to U/V detector operation. 2

6.11. Automatic Total Flooding Halon 1301 Systems.

6.11.1. General.

6.11.1.1. Automatic Halon 1301 systems specified herein shall be of the total flooding type, and shall be in accordance with the latest issue of NFPA Standard No. 12A.

6.11.1.2. Automatic Total Flooding Halon 1301 Systems shall be as manufactured by Fenwal, Incorporated, or SFDI-approved equivalent.

6.11.1.3. The systems shall be designed for a minimum concentration of 5 percent and a maximum of 7 percent by room volume at 70 F. Concentrations shall be maintained for at least 10 minutes.

6.11.1.3.1. Concentration tests shall be considered acceptable if after ten minutes, the concentration has not dropped greater than 20 percent of the original minimum design concentration by room or area volume. If this level is not achieved, the test will not be considered acceptable. Should the test fail, a retest at the Contrator's expense shall be conducted after a review and analysis of the design problem(s) is made and a report issued to the Construction Manager stating problem and corrective action to be taken. Construction Manager shall approve of corrective action prior to retesting. 2

6.11.1.3.2. Failure of the test resulting from conditions beyond the Contractor's control shall relieve the Contractor of retesting the system at his expense. However, it shall be his responsibility to review the entire installation prior to testing to ensure the tests can be properly conducted. If problems are discovered at this time, witnessing personnel shall be notified and the test postponed until corrective action is taken by responsible party.

6.11.1.4. Gas quantities shall include required demand, plus 100 percent Halon 1301 connected reserve. In addition, all necessary Freon 122 gas shall also be provided. 2 2 2

6.11.1.5. Full discharge concentration tests using Halon 12 shall be performed for all Halon protected areas. One (1) set of containers filled with test gas shall also be provided.

6.11.2. Protection shall be provided as follows:

6.11.2.1. One (1) system for Thermal Storage Control Building BL-709.

6.11.2.2. One (1) system for Thermal Storage Control Building 8L-710.

6.11.2.3. One (1) system for Elevation 13 of Receiver Tower.

6.11.2.4. One (1) system for Elevation 14 of Receiver Tower.

6.11.3. System components shall include, but not necessarily be limited to, the following:

6.11.3.1. Halon containers with Halon 1301 gas and all Halon 12 test gas. Lockable container racks (when necessary).

6.11.3.2. All piping, valves and nozzles, as required.

6.11.3.3. Pressure gages, initiators, when required, valves and control heads. 2

6.11.3.4. Spare contacts for HVAC shutdown and operation of local alarm horn and remote annunciation. 2 2

6.11.3.5. Photoelectric smoke detectors including all trim as specified in Paragraph 6.5.8.1.

6.11.3.6. Surface type remote control break-glass type switches for manual operation.

6.11.3.7. Audio-visual alarms.

6.11.4. Single or multizone control panels for the above systems shall be as manufactured by Fenwal, Incorporated, or SFDI-approved equivalent. Panels shall be compatible with Halon system and listed or approved for Halon release. Panels shall be located outside the protected room or building, adjacent to the main doorway entrance. Appropriate NEMA type enclosures suitable for the environment shall be provided. View windows shall be provided (if none exist) to permit observation of visual status (Power, Trouble, Alarm) indicators. 2 2 2 2 2

6.11.5. Provisions shall be made at each control panel for remote indication of system operating status at the Fire Protection Supervisory Panel (by others) through the required sets of SPDT contacts located inside each control panel. Panel functions shall be as specified in Paragraph 6.5.7. 2

6.11.6. Each system shall be provided with three (3) additional N.C. contacts or relays as required in an adjacent panel to perform functions called out under operational sequence below. 2 2

6.11.7. Photoelectric detectors shall be installed throughout each room in a cross-zoned configuration. Location of the detectors shall be so arranged to ensure prompt detection during normal operation of the ventilation system. Detector spacing shall not exceed 400 square feet (maximum) per detector. 2

6.11.8. In addition to automatic detectors, manual pull stations shall be provided for local activation of the systems. These switches shall be located inside at all doorways of each area protected. 2

6.11.9. Audio-visual alarms shall be provided outside each doorway to the protected rooms. A sign, approximately 14 inches by 20 inches, indicating purpose of audio-visual alarm (HALON DISCHARGE IN PROGRESS WHEN HORN SOUNDS AND LIGHT FLASHES - DO NOT ENTER) shall be located beneath each horn. Alarms shall be as referenced in Paragraph 6.6.7. 2 2

6.11.10. Detectors shall be installed and tested as covered in Paragraph 7.4 prior to Halon discharge tests. 2

NOTE: All detectors shall be installed with 10 feet of flexible conduit to permit relocation. 2 2

6.11.10.1. Deleted. 2

6.11.10.2. Deleted. 2

6.11.10.3. Deleted. 2

6.11.10.4. Deleted. 2

6.11.10.5. Deleted. 2

6.11.11. Halon system shall be tested in accordance with Paragraph 7.3. 2

6.11.12. Operational sequence shall be as follows: 2

6.11.12.1. Zone 1 detector system shall activate local and remote alarms; and shut down the room's air handling units, all contributing exhaust and return air fans, and all electrically operated wall dampers where so equipped. 2 2

6.11.12.2. Zone 2 detection system after operation shall actuate the system. 2

6.11.12.3. Manual activation of the system shall perform those functions as described in Subparagraphs 6.11.12.1. and 6.11.12.2. 2

6.12. Fire Detection Systems.

6.12.1. Photoelectric detection systems shall provide protection for "alarm only" throughout the Warehouse Building (BL-703), Cooling Tower Remote MCC Building and Thermal Storage Control Building (BL-712).

6.12.1.1. All detection systems shall be installed in accordance with the latest issues of NFPA Standards No. 72A and 72E. 2

6.12.1.2. Photoelectric detectors shall be as specified in Paragraph 6.5.8.1.

6.12.1.3. Detector spacing shall not exceed 400 square feet per detector (maximum) at building ceiling level. Detectors shall be so located to ensure prompt detection under protected building's normal ventilation system operation.

6.12.1.4. Manual pull stations shall be provided inside and adjacent to all exterior doors. These stations shall be Model 4015 as manufactured by Autocall, or SFDI-approved equivalent. 2

6.12.1.5. All systems shall be for "alarm only." Operation of any detector or manual pull station shall activate both local and remote (at the Fire Protection Supervisory Panel by others) alarms.

6.12.1.6. These systems shall each be supervised by a single zone control panel as covered in Paragraph 6.5.7.

6.12.1.7. A single alarm horn shall be provided adjacent to each control panel. Horns shall be Model 450N.

6.12.2. Ultraviolet (U/V) detection system shall provide protection throughout the TSS Pump Area and Heat Exchanger Area.

6.12.2.1. All detectors shall be installed in accordance with those Standards covered in Paragraph 6.12.1.1. and the manufacturer's instructions.

6.12.2.2. Detectors shall be so located to ensure 100 percent area coverage of all equipment for which detection is provided. Layout shall ensure no "blind spots" exist which could result in delayed or undetected response.

6.12.2.3. Detector system shall be as referenced in Paragraph 6.5.8. Detectors shall be Model No. C7050B.

6.12.2.4. Controller(s) for this system shall be Model R7303 and shall be located in the EPGS Building. Location shall be coordinated with the Construction Manager. NEMA 4 enclosure(s) with view window shall be provided for housing of the controller(s). 2 2

6.12.2.5. Each area (TSS Pump Area/TSS Heat Exchanger Area) shall constitute a separate zone. A spare contact shall be dedicated on each controller for remote annunciation to the Fire Protection Supervisory Panel (by others).

6.12.2.6. System operation shall simultaneouly shut down all TSS pumps and associated equipment, open master control valve on foam monitor system and transmit local and remote alarms.

6.12.3. All detection system detector layouts are subject to final acceptance by the Construction Manager. Should review by the Construction Manager determine additional detectors are required, they shall be provided at no additional cost.

6.13. Portable Fire Extinguishers.

6.13.1. Portable fire extinguishers, including mounting brackets and identification labels, shall be provided for the Buildings and locations called out in Appendix A. This Appendix lists type, unit size, quantities required and locations for the portable fire extinguishers.

6.13.2. Identification labels, as specified in the latest issue of NFPA Standard No. 10, shall be supplied as required to label all sides of columns or walls on which extinguishers are mounted.

6.13.2.1. Fire extinguisher identification labels shall be applied as follows:

(1) Columns - locate labels 9 feet above finished floor or walking surface. In areas where ceiling height is less than 9 feet, place labels at 7 foot level.

(2) Walls - Place directly above extinguisher with mounting height the same as above.

6.13.3. Multipurpose dry chemical extinguishers shall be the cartridge type to ensure ease of maintenance. The minimum UL rating for 20 pound units shall be 10 A:60 B:C. The minimum UL rating for 30 pound units shall be 6 A:60 B:C.

6.13.4. All dry chemical portable fire extinguishers shall be as manufactured by Ansul, or SFDI-approved equivalent.

6.13.5. All Halon 1211 portable fire extinguishers shall be as manufactured by Graviner, Inc., or SFDI-approved equivalent.

6.13.6. Extinguishers shall be mounted as follows:

Type Extinguisher	Height at Top of Extinguisher, Feet-Inches
9 lb. Halon 1211	5-0
20 & 30 lb. Dry Chemical	3-6

7.0. TESTS AND APPROVAL AFTER INSTALLATION

7.1. After all piping and above ground systems are installed, they shall be thoroughly tested by the Contractor and witnessed by the Construction Manager and the Barstow Fire Department. A minimum of two (2) weeks advance notice of the pending tests shall be given to the Construction Manager to permit his scheduling of required personnel and to prevent any disruptions to any other on-site activities. Any portion of the work which fails to function 2

to the satisfaction of the Construction Manager, and any defects which are disclosed, shall be remedied by and at the expense of the Contractor. A complete record of all tests and their results shall be furnished to the Construction Manager by those making the tests. Form No. 85 described below and attached as a supplement shall be filled out for record purposes for all water systems. Decision by the Construction Manager not to witness field acceptance tests or inspections shall in no way relieve the Contractor from full responsibility for the quality and correctness of the work. 2

7.1.1. Acceptance tests, certification and approval shall be conducted in accordance with the latest issues of NFPA Standards No. 11, 13, 14 and 24. 2

7.1.2. Form No. 85 - Contractor's Material and Test Certificate.

7.1.2.1. All piping shall be flushed and hydrostatically tested as specified in the attached Form No. 85, PART "A" GENERAL, TEST DESCRIPTION section. In addition, all other requirements specified in this Form No. 85 shall be complied with, and three (3) copies of the completed form, including the required witnessing signatures, shall be supplied to the Construction Manager. 2

7.1.2.2. The Contractor shall complete all applicable parts of the form. A separate PART "C" shall be provided for each riser and/or header which the Contractor installs. If the entire riser/header system is tested at one time, then only one (1) form is required. Contractor shall complete a separate PART "C" for each system installed. 2

7.2. Semi-Automatic Foam Monitor System.

7.2.1. Acceptance tests, certification and approval will be conducted in accordance with the latest issue of NFPA Standard No. 11.

7.2.2. After installation, all piping shall be hydrostatically tested and, if permitted by the Construction Manager, full flow tests (using water only) made through all monitor nozzles.

7.2.3. Functional tests shall be performed on all valves, detectors, control equipment, manual operating devices and alarms.

7.2.4. Three (3) copies of Foam System Acceptance Test Report with witnessing personnel signatures shall be filled out and left with the Construction Manager after successful completion of the test. 2 2 2

7.3. Automatic Total Flooding Halon 1301 Systems.

7.3.1. Approval tests shall be conducted in accordance with the latest issue of NFPA Standard No. 12A. 2

7.3.2. Upon completion of installation, the system shall be thoroughly tested for operation and function. Tests shall include pressure testing (using air) of all piping, "puff testing" of all piping with either Freon 122 or CO_2 to remove all foreign matter, functional testing of all mechanical and electrical equipment and careful inspection of all piping and nozzles. 2

Puff testing shall be performed as follows:

- Place cloth bag over each nozzle in system.
- Connect line from gas cylinder into system header manifold.
- Open valve on gas cylinder and permit gas to flow through system piping until all bags are observed expanding.
- Those nozzles whose bags do not expand should be checked for obstructions in the piping and/or nozzle.
- After above completed, remove bags and reconnect system piping.

7.3.3. Complete discharge tests using Freon 12 with concentration readings taken to verify system design shall also be provided. Readings shall be taken at 3 levels in each protected room/area using an FM certified 3 point strip chart recorder. 2 2

7.3.4. Halon system discharge tests shall be performed by operation of any manual pull station associated with the system.

7.3.5. Prior to system discharge tests, detectors shall be tested, see Automatic Detectors, Paragraph 7.4.5.

7.3.6. Once the Halon system's associated detection system had been accepted, the automatic discharge mode of the detection system shall be connected.

7.3.7. Pressure testing of piping shall be at 150 psig for 1 hour with no leaks. 2

7.3.8. Three (3) copies of Halon System Field Installation Acceptance Test Report with witnessing personnel signatures shall be filled out and left with the Construction Manager after successful completion of tests. 2

7.4. Automatic Detectors. Approval tests shall be conducted in accordance with the latest issues of NFPA Standards No. 72A and 72E. Detectors associated with Halon System must also be tested according to Paragraph 6.11.10. In addition, manufacturer's instructions along with the following, must also be complied with: 2 2

7.4.1. After initial photoelectric detector installation is completed and prior to functional testing, all detectors shall have sensitivity checked and firing point adjusted to meet recommended factory settings and a log prepared stating each detector's setting. This log will aid in future maintenance and system testing.

7.4.2. All detectors and all other electrical devices shall be checked to see that they are electrically supervised as installed. Corrective action, as required, shall take place prior to further testing.

7.4.3. Once the above tests are completed, each detector shall be functionally tested by the Contractor using an acceptable test smoke or U/V source. Acceptability of test smoke shall be determined by the Construction Manager. However, typical test smoke for functional testing is generated by burning cotton rope while smoke for air pattern tests is produced by controlled burning 2 oz. of computer printout paper in a safety can. 2 2 2

7.4.4. Final location of all photoelectric detectors shall be based on smoke pattern tests to determine proper placement in the protected room or area.

Note: This requirement only applies to detectors associated with Halon 1301 Systems.

These tests shall be conducted to ensure detectors are properly located and will respond promptly to a fire within the room or area under normal ventilating operating conditions.

Note: Discharge testing of the Halon systems shall not take place until the above tests have been completed to the satisfaction of the Construction Manager. 2

Tests for photoelectric detectors shall be conducted as follows with the air handling system in service: 2

7.4.4.1. Test smoke shall be placed at the floor level in at least three areas within each room, typically in close proximity to electronic equipment locations. Smoke shall be detected within 60 seconds.

Note: Subfloor testing shall be performed by placing test smoke in vicinity of cables.

7.4.4.2. Smoke must pass by and actuate the nearby detectors. Should such tests indicate improper detector placement, new locations shall be designated and the detector(s) relocated. Tests shall be rerun to verify the new locations.

7.4.4.3. Detector sensitivity shall be readjusted (as necessary) to ensure prompt operation during these tests. If new detector sensitivity is required, it shall be entered into the detector log described above.

7.4.4.4. Any detector which fails these tests shall be replaced and the new unit retested at no additional cost to the Contractor. 2

7.4.5. At the completion of the above tests, Halon system discharge tests shall be performed. See Paragraph 7.3. 2 2

7.4.6. After detector smoke pattern tests have been successfully completed, each detection system associated with the Halon system shall be left in an "alarm mode" whereby it shall undergo a stability test period of not less than seven (7) consecutive days.

7.4.6.1. During this period, should there be any unwarranted alarms due to the sensitivity setting of the detectors, the Contractor shall readjust the detectors to a stable range. Any readjustment shall necessitate reconducting the smoke test in Paragraph 7.4.4. During the "alarm mode," operation of detectors shall only activate alarm. Actuation of the Halon systems during this time period shall be strictly manual.

7.4.6.2. After successfully completing Subparagraphs 7.4.4. and 7.4.6., the Contractor shall again conduct tests to ensure that the systems still perform as specified in Paragraph 7.4.4. 2

7.4.6.3. It at the end of the stability test period, the systems do not comply with Subparagraphs 7.4.4. and 7.4.6., the systems shall be removed and replaced with a system that will meet the requirements. This shall be done at no additional cost to the Contract. 2

7.4.6.4. Three (3) copies of the Fire Detection System Installation Acceptance Report with witnessing personnel signatures shall be filled out and left with the Construction Manager after successful completion of the test. 2

7.5. Contractor shall cover up any equipment which could be damaged by water or Freon during testing. After tests are completed, Contractor shall remove all covers and clean up any water and/or damage produced by the test(s). 2 2

8.0. FINISHING AND PAINTING

8.1. General.

8.1.1. All equipment surfaces shall be cleaned and all surfaces requiring painting shall be painted by the equipment manufacturer before shipment.

8.1.2. Exposed ferrous surfaces of piping and hangers shall be prime painted only. Any abraded or bare surfaces including work of others damaged by this Contractor shall have primer repaired by this Contractor at no additional cost.

8.1.3. Finish painting of piping and hangers will be by others.

8.2. Cleaning and Closures. All internal and external surfaces of the equipment shall be thoroughly cleaned of all mill scale, loose metal particles, weld spatter, slag, dirt and other foreign matter and shall receive a surface preparation compatible with that specified by the prime paint manufacturer as required for proper paint application. All burrs shall be removed and all sharp edges shall be eased. Following cleaning, all openings shall be sealed against entry of paint, water, dirt and debris during painting, shipment and field handling.

8.3. Painting. All exposed ferrous surfaces of the equipment shall, except as follows, be given one (1) coat of rust-inhibitive, modified alkyd flat finish primer that is compatible with the maximum operating conditions that will be encountered:

8.3.1. Name and data plates and machined mating surfaces shall not be painted, but shall be coated with a slushing compound.

8.3.2. All instruments and control panels shall receive manufacturer's standard factory finish only.

8.3.3. All piping, pipe fittings, hangers and auxiliary steel will require priming unless galvanized or insulated.

8.4. Damaged Galvanized Touch Up.

8.4.1. Any galvanized surfaces that are damaged due to abrading, welding, cutting, etc., must have a touch up with a suitable paint. See Article 16.0, PRIME AND TOUCH UP PAINTING.

8.4.2. All damaged areas must first be properly cleaned using the techniques described in SSPC-SP2, "Hand Tool Cleaning" and SSPC-SP3, "Power Tool Cleaning."

8.4.3. After proper cleaning, all areas requiring touch up will be coated with a paint meeting the minimum requirements of U.S. Government Specification MIL-P-21035, "Paint, High Zinc Content, Galvanizing Repair."

8.4.4. Application shall be in strict accordance with manufacturer's recommendations.

9.0. PREPARATION FOR SHIPMENT

For shipment, each unit shall be disassembled only to such extent as may be necessary to facilitate field handling and prevent damage during shipment. Each assembly or component shall be skidded, crated, boxed or otherwise protected against damage or loss during shipment, and to facilitate field handling. All openings shall be closed with temporary closures to prevent entry of dust, dirt or other foreign matter.

10.0. SPECIAL TOOLS AND DEVICES

One (1) complete set of all special tools or special devices, including any metric wrenches or other hand tools that are not standard in the United States, required for operation and/or maintenance of all equipment furnished under this Contract shall be provided and delivered with the equipment.

11.0. SPARE PARTS

11.1. The wet pipe sprinkler system installed shall be provided with a cabinet containing a special sprinkler wrench, and six spare sprinklers of the type rating as used.

11.2. The Contractor shall furnish two (2) spare detectors of each model furnished as part of this Contract. 2

11.3. All items covered in Paragraph 11.1. and 11.2. shall be supplied in individual containers marked as "Spares," and shall be in a new and unused condition on delivery.

12.0. DOCUMENTATION

Documentation shall be in accordance with Specification No. FJ50.50 and Engineering Standard No. FJ60.60.

APPENDIX A

PROJECT NAME 10 MWe Solar Pilot Plant

TABLE I

PORTABLE FIRE EXTINGUISHER SCHEDULE

CO_2/HALON 1211* POUNDS					DRY CHEMICAL POUNDS				MULTI PURPOSE DRY CHEMICAL POUNDS				CABINET	AREA	LOCATION C - COLUMN W - WALL R - RAIL	REMARKS
7*	10	15	20	60	10	20	30	120	10	20	30	150				
1														Thermal Storage Contr. Bldg. BL-709	W	Locate Adjacent to Door
1														Thermal Storage Contr. Bldg. BL-710	W	Locate Adjacent to Door
1														Thermal Storage Contr. Bldg. BL-712	W	Locate Adjacent to Door
														Receiver Tower:		
1														Electronic Room - 13th Level	W	Locate Adjacent to Door
1														Electronic Room - 14th Level	W	Locate Adjacent to Door
										2				Raw/Service Water Pump Bldg.	W	Locate on East Wall and South Wall Adj. to Doors
										2				Secondary Fire Pump Bldg.	W	Locate One Adjacent to Door @ West Wall (inside), and Adjacent to Door @ East Wall (inside)
											2			Warehouse	C	Locate on Col. 1-A.3 and Col. 5-A.3
														Cooling Tower Remote MCC Bldg.	W	Locate Adjacent to Door
5										4	2					Total (without spares)
1										1	1					Spares
6										5	3					TOTAL (With Spares)

2

* WHEELED UNITS

APPENDIX B

STANDARD FORM OF THE NATIONAL AUTOMATIC SPRINKLER & FIRE CONTROL ASSOCIATION, INC.

CONTRACTOR'S MATERIAL & TEST CERTIFICATE
SPRINKLER SYSTEMS - WATER SPRAY SYSTEMS

PART "A" GENERAL

PROCEDURE

UPON COMPLETION OF WORK, INSPECTION AND TESTS SHOULD BE MADE BY CONTRACTOR'S REPRESENTATIVE AND WITNESSED BY AN OWNER'S REPRESENTATIVE. ALL DEFECTS SHOULD BE CORRECTED AND SYSTEM LEFT IN SERVICE BEFORE CONTRACTOR'S MEN FINALLY LEAVE THE JOB.

A CERTIFICATE SHOULD BE FILLED OUT AND SIGNED BY BOTH REPRESENTATIVES. COPIES SHOULD BE PREPARED FOR INSPECTING AUTHORITIES, OWNER AND CONTRACTOR. IT IS UNDERSTOOD THE OWNER'S REPRESENTATIVE'S SIGNATURE IN NO WAY PREJUDICES ANY CLAIM AGAINST CONTRACTOR FOR FAULTY MATERIAL, POOR WORKMANSHIP OR FAILURE TO COMPLY WITH INSPECTING AUTHORITY'S REQUIREMENTS OR LOCAL ORDINANCES.

PROPERTY NAME			DATE
PROPERTY ADDRESS			
PLANS	ACCEPTED BY INSPECTION AUTHORITY (IES) NAMES		
	ADDRESS		
	INSTALLATION CONFORMS TO ACCEPTED PLANS	YES ☐	NO ☐
	EQUIPMENT USED IS APPROVED	YES ☐	NO ☐
	IF NO, STATE DEVIATIONS		
INSTRUCTIONS	HAS PERSON IN CHARGE OF FIRE EQUIPMENT BEEN INSTRUCTED AS TO LOCATION OF CONTROL VALVES AND CARE OF THIS NEW EQUIPMENT	YES ☐	NO ☐
	IF NO, EXPLAIN		
	HAS A COPY OF INSTRUCTION AND MAINTENANCE CHART BEEN LEFT AT PLANT	YES ☐	NO ☐
	IF NO, EXPLAIN		
TEST DESCRIPTION	FLUSHING: Flow the required rate until mains are clear as indicated by no collection of foreign material in outlet caps at outlets such as hydrants and blow-offs. Flush at flows not less than 750 GPM for 4-inch pipe and smaller, 1000 GPM for 5-inch, 1500 GPM for 10-inch, 2000 GPM for 12-inch. Where supply cannot produce stipulated flow rate, obtain maximum available by using properly sized discharge devices. HYDROSTATIC: Hydrostatic test should be made at not less than 200 PSI for two hours or 50 PSI above static pressure in excess of 150 PSI. Differential dry-pipe valve clappers should be left open during test to prevent damage. All above ground piping leakage should be stopped. LEAKAGE: New pipe laid with rubber gasketed joints should, if the workmanship is satisfactory, have no leakage at the joints. Unsatisfactory amounts of leakage usually result from twisted, pinched or cut gaskets. However, some leakage might result from small amounts of grit or small imperfections. The amount of leakage at the joints should not exceed 2 quarts per hour per 100 joints irrespectively of pipe diameter. The leakage should be distributed over all joints. If such leakage occurs at a few joints the installation should be considered unsatisfactory and necessary repairs made. New pipe laid with caulked lead or lead-substitute joints should, if the workmanship is satisfactory, have little or no leakage at the joints. Any joint having leakage or more than a "slight drip" or "weeping" should be repaired. Leakage should not exceed 1 oz. (liquid measure) per hour per inch of pipe diameter per joint. The leakage should be distributed over all joints. If such leakage occurs almost entirely at a few joints, the installation should be considered unsatisfactory and necessary repairs made. PNEUMATIC: Establish 40 PSI air pressure and measure pressure drop which should not exceed 1 1/2 PSI in 24 hours. Test pressure gauge at normal water level and air pressure, and measure air pressure drop which should not exceed 1 1/2 PSI in 24 hours.		

PART "B" — UNDERGROUND PIPING

LOCATION	FEEDS BLDGS.		
UNDERGROUND PIPES AND JOINTS	PIPE TYPE AND CLASS	TYPE JOINT	
	CONFORMS TO _____ STANDARD	YES ☐	NO ☐
	IF NO, EXPLAIN		
	JOINTS NEEDING ANCHORAGE CLAMPED, STRAPPED OR BACKED IN ACCORDANCE WITH _____ STANDARD	YES ☐	NO ☐
	IF NO, EXPLAIN		

TESTS REQUIRED	FLUSHING	...	HYDROSTATIC	...	LEAKAGE
FLUSHING TESTS	NEW UNDERGROUND PIPING FLUSHED ACCORDING TO _____ STANDARD BY (COMPANY)				YES ☐
	HOW WAS FLUSHING FLOW OBTAINED	PUBLIC WATER ☐	TANK OR RESERVOIR ☐		FIRE PUMP ☐
	THROUGH WHAT TYPE OPENING		HYD. BUTT. ☐		OPEN PIPE ☐
	LEAD-INS FLUSHED ACCORDING TO _____ STANDARD BY (COMPANY)				YES ☐
	HOW WAS FLUSHING FLOW OBTAINED	PUBLIC WATER ☐	TANK OR RESERVOIR ☐		FIRE PUMP ☐
	THROUGH WHAT TYPE OPENING		Y CONN. TO FLANGE & SPIGOT ☐		OPEN PIPE ☐

HYDROSTATIC TEST
ALL NEW UNDERGROUND PIPING HYDROSTATICALLY TESTED AT _____ P.S.I. FOR _____ HOURS

LEAKAGE TEST
TOTAL AMOUNT OF LEAKAGE MEASURED _____ GALS. _____ HOURS
ALLOWABLE LEAKAGE _____ GALS. _____ HOURS

HYDRANTS
NUMBER INSTALLED | TYPE AND MAKE
ALL OPERATE SATISFACTORILY YES ☐ NO ☐

CONROL VALVES
WATER CONTROL VALVES LEFT WIDE OPEN YES ☐ NO ☐
IF NO, STATE REASON

REMARKS
DATE LEFT IN SERVICE

PARTS A & B
NAME OF SPRINKLER CONTRACTOR | FOR PROPERTY OWNER (SIGNED) TITLE

SIGNATURES
FOR SPRINKLER CONTRACTOR (SIGNED) | DATE

PART "C" — SPRINKLER & WATER SPRAY ABOVE GROUND PIPING (FILL OUT SEPARATE PART "C" FOR EACH RISER)

LOCATION
SERVES BLDGS.

TESTS REQUIRED
1 HYDROSTATIC TEST OF ALL PIPING
2 PNEUMATIC TEST OF ALL DRY PIPING
3 EQUIPMENT OPERATION TESTS OF ALL EQUIPMENT

SPRINKLERS OR SPRAY NOZZLES

MAKE	MODEL	SIZE	QUANTITY	TEMPERATURE RATING

PIPE AND FITTINGS
MATERIAL AND KIND CONFORMS TO _____ STANDARD
IF NONE, EXPLAIN

ALARM VALVE OR FLOW INDICATOR

ALARM DEVICE			MAXIMUM TIME TO OPERATE THROUGH TEST PIPE	
TYPE	MAKE	MODEL	MIN.	SEC.

DRY PIPE VALVES

MAKE	MODEL	SER. NO.	OPERATING TEST RESULTS: TIME TO TRIP THROUGH TEST PIPE — WITHOUT A. C. D. MIN.	WITHOUT A. C. D. SEC.	WITH A. C. D. MIN.	WITH A. C. D. SEC.	WATER PRESS. P.S.I.	AIR PRESS. P.S.I.	TRIP POINT AIR PRESS. P.S.I.	TIME WATER REACHED TEST OUTLET MIN.	TIME WATER REACHED TEST OUTLET SEC.	ALARM OPERATED PROPERLY YES	ALARM OPERATED PROPERLY NO

IF NO, EXPLAIN

DELUGE & PREACTION VALVES
OPERATION PNEUMATIC ☐ ELECTRIC ☐ HYDRAULIC ☐
PIPING SUPERVISED YES ☐ NO ☐ | DETECTING MEDIA SUPERVISED YES ☐ NO ☐
DOES VALVE OPERATE FROM THE MANUAL TRIP AND/OR REMOTE CONTROL STATIONS YES ☐ NO ☐
IS THERE AN ACCESSIBLE FACILITY IN EACH CIRCUIT FOR TESTING YES ☐ NO ☐
IF NO, EXPLAIN

MAKE	MODEL	DOES EACH CIRCUIT OPERATE SUPERVISION LOSS ALARM YES	SUPERVISION LOSS ALARM NO	DOES EACH CIRCUIT OPERATE VALVE RELEASE YES	VALVE RELEASE NO	MAXIMUM TIME TO OPERATE RELEASE MIN.	MAXIMUM TIME TO OPERATE RELEASE SEC.

TESTS
ALL PIPING HYDROSTATICALLY TESTED AT _____ PSI FOR _____ HOURS
DRY PIPING PNEUMATICALLY TESTED YES ☐ NO ☐
EQUIPMENT OPERATE PROPERLY YES ☐ NO ☐
IF NO, STATE REASON
DRAIN TEST: READING OF GAGE LOCATED NEAR WATER SUPPLY TEST PIPE: STATIC PRESSURE _____ PSI RESIDUAL PRESSURE WITH VALVE IN TEST PIPE OPEN WIDE: _____ PSI

BLANK TESTING GASKETS
NUMBER USED | LOCATIONS | NUMBER REMOVED

REMARKS
DATE LEFT IN SERVICE WITH ALL CONTROL VALVES OPEN.

PART "C" SIGNATURES
NAME OF SPRINKLER CONTRACTOR | FOR PROPERTY OWNER (SIGNED) | TITLE
FOR SPRINKLER CONTRACTOR (SIGNED)

FOAM SYSTEM
ACCEPTANCE TEST REPORT

(Submit separate report for each system)

PROJECT: _____ DATE _____

JOB NO. _____ CONTRACTOR'S SYSTEM NO. _____

LOCATION _____

AREA BEING PROTECTED: _____

TYPE SYSTEM: LOW EXPANSION ☐ MEDIUM EXPANSION ☐ HIGH EXPANSION ☐

TEST PERFORMED BY: _____ DATE/TIME _____ / _____

INSTALLED PER JOB DRAWING AND SPECIFICATIONS? _____ IF NO, DESCRIBE UNDER COMMENTS.

BRIEF DESCRIPTION OF HOW FOAM SAMPLE IS COLLECTED _____

METHOD OF SYSTEM ACTUATION FOR TEST: ☐ AUTOMATIC ☐ MANUAL

FOAM EXPANSION DETERMINATION

RESULTS _____

FOAM 25 PER CENT DRAINAGE TIME DETERMINATION

TIME - MIN.	DRAINED SOLUTION VOLUME-ML

RESULTS _____

WITNESSING PERSONNEL SIGNATURES:	NAME	TITLE	DATE
INSTALLING CONTRACTOR'S REPRESENTATIVE			
CO.			
ENGINEER'S REPRESENTATIVE			
CO.			
CLIENT'S REPRESENTATIVE			
CO.			
INSURANCE COMPANY'S REPRESENTATIVE			
CO.			

FOAM SYSTEM
ACCEPTANCE TEST REPORT

CONCENTRATION DETERMINATION

RESULTS

SUMMARY OF SYSTEM TESTS

COMMENTS

FOAM SYSTEM
ELECTRICAL SYSTEM COMPONENT CHECK SHEET

CONTROL PANEL	YES	NO
Supervised detection circuits		
Supervised alarm signal circuits		
Supervised release circuit to point of release		
Supervised manual pull stations		
Supervised time delay relays		
Supervised foam cancel switch		
Alarm Silence switch with ring back feature		
System trouble silence switch with ring back feature		
Circuit annunciator control panel		
– Both alarm and trouble		
– Battery standby with charger: 6 Amp hour		
12 Amp hour		
26 Amp hour		
_____ Amp hour (fill in)		
Pre-alarm detection mode:		
– Ionization detectors		
– Photoelectric detectors		
– Thermal detectors		
– U/V detectors		
– Other (define)		
Pre-alarm function:		
– Audible alarm only		
– Audible alarm with visible indicator		
– HVAC equipment shutdown relays ☐ Damper shutdown relays ☐		
– Magnetic door release relays		
– Equipment shutdown		
– Remote annunciator		
System actuation mode:		
– Cross zoned ionization/photoelectric detectors		
– Single zone ionization/photoelectric detectors		
– Thermal detectors		
– U/V detectors		
– Manual pull stations		
– Other (define)		
System actuation function:		
– Audible alarm with visible indicator		
– Audible alarm only		
– HVAC equipment shutdown relays ☐ Damper shutdown relays ☐		
– Power and equipment shutdown relays		
– Magnetic door release relays		
Installation and inspection:		
– Engineering, installation & maintenance manuals provided		
– Full system discharge test		
– Functional test		
– Piping flushed		
– Reserve system ☐ Automatic transfer		
☐ Manual transfer		

HALON 1301 FIRE SUPPRESSION SYSTEM
INSTALLATION ACCEPTANCE TEST REPORT

(Submit separate report for each system)

PROJECT: _____ DATE _____

JOB NO. _____ CONTRACTOR'S SYSTEM NO. _____

LOCATION _____

AREA BEING PROTECTED: _____

TYPE SYSTEM: TOTAL FLOOD ☐ LOCAL ☐ MODULAR ☐

TEST PERFORMED BY: _____ DATE/TIME _____ / _____

1. AGENT STORAGE CONTAINER INSPECTION Date Made _____ Initial _____

SER. NO.	PRESSURE	WEIGHT	SER. NO.	PRESSURE	WEIGHT	SER. NO.	PRESSURE	WEIGHT	SER. NO.	PRESSURE	WEIGHT

	Check OK	Initial	Date
2. MOUNTING BRACKETS PROPERLY SECURED			
3. INSTALLATION OF CONTAINERS			

4. INSPECTION OF DETECTION SYSTEM

Pre-alarm:
- ☐ Ionization/Photoelectric Detectors
- ☐ Thermal Detectors (Preset to _____ °F: _____ °C)
- ☐ Ultraviolet Detectors
- ☐ Other (define) _____

Mode of Actuation
- ☐ Ionization/Photoelectric Detectors - Spacing = _____ feet (__m)
- ☐ Thermal Detectors - Spacing = ___ feet (__m) (Preset to __ °F: __ °C)
- ☐ Ultraviolet Detectors - Spacing = _____ feet (__m)
- ☐ Other (define) _____ Spacing = _____ Ft. (__m)

Detectors spaced by (check appropriate) symmetry ☐ or according to specific hazard ☐

		Check OK	Initial	Date
5. THERMAL DETECTOR CIRCUIT TEST	Volts _____			
6. BATTERY STANDBY UNIT TEST				
7. SYSTEM CONTROL UNIT TEST				
8. DETECTOR RESPONSE AND MANUAL PULL STATION TESTS	(a) Smoke Detectors			
	(b) Thermal Detectors			
	(c) Ultraviolet Detectors			
	(d) Other (define) _____			
	(e) Manual Pull Station Test			
9. INITIATOR INSTALLATION (When Provided)	(a) Insulation Resistance Check			
	(b) Initiator Resistance Check			
10. FINAL SYSTEM CHECK-OUT				
11. FINAL SYSTEM HOOK-UP				

12. PIPING BLOWNOUT WITH (check one) FREON 12 ☐; OR CO_2 ☐.

13. INSTALLED PER JOB DRAWING AND SPECIFICATIONS _____ IF NO, DESCRIBE UNDER COMMENTS.

WITNESSING PERSONNEL SIGNATURES:	NAME	TITLE	DATE
INSTALLING CONTRACTOR'S REPRESENTATIVE			
CO. _____			
ENGINEER'S REPRESENTATIVE			
CO. _____			
CLIENT'S REPRESENTATIVE			
CO. _____			
INSURANCE COMPANY'S REPRESENTATIVE			
CO. _____			

HALON 1301 FIRE SUPPRESSION SYSTEM
INSTALLATION CONTRACTOR COMPONENT TEST REPORT

Zone _____

Agent Storage Container # _____ Weight _____ Pressure _____ Temp. _____

NOTE: If more than six containers in system, use additional page 2.

_____ Weight _____ Pressure _____ Temp. _____
_____ Weight _____ Pressure _____ Temp. _____
_____ Weight _____ Pressure _____ Temp. _____
_____ Weight _____ Pressure _____ Temp. _____
_____ Weight _____ Pressure _____ Temp. _____

— Mounting Brackets Checked _____

— Piping and Nozzles Checked _____

Initiator ( ) Circuit Test _____ Ohms, Megger Test _____ Replaced _____

Ionization Detectors ( ) Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____

Photoelectric Detectors ( ) Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____

Thermal Detectors ( ) Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____

U/V Detectors ( ) Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____

Others (define)_____ Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____
Method _____

Manual Pull Stations ( ) Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____

Alarm Lights ( ) Actuation Test _____ Lamps Replaced _____ Quantity _____

Alarm Signals ( ) Actuation Test _____ Quantity _____

Battery Test _____ Volts _____ Bleed Down & Recharge _____

Building Alarm Activated Yes ☐ No ☐

Dampers(s) Activated Yes ☐ No ☐ Type _____ Quantity _____

Interlocks Checked Yes ☐ No ☐ Type _____ Quantity _____

HVAC Shutdown Checked Yes ☐ No ☐

Panel Lamps Checked Yes ☐ No ☐

Door Release Checked Yes ☐ No ☐ Door Closure Occured Yes ☐ No ☐ If No, Describe Under Comments

System Left Armed - Date _____

Dis-Armed - Date _____

Reason _____

Comments

_____

_____

_____

_____

_____

_____

_____

_____

_____

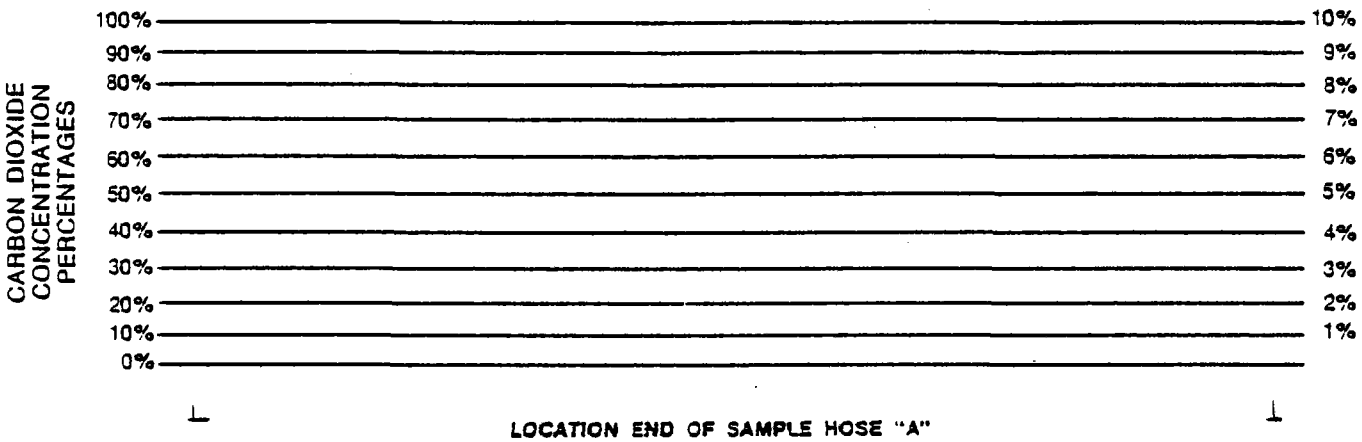
HALON 1301 FIRE SUPPRESSION SYSTEM
ELECTRICAL SYSTEM COMPONENT CHECK SHEET

CONTROL PANEL	YES	NO
Supervised detection circuits		
Supervised alarm signal circuits		
Supervised release circuit to point of release		
Supervised manual pull stations		
Supervised time delay relays		
Supervised Halon cancel switch		
Dead front design panel		
Alarm silence switch with ring back feature		
System trouble silence switch with ring back feature		
Circuit annunciator at Halon panel		
– Both alarm and trouble		
– Battery Standby with charger: 6 Amp hour		
12 Amp hour		
26 Amp hour		
___ Amp hour (fill in)		
Pre-alarm detection mode:		
– Ionization detectors		
– Photoelectric detectors		
– Thermal detectors		
– U/V detectors		
Other (define)_____		
Pre-alarm function:		
– Audible alarm only		
– Audible alarm with visible indicator		
– HVAC equipment shutdown relays ☐ Damper shutdown relays ☐		
– Magnetic door release relays		
– Remote annunciator		
System actuation mode:		
– Cross zoned ionization/photoelectric detectors		
– Single zone ionization/photoelectric		
– Thermal detectors		
– U/V detectors		
– Other (define)_____		
– Manual pull stations		
System actuation function:		
– Audible alarm with visible indicator		
– Audible alarm only		
– HVAC equipment shutdown relays ☐ Damper shutdown relays ☐		
– Power and computer shutdown relays		
– Magnetic door release relays		
Installation and inspection:		
– Engineering, installation & maintenance manuals provided		
– Full system discharge test using Halon 122		
– Full system discharge test using Halon 1301		
– Functional test		
– Piping blown out		
– Reserve system ☐ Automatic transfer		
☐ Manual transfer		

PROJECT: _____ DATE: _____

AREA BEING PROTECTED _____

VERTICAL LINE DIVISIONS EQUAL 60 SECONDS



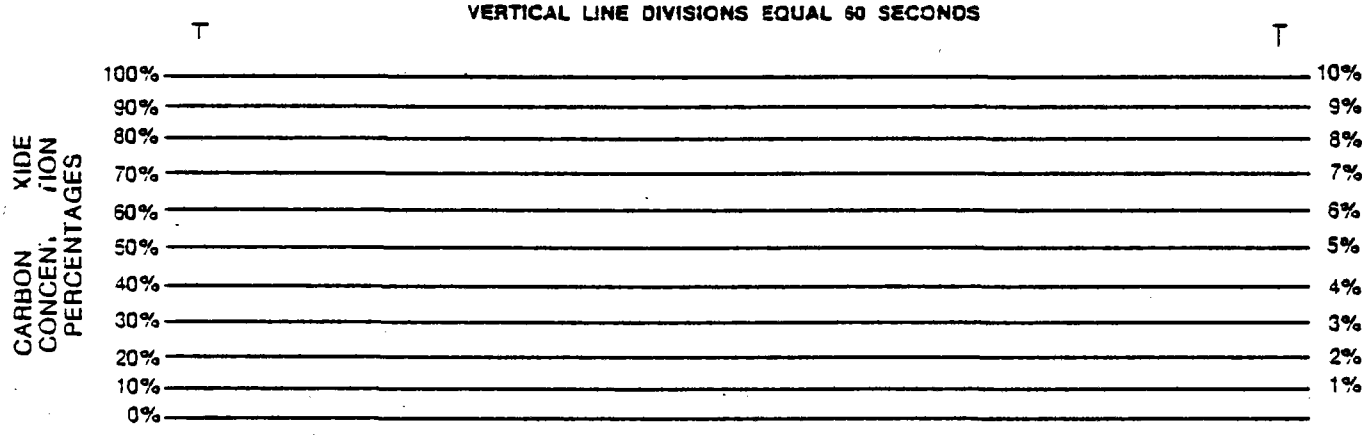
LOCATION END OF SAMPLE HOSE "A"

DISTANCE FROM: NORTH WALL___FT.; EAST WALL___FT.; SOUTH WALL___FT.; WEST WALL___FT.

DISTANCE ABOVE: FLOOR_____FT.; RAISED FLOOR_____FT.; SUBFLOOR _____FT.

HAZARD HEIGHT — FLOOR TO CEILING_____FT. UNDERFLOOR HEIGHT — _____FT.

VERTICAL LINE DIVISIONS EQUAL 60 SECONDS



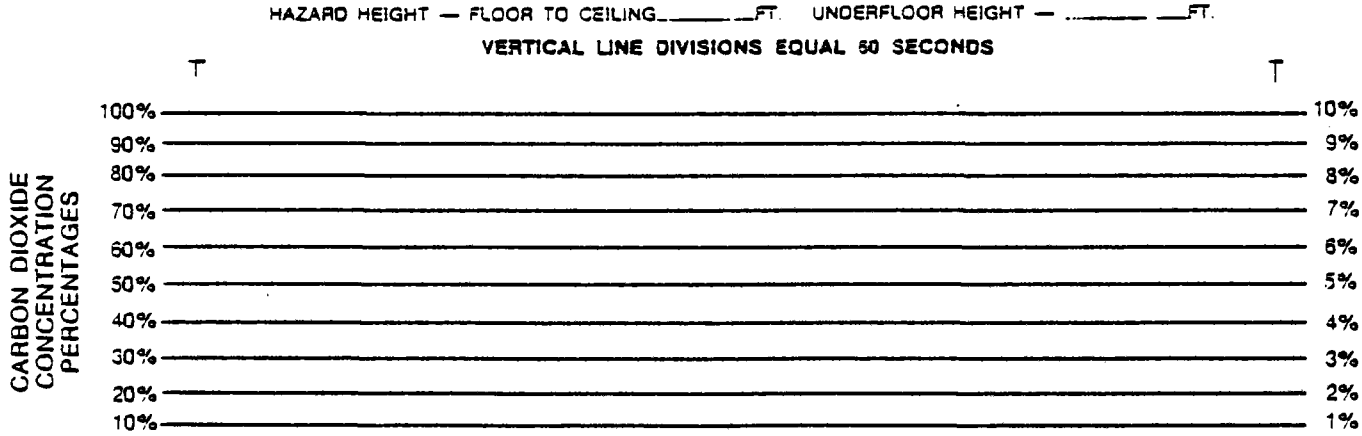
LOCATION END OF SAMPLE HOSE "B"

DISTANCE FROM: NORTH WALL___FT.; EAST WALL___FT.; SOUTH WALL___FT.; WEST WALL___FT.

DISTANCE ABOVE: FLOOR_____FT.; RAISED FLOOR_____FT.; SUBFLOOR _____FT.

HAZARD HEIGHT — FLOOR TO CEILING_____FT. UNDERFLOOR HEIGHT — _____FT.

VERTICAL LINE DIVISIONS EQUAL 60 SECONDS



LOCATION END OF SAMPLE HOSE "C"

DISTANCE FROM: NORTH WALL___FT.; EAST WALL___FT.; SOUTH WALL___FT.; WEST WALL___FT.

DISTANCE ABOVE: FLOOR_____FT.; RAISED FLOOR_____FT.; SUBFLOOR _____FT.

HAZARD HEIGHT — FLOOR TO CEILING_____FT. UNDERFLOOR HEIGHT — _____FT.

FIRE DETECTION SYSTEM
INSTALLATION ACCEPTANCE TEST REPORT

(Submit separate report for each system)

PROJECT: _____ DATE _____

JOB NO. _____ CONTRACTOR'S SYSTEM NO. _____

LOCATION _____

AREA BEING PROTECTED: _____

TYPE SYSTEM: IONIZATION ☐ PHOTOELECTRIC ☐ THERMAL ☐
U/V ☐ FLAME ☐ INFRARED ☐

TEST PERFORMED BY: _____ DATE/TIME _____

1. INSPECTION OF DETECTION SYSTEM

Pre-alarm: (if any)
- ☐ Ionization Detectors
- ☐ Photoelectric Detectors
- ☐ Thermal Detectors (Preset to _____ °F: _____ °C)
- ☐ Ultraviolet Detectors
- ☐ Other _____

Mode of Actuation
- ☐ Ionization/Photoelectric Detectors - Spacing = _____ feet (_____ m)
- ☐ Thermal Detectors - Spacing = _____ feet (_____ m) (Preset to _____ °F: _____ °C)
- ☐ Ultraviolet Detectors - Spacing = _____ feet (_____ m)
- ☐ Other (define) _____ Spacing = _____ feet (_____ m)

Detectors spaced by (check appropriate) symmetry ☐ or according to specific hazard ☐.

		Check OK	Initial	Date
2. DETECTOR CIRCUIT TEST	Volts _____			
3. BATTERY STANDBY UNIT TEST				
4. SYSTEM CONTROL UNIT TEST				
5. DETECTOR RESPONSE AND MANUAL PULL STATION TESTS	(a) Smoke Detectors			
	(b) Thermal Detectors			
	(c) Ultraviolet Detectors			
	(d) Other (define) _____			
	(e) Manual Pull Station Test			
6. FINAL SYSTEM CHECK-OUT				
7. FINAL SYSTEM HOOK-UP				

8. INSTALLED PER JOB DRAWING AND SPECIFICATIONS _____ IF NO, DESCRIBE UNDER COMMENTS

WITNESSING PERSONNEL SIGNATURES:	NAME	TITLE	DATE
INSTALLING CONTRACTOR'S REPRESENTATIVE			
CO. _____			
ENGINEER'S REPRESENTATIVE			
CO. _____			
CLIENTS REPRESENTATIVE			
CO. _____			
INSURANCE COMPANY'S REPRESENTATIVE			
CO. _____			

FIRE DETECTION SYSTEM
INSTALLATION CONTRACTOR COMPONENT TEST REPORT

Zone _____

Ionization Detectors ( )
Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____

Photoelectric Detectors ( )
Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____

Thermal Detectors ( )
Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____

U/V Detectors ( )
Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____
Method _____

Others _____ ( )
Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____

Manual Pull Stations ( )
Part No. _____ Quantity _____
Circuit Test _____
Actuation Test _____ All _____ Random _____

Alarm Lights ( ) Actuation Test _____ Lamps Replaced _____ Quantity _____
Alarm Signals ( ) Actuation Test _____ Quantity _____
Battery Test _____ Volts _____ Bleed Down & Recharge _____
Building Alarm Activated Yes ☐ No ☐
Damoers(s) Activated Yes ☐ No ☐ Type _____ Quantity _____
Interlocks Checked Yes ☐ No ☐ Type _____ Quantity _____
HVAC Shutdown Checked Yes ☐ No ☐
Panel Lamps Checked Yes ☐ No ☐
Door Release Checked Yes ☐ No ☐ Door Closure Occured Yes ☐ No ☐ If No, Describe Under Comments
System Left Armed - Date _____
Dis-Armed - Date _____
Reason _____

Comments _____

FIRE DETECTION SYSTEM
ELECTRICAL SYSTEM COMPONENT CHECK SHEET

CONTROL PANEL	YES	NO
Supervised detection circuits		
Supervised alarm signal circuits		
Supervised manual pull stations		
Dead front design panel		
Alarm silence switch with ring back feature		
System trouble silence switch with ring back feature		
Circuit annunciator at panel		
– Both alarm and trouble		
– Battery Standby with charger: 6 Amp hour		
12 Amp hour		
26 Amp hour		
_____ Amp hour (Fill in)		
Pre-Alarm detection mode:		
– Ionization detectors		
– Photoelectric detectors		
– Thermal detectors		
– U/V detectors		
– Other (Define) _____		
Pre-alarm function: (Indicate Function)		
– Audible alarm only		
– Audible alarm with visible indicator		
– HVAC equipment shutdown relays ☐ Damper shutdown relays ☐		
– Magnetic door release relays		
– Remote annunciator		
System alarm mode:		
– Ionization detectors		
– Photoelectric		
– Thermal detectors		
– U/V detectors		
– Other (Define) _____		
– Manual pull stations		
System actuation function: (Indicate Function)		
– Audible alarm only		
– Audible alarm with visible inidcator		
– HVAC equipment shutdown relays ☐ Damper shutdown relays ☐		
– Power shutdown relays		
– Magnetic door release relays		
Installation and inspection:		
– Engineering, installation & maintenance manuals provided		
– Functional test		

APPENDIX C

EQUIPMENT DATA

NAME OF BIDDER _____

Bidder shall fill in all spaces provided in the following Equipment Data section:

1. WET PIPE SPRINKLER/FIRE HOSE SYSTEM - (DIESEL FIRE PUMP BUILDING)

   A. Water Data

      a. Required flow at Contractor's terminal (gpm) _____

      b. Calculated pressure at Contractor's terminal (psi) _____

      c. Surface Area Density (gpm/sq ft) _____

      d. End head pressure _____

   B. Sprinklers

      a. Manufacturer _____

      b. Model number _____

      c. Quantity to be installed _____

      d. Type _____

      e. Capacity each nozzle, gpm _____

   C. Pipe

      a. Schedule _____

      b. Material _____

   D. Hose rack

      a. Manufacturer _____

      b. Model number _____

   E. Fire Hose

      a. Manufacturer _____

      b. Model number _____

EQUIPMENT DATA (CONTD)

NAME OF BIDDER _____

F. Nozzle

a. Manufacturer _____

b. Model number _____

G. Pressure Restricting Disc

a. Manufacturer _____

b. Model number _____

H. Control Valve

a. Manufacturer _____

b. Model number _____

c. Size, inches _____

I. Waterflow Switch

a. Manufacturer _____

b. Model number _____

2. DRY STANDPIPE SYSTEM - WAREHOUSE

A. Hose racks

a. Manufacturer _____

b. Model number _____

c. Quantity (total) _____

B. Fire Hose

a. Manufacturer _____

b. Model number _____

c. Quantity (total) _____

EQUIPMENT DATA (CONTD)

NAME OF BIDDER _____

C. Nozzles

a. Manufacturer _____

b. Model number _____

c. Quantity _____

d. Size, inches _____

D. Automatic control valve

a. Manufacturer _____

b. Model number _____

E. Pressure switches

a. Manufacturer _____

b. Model number _____

F. Restricting discs

a. Manufacturer _____

b. Model number _____

c. Quantity _____

G. Hose station angle valves

a. Manufacturer _____

b. Model number _____

c. Quantity _____

d. Size, inches _____

H. Wall Fire Hydrant/Control Valve

a. Manufacturer _____

EQUIPMENT DATA (CONTD)

NAME OF BIDDER _____

b. Model number _____

c. Operator Model No. _____

I. Pushbutton Stations

a. Manufacturer _____

b. Model number _____

c. Quantity _____

3. SEMI-AUTOMATIC FOAM MONITOR SYSTEM

A. Deluge Valve

a. Manufacturer _____

b. Model number _____

c. Size, inches _____

B. Strainer

a. Manufacturer _____

b. Model number _____

c. Size, inches _____

C. Gate Valve

a. Manufacturer _____

b. Model number _____

c. Size, inches _____

D. Control Panel

a. Manufacturer _____

b. Model number _____

c. Number of contacts _____

EQUIPMENT DATA (CONTD)

NAME OF BIDDER _____

E. Alarm Horn

a. Manufacturer _____

b. Model number _____

c. Size, inches _____

F. Pressure switch

a. Manufacturer _____

b. Model number _____

G. Balanced Pressure Proportioner Tank

a. Manufacturer _____

b. Model number _____

c. Capacity, Main/Reserve (gal.) _____ / _____

H. Foam Concentrate

a. Manufacturer _____

b. Type/% concentrate _____ / _____

c. Quantity (gallons) _____

I. Foam Monitor Nozzle

a. Manufacturer _____ / _____

b. Model number _____

c. Size, inches _____

EQUIPMENT DATA (CONTD)

NAME OF BIDDER _____

4. AUTOMATIC HALON 1301 SYSTEMS

	Thermal Storage Control Bldg.		Receiver Tower	
	BL-709	BL-710	14th Level	13th Level
A. Halon System				
a. Manufacturer				
b. Capacity, pounds				
(1) Main				
(2) Reserve				
(3) Total				
c. Storage temperature, F				
d. Design pressure, psig				
B. Nozzles				
a. Manufacturer				
b. Model number				
c. Quantity				

EQUIPMENT DATA (CONTD)

NAME OF BIDDER _____

	Thermal Storage Control Bldg. BL-709	Thermal Storage Control Bldg. BL-710	Receiver Tower 14th Level	Receiver Tower 13th Level
C. Piping				
a. Material				
b. Schedule				
c. Size, inches (range)				
D. Audio-Visual Alarms				
a. Manufacturer				
b. Model number				
c. Quantity				
E. Control Panel/Detectors				
a. Manufacturer	/	/	/	/
b. Model number	/	/	/	/
c. No. of contacts	/	/	/	/
d. Quantity	/	/	/	/
F. Test Gas				
a. Type				
b. Quantity, pounds				

EQUIPMENT DATA (CONTD)

NAME OF BIDDER _____

5. AUTOMATIC FIRE DETECTION SYSTEMS

	Warehouse Building (BL-703)	Cooling Tower Remote MCC Building	Electrical Equipment Building BL-712	TSS Pump/ Heat Exchanger Areas
A. Detectors				
a. Manufacturer				
b. Model number				
c. Type				
d. Quantity (total)				
B. Control Panel				
a. Manufacturer				
b. Model number				
c. No. of zones				
C. Alarm horn/manual pull stations				
a. Manufacturer	/	/	/	/
b. Model number	/	/	/	/
c. Quantity (total)	/	/	/	/

EQUIPMENT DATA (CONTD)

NAME OF BIDDER _____

6. FIRE EXTINGUISHERS

	Dry Chemical	Halon
a. Manufacturer		
b. Model number		
c. U.L. Rating A:B:C		
d. Capacity, pounds		
e. Quantity		

7. FIRE HYDRANTS

A. Manufacturer _____

B. Model number _____

C. Opening Direction _____

D. Quantity _____

E. Weight (lbs) each _____

8. POST INDICATOR ASSEMBLIES

A. Manufacturer _____

B. Model number _____

C. Quantity _____

D. Size, inches _____

E. Weight (lbs) each _____

9. FIRE DEPARTMENT PUMPER/SUCTION CONNECTIONS

A. Manufacturer _____ / _____

B. Model number _____ / _____

C. Quantity _____ / _____

D. Size, inches _____ / _____

EQUIPMENT DATA (CONTD)

NAME OF BIDDER _____

10. UNDERGROUND PIPING

A. Manufacturer _____

B. Material _____

C. Pipe Size (Range) _____

11. FIRE HOSE HOUSES/CABINET

A. Manufacturer _____ / _____

B. Model number _____ / _____

C. Quantity _____ / _____

12. FIRE HOSE

A. Manufacturer _____ / _____

B. Model number _____ / _____

C. Length (Total-ft)

(1) Hose size 1-1/2" _____ / _____

(2) Hose size 2-1/2" _____ / _____

13. FIRE HOSE NOZZLES (WATER/FOAM)

A. Manufacturer _____ / _____

B. Model No.

a. 1-1/2"/2-1/2" Electrical Type _____ / _____

b. 1-1/2"/2-1/2" Combination _____ / _____

C. Quantity (total each Electrical/Combination)

a. 1-1/2" _____ / _____

b. 2-1/2" _____ / _____

EQUIPMENT DATA (CONTD)

NAME OF BIDDER _____

14. FIRE HYDRANT MONITOR NOZZLES

A. Manufacturer _____

B. Model number _____

C. Quantity _____

APPENDIX 6

DRAWINGS AND DATA FOR GOVERNMENT FURNISHED EQUIPMENT

DRAWINGS AND DATA FOR GOVERNMENT FURNISHED EQUIPMENT

The purpose of this Appendix is to include, for the Contractor's information, all of the available information from the suppliers of the Government Furnished Equipment. This includes for example, data from the suppliers of the receiver feed pump, fire pumps, critical piping, etc.

These data will be updated by the Contractor and will become a part of this contract.

APPENDIX 7

BID DATA SECTION

BID DATA SECTION

The Contractor should include in this section of the Contract the Bid Data which he will receive from his selected Bidders for Contractor Furnished Equipment. These data will then become a part of this Contract.