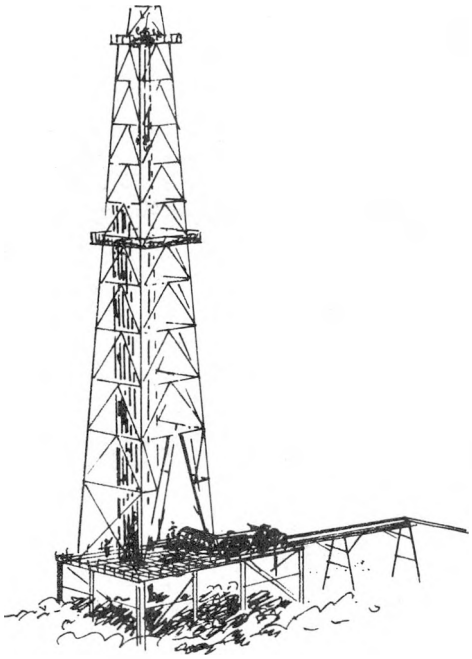
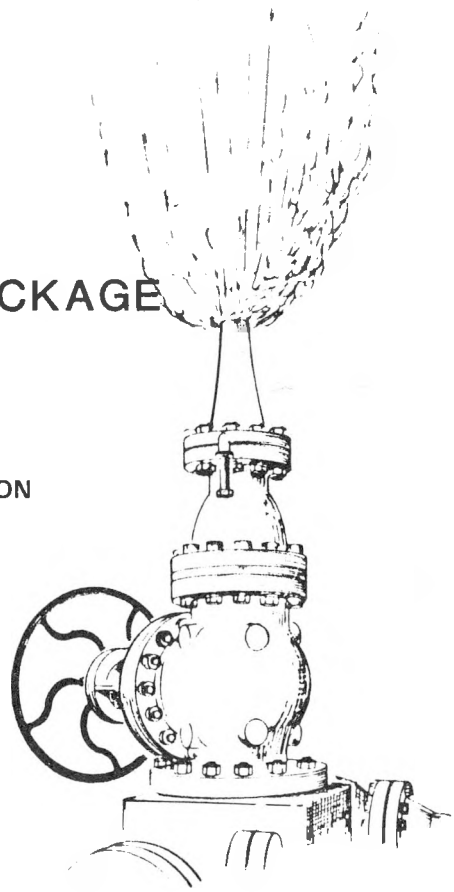


PLANNING AND DESIGN OF ADDITIONAL EAST MESA GEOTHERMAL TEST FACILITIES (PHASE 1B)

REPORT NO. 28653-6002-RU-00
15 OCTOBER 1976

VOLUME II: PROCUREMENT PACKAGE



Prepared For
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
CONTRACT NO. E(04-3)-1140

TRW
SYSTEMS AND ENERGY

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

SAN/1140-01

PLANNING AND DESIGN OF ADDITIONAL EAST MESA GEOTHERMAL TEST FACILITIES (PHASE 1B)

VOLUME II — PROCUREMENT PACKAGE

R. O. Pearson

DISCLAIMER

This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

TRW®
DEFENSE AND SPACE SYSTEMS GROUP

SYSTEMS ENGINEERING AND INTEGRATION DIVISION
ONE SPACE PARK, REDONDO BEACH, CALIFORNIA 90278
October 1976

PREPARED FOR THE
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
DIVISION OF GEOTHERMAL ENERGY
UNDER CONTRACT E(04-3)-1140

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MGW

NOTICE

This report was prepared to document work sponsored by the United States Government. Neither the United States nor its agent, the United States Energy Research and Development Administration, nor any Federal employees, nor any of their contractors, subcontractors or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.

NOTICE

Reference to a company or product name does not imply approval or recommendation of the product by TRW or the U.S. Energy Research and Development Administration to the exclusion of others that may be suitable.

FORWARD

Procurement packages of technical specifications and construction drawings for eleven test facility additions to the ERDA East Mesa Geothermal Component Test Facility are presented herein.

Each of the specifications includes all of the technical requirements needed for procurement and construction starting with Division 2. Division 1 - General Requirements must be furnished by the procuring agency.

Since Phase 1A was procured by the Bureau of Reclamation, the specification and drawing formats were closely coordinated with that agency. For example, space was left above our title block sufficient to accommodate the Bureau of Reclamation standard title block in the event that they are the procuring agency again. It should be noted, however, that the format is not restrictive to procurement by any particular government agency.

Procurement Cost and Schedule Estimates

Reference	Item	Cost	Months
1.	Injection Pump (6821.22A)	$ 54,200	
2.	Injection Pipeline (6821.22B)	224,000	7
3.	Control/Instrument Spools (6821.22C)	—	—
a.	1 ea. SP-1 Brine Supply — (4 in)	6,510	5 — 8
b.	1 ea. SP-2 Brine Reinj. — (6 in)	6,146	5
c.	1 ea. SP-3 Blowdown — (4 in)	2,465	5
d.	2 ea. SP-4 Brine Supply — (2 in)	8,532	5 — 8
e.	2 ea. SP-5 Brine Reinj. — (3 in)	9,101	5
f.	1 ea. SP-6 Blowdown — (2 in)	1,548	5
g.	1 ea. SP-7 Brine Supply — (8 in)	14,805	5 — 8
h.	1 ea. SP-8 Brine Reinj. — (8 in)	7,584	5
i.	1 ea. SP-9 CW Supply — (6 in)	8,832	5 — 8
j.	1 ea. SP-10 CW Return — (6 in)	8,611	5
k.	2 ea. SP-11 CW Supply — (3 in)	9,986	5 — 8
l.	2 ea. SP-12 CW Return — (3 in)	12,766	5
4.	Calibration Test Bench (6821.22D)	6,500	4
5.	Test Pad Mods (6821.22E)	184,300	5
6.	Test Piping Headers (6821.22F)	190,800	5
7.	Wells (6821.22H)	—	9
a.	18-5 Production (24^{o})	483,682	7
b.	88-4 Injection (Vertical)	403,077	7
c.	52-2 Injection (48^{o})	535,448	7
8.	Mesa 5-1 Modifications (6821-22K)	30,590	1
9.	Well 8-1 Downhole Pump (6821-22L)	47,000	5
10.	Well 8-1 Booster Pump (6821.22N)	13,600	7
	Total	$2,270,083	

CONTENTS

VOLUME II - PROCUREMENT PACKAGES

1. INJECTION PUMP SYSTEM

6821.221-S	Specification
6821.22A-01	Site Plan and Electrical Details
6821.22A-02	Piping Plan and Details
6821.22A-03	Structural Details

2. 52-2 INJECTION PIPELINE

6821.22B-S	Specification
6821.22B-01	Site Plan
6821.22B-02	Pipeline Plan and Profile Station No. 0+00 - 30+00
6821.22B-03	Pipeline Plan and Profile Station No. 30+00 - 60+00
6821.22B-04	Pipeline Plan and Profile Station No. 60+00 - 73+50
6821.22B-05	Pipeline Plan and Profile Station No. 73+50 - 79+16
6821.22B-06	Sections and Details

3. CONTROL AND INSTRUMENTATION SPOOLS

6821.22C-S	Specification
6821.22C-01	Piping Diagrams and Scheduling
6821.22C-02	Manifold Spools No. 1, 2, 3, 9, 10
6821.22C-03	Manifold Spools No. 4, 5, 6, 11, 12
6821.22C-04	Manifold Spools No. 7, 8

4. CALIBRATION TEST BENCH

6821.22D-S	Specification
6821.22D-01	Bench Installation

5. TEST PAD MODIFICAIONS

6821.22E-S	Specification
6821.22E-01	Location Plan
6821.22E-02	Site Plan
6821.22E-03	Paving, Grading and Demolition Plan
6821.22E-04	Concrete Test Pad Floor Plan and Details
6821.22E-05	Building Elevations, Sections and Details
6821.22E-06	Miscellaneous Details
6821.22E-07	Fence Details
6821.22E-08	Lighting and Grounding Plan

6. TEST PAD PIPING HEADERS

6821.22F-S	Specification
6821.22F-01	Location Plan
6821.22F-02	Site Plan

CONTENTS (Continued)

6821.22F-03	Piping and Instrumentation Diagram
6821.22F-04	Piping Plan and Details
6821.22F-05	Header Piping Station and Details
6821.22F-06	Piping Header Section and Miscellaneous Details
6821.22F-07	Header Piping Support Rack
6821.22F-08	Electrical Single Line Diagram
6821.22F-09	Power and Grounding Plan
6821.22F-10	Power Station Details
6821.22F-11	Temporary Cross Connections (Option A)

7. PRODUCTION AND INJECTION WELLS

6821.22H-S	Specification
6821.22H-01	Site Plan
6821.22H-02	Casing Head Equipment
6821.22H-03	Concrete Cellar
6821.22H-04	Schematic Well Section

8. WELL 5-1 MODIFICATIONS

6821.22K-S	Specification

9. WELL 8-1, DOWN-HOLE PUMP

6821.22L-S	Specification

10. WELL 6-1, DOWN-HOLE PUMP

6821.22M-S	Specification

11. WELL 8-1 BOOSTER PUMP

6821.22N-S	Specification
6821.22N-01	Site Plan and Electrical Details
6821.22N-02	Booster Pump and Pad Details

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Contract No. E(04-3) - 1140

TASK 4.1.1

INJECTION PUMP SYSTEM

SPECIFICATION 6821.22A-S

Prepared by:

Environmental, Power and Facilities Department

TRW
SYSTEMS GROUP

FOREWORD

The work is situated approximately 10 miles east of Holtville, California, in Imperial County, and is accessible by primary and secondary roads. Work to be performed consists of furnishing and installing an injection pump to pump spent brines from the ERDA test facility for reinjection in well ERDA US 88-4.

Features of the work include clearing, excavation and placing concrete for pump slab and pipe supports, and furnishing and installing a pump with ancillaries including a surge tank, pipe manifolds, instrumentation and electrical service.

DESCRIPTION OF THE WORK

The work required under these specifications consists of furnishing and installing an injection pump to pump spent geothermal brines from the ERDA component test facility for reinjection in well ERDA US 88-4.

Principal components of the work to be performed under these specifications include the following:

a. Clearing, excavation and compaction of earth for pump slab and pipe supports.
b. Furnishing and placing reinforced concrete for pump slab and pipe supports.
c. Furnishing and installing manifold piping consisting of 8-, and 6-inch diameter Schedule 40 insulated pipe complete with pipe supports, pipe rollers, pipe expansion joints, control and isolation valves, surge tank, nitrogen pressurization manifold, and miscellaneous fittings.
d. Furnishing and installing centrifugal injection pump.
e. Furnishing and installing instrumentation system consisting of temperature, pressure, and flow indicators and controllers.
f. Provision of electrical services to the pump from the substation.

INJECTION PUMP SYSTEM

Bids will be considered on the following schedule, but no bid will be considered for only part of the schedule.

S C H E D U L E

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
1	Excavation for structures	6 cu. yd.	$_____	$_____
2	Compacting for structures	1 cu. yd.	_____	_____
3	Furnishing and placing reinforcement	470 lb.	_____	_____
4.	Furnishing and placing concrete	7.6 cu. yd.	_____	_____
5.	Furnishing and installing pump	FOR THE LUMP SUM OF --		_____
6.	Furnishing and installing tank	FOR THE LUMP SUM OF --		_____
7.	Furnishing and installing instrumentation	FOR THE LUMP SUM OF --		_____
Furnishing and installing steel pipe as follows:				
8.	8-inch diameter, Schedule 40	60.1 lin. ft.	_____	_____
9.	6-inch diameter, Schedule 40	52 lin. ft.	_____	_____
Furnishing and installing pipe insulation:				
10.	On 8-inch pipe, fittings, valves and appurtenances	60.1 lin. ft.	_____	_____
11.	On 6-inch pipe, fittings, valves and appurtenances	52 lin. ft.	_____	_____
Furnishing and installing expansion joints:				
12.	8-inch	1 ea.	_____	_____
13.	6-inch	2 ea.	_____	_____

SCHEDULE (cont)

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
	Furnishing and installing valves and gaskets as follows:			
14.	8-inch, ball, Class 300	1 ea.	$_____	$_____
15.	6-inch, ball, Class 300	1 ea.	_____	_____
16.	8-inch, gate, Class 300	2 ea.	_____	_____
17.	6-inch, gate, Class 300	2 ea.	_____	_____
18.	8-inch, control valve, Class 300	1 ea.	_____	_____
19.	6-inch control valve, Class 300	1 ea.	_____	_____
20.	6-inch check valve, Class 300	1 ea.	_____	_____
21.	Furnishing and installing 8-inch flexible ball joints	2 ea.	_____	_____
22.	Furnish and install nitrogen manifold	FOR THE LUMP SUM OF --		_____
23.	Furnish and install make-up water piping,fittings, and valves	FOR THE LUMP SUM OF --		_____
24.	Furnish and install tank vent pipe, fittings, and valves	FOR THE LUMP SUM OF --		_____
25.	Miscellaneous metalwork	1904 lb.	_____	_____
26.	Furnishing and installing miscellaneous steel pipe fittings, including but not limited to: tapers, tees, elbows, crosses, flanges and caps	2327 lb.	_____	_____
27.	Furnishing and installing all electrical equipment, conduit and wiring	FOR THE LUMP SUM OF --		_____

INJECTION PUMP SYSTEM
GENERAL OUTLINE

DIVISION 2 -- EARTHWORK

Section 2.1 -- EARTHWORK

- 2.1.1 Classification of Excavation
- 2.1.2 Site Grading
- 2.1.3 Excavation for Structures
- 2.1.4 Backfill About Structures
- 2.1.5 Compacting Backfill About Structures
- 2.1.6 Excavation and Backfill for Trenches
- 2.1.7 Disposal of Excavated Materials
- 2.1.8 Gravel Fills
- 2.1.9 Compacting Earth Materials

DIVISION 3 -- CONCRETE

Section 3.1 -- CONCRETE

- 3.1.1 Concrete, General
- 3.1.2 Materials
- 3.1.3 Composition
- 3.1.4 Batching and Mixing
- 3.1.5 Forms, Preparation for Placing, and Placing
- 3.1.6 Protection and Curing
- 3.1.7 Repair of Concrete
- 3.1.8 Reinforcement
- 3.1.9 Measurement and Payment
- 3.1.10 Concrete Floor Hardener
- 3.1.11 Grouting Mortar for Metalwork

DIVISION 4 -- PIPE MANIFOLDS

Section 4.1 -- PIPE MANIFOLDS

- 4.1.1 Pipe Manifolds
- 4.1.2 Testing the Pipe Manifold
- 4.1.3 Guarantee
- 4.1.4 Steel Pipe and Fittings

DIVISION 5 -- MISCELLANEOUS METALWORK

Section 5.1 -- MISCELLANEOUS METALWORK

- 5.1.1 Miscellaneous Metalwork

DIVISION 6 -- INSTRUMENTATION

Section 6.1 -- INSTRUMENTATION

6.1.1 General
6.1.2 Testing
6.1.3 Cleaning
6.1.4 Materials
6.1.5 Instruments
6.1.6 Instrument and Control Calibration and Adjustment
6.1.7 Nameplates
6.1.8 Payment

DIVISION 7 -- PUMP

Section 7.1 -- PUMP

7.1.1 Pump

DIVISION 8 -- ELECTRICAL SYSTEM

Section 8.1 -- ELECTRICAL SYSTEM

8.1.1 General
8.1.2 Acceptance of Electrical System
8.1.3 Drawings and Data to be Furnished by the Contractor
8.1.4 Grounding
8.1.5 Electrical Conduit System
8.1.6 Insulated Electrical Wires and Cables
8.1.7 Motor Starter
8.1.8 Circuit Breaker
8.1.9 Motor Control
8.1.9.1 Cavitation Control
8.1.9.2 Flow Switch
8.1.10 Payment

DIVISION 9 -- PAINTING

Section 9.1 -- PAINTING

9.1.1 Painting
9.1.2 Painting Tabulation
9.1.3 Color Schedule for Painting

DIVISION 10 -- DRAWINGS

Section 10.1 -- DRAWINGS

10.1.1 Drawings, General
10.1.2 List of Drawings

DIVISION 2 -- EARTHWORK

SECTION 2.1--EARTHWORK

2.1.1 Classification of Excavation

a. General--Bidders and the contractor must assume all responsibility for deductions and conclusions as to the nature of the materials to be excavated and the difficulties of making and maintaining the required excavations

b. Clearing--Any brush, plant growth, or other unsuitable material shall be removed and disposed of. The cost of all clearing shall be included in the prices bid in the schedule for various items of work.

2.1.2 Site Grading

a. General--The contractor shall perform all excavation for site grading to the subgrade for final elevations as shown on the drawings or established by the contracting officer. The contractor shall use materials removed in excavation for constructing fills. Fills shall be constructed and compacted in accordance with provisions of **Paragraph 2.1.9** hereof. Any extra or unsuitable excavated material from site grading shall be disposed of in waste areas as directed by the contracting officer.

b. Costs--The cost of site grading shall be included in the prices bid in the schedule for various items of work, which prices shall include the cost of all labor, equipment, and incidentals required to perform the site grading as herein specified.

2.1.3 Excavation for Structures

a. Measurement for payment--Excavation for structures will be measured for payment to excavation pay lines shown on the drawings, or if not shown on the drawings to pay lines in accordance with the provisions of this paragraph. Regardless of quantities removed, measurement for payment will be made to the prescribed pay lines: Except, That for purposes of safety or other practicable reasons in connection with individual structures the Government reserves the right to require the contractor to excavate to the prescribed pay lines. No payment will be made for excavation or removal of material which is outside of the prescribed pay lines.

Measurement of excavation will be in accordance with the following:

Pump and tank slab and pipe support base--Measurement of excavation for structures will include all required excavation for the structure below the original ground surface and between vertical planes at the ends of the structure or combination of adjoining structures. Such measurement will also include any excavation for the structure outside of these vertical planes which may be required below the original ground surface and outside of the pay lines for excavation for the concrete footings. Measurement of excavation will be made to dimensions one foot outside of the foundations of the structure and to slopes of 1:1 to ground surface.

b. Foundations for structures--Excavation for the foundation of structures shall be to the elevations shown on the drawings or established by the contracting officer. The contractor shall prepare the foundations at structure sites by methods which will provide firm foundations for the structures. The bottom and side slopes of common excavation, upon or against which the structure is to be placed, shall be finished to the prescribed dimensions, and the surfaces so prepared shall be moistened and tamped with suitable tools to form firm foundations upon or against which to place the structure.

Where rock or other unsuitable material is encountered in the foundation for a structure, the contracting officer will direct additional excavation to remove the unsuitable material. This additional excavation shall be made to provide a minimum clearance between the undisturbed foundation and the underside of the structure and the additional excavation shall be refilled with compacted backfill to provide a firm foundation for the structure. Measurement and payment for excavation, backfill, and compacting backfill will be made to depths and dimensions prescribed by the contracting officer.

If at any point in excavation the foundation material is excavated beyond the lines required to receive the structure, the overexcavation shall be filled with suitable materials and compacted in accordance with Paragraph 2.1.9 (Compacting Earth Materials). If at any point in excavation, the natural foundation material is disturbed or loosened during the excavation process or otherwise, it shall be compacted in place or, where directed, it shall be removed and replaced with suitable material and compacted in accordance with Paragraph 2.1.9 (Compacting Earth Materials). Any and all excess excavation or overexcavation performed by the contractor for any purposes or reason except for additional excavation as may be prescribed by the contracting officer and whether or not due to the fault of the contractor, shall be at the expense of the contractor. Fill and compacting of fill for such excess excavation or over excavation shall be at the expense of the contractor.

c. Payment--Insofar as practicable, the material moved in excavation for structures shall be used for backfill and embankments, otherwise it shall be wasted as directed by the contracting officer. Payment for excavation for structures will be made at the unit price per cubic yard bid in the schedule. The unit price bid in the schedule for excavation for structures shall include the cost of all labor and materials, of all other work necessary to maintain the excavations in good order during construction, and shall include the cost of disposal of the excavated material.

2.1.4 Backfill About Structures

a. General--Backfill about structures shall be placed to the lines shown on the drawings, as prescribed in this paragraph, or as directed. The type of material used for backfill, the amount thereof, and the manner of depositing the material shall be subject to approval. Insofar as practicable, backfill material shall be obtained from material moved in excavating for structures, but when sufficient suitable material is not available from this source or from adjacent canal excavation, additional material shall be obtained from approved borrow pits. Except as otherwise provided in Paragraph 2.1.5 (Compacting Backfill About Structures), special compaction of the backfill will not be required.

b. Structures on fill--Where the original ground surface is below the base of a structure or below the bottom of a structure, all fill required for the structure foundation and all fill up to the bottom of a structure shall be placed as embankment. All fill about the structures above the original ground surface and outside of the above described backfill shall be placed as embankment.

c. Measurement and payment--Excavation refill required to be placed about structures that is within the payline limits for excavation for the structures will be measured in place for payment as backfill about structures. Fill about the structures above the orignal ground surface and within the slopes of excavation pay lines for such structures as extended to intersect the finished surfaces of adjacent earthwork will be measured for payment as backfill about structures: Except, That above the original ground surface the excavation pay lines will be extended to intersect the finished surfaces at slopes of one to one. Where the original ground surface is below the base of a structure, measurement, for payment, of backfill will be made above the structure base and within the lines prescribed in Subparagraph b. for backfill.

Measurement, for payment, of backfill about structures will be made only for the quantities actually placed within the limits of the established pay lines.

11

Payment for backfill about structures will be made at the unit price per cubic yard bid in the schedule, which unit price shall include the cost of all work connected therewith, including the excavation and haul of the necessary material.

Refill of excavation performed outside of the established pay lines for excavation for structures shall be placed in the same manner as specified for the adjacent backfill, and such refill shall be placed at the expense of the contractor.

2.1.5 Compacting Backfill About Structures

a. General--Unless otherwise shown on the drawings, backfill about structures shall be compacted as prescribed in this paragraph or as directed.

To provide adequate protection for compacted backfill about a structure, the Government reserves the right to direct the contractor to place a sufficient amount of backfill or embankment material over the compacted backfill within 72 hours after compacting of the backfill has been completed.

The 1:1 slopes specified below shall extend from the top of the concrete walls to their intersection with the surfaces of the excavation or embankment as the case may be.

b. Location of compacted backfill--

(1) Backfill about the pump and tank slab and pipe support base shall be compacted to slopes of 1:1 from the concrete bases to the ground surface: Provided, That where the structure is located in compacted embankment, the backfill shall be compacted to the elevation prescribed for the adjacent compacted embankment.

c. Material and compacting--The material used for backfill to be compacted shall be selected material, containing no stones larger than 3 inches in diameter, approved by the contracting officer, and obtained from required excavation or approved borrow pits. To prevent unequal loadings and displacement of structures, the backfill shall be placed and compacted in layers having essentially the same top elevation on each side of the structure. All materials in backfill to be compacted shall be placed, moistened, and compacted as provided in Paragraph 2.1.9 (Compacting Earth Materials).

d. Measurement and payment--Measurement for payment for compacting backfill about structures will be made in place to the lines shown on the drawings, as prescribed in this paragraph, or as directed by the contracting officer and will be made only for the quantities actually compacted within the limits of the established pay lines for backfill about structures, and the compacting of refill outside of excavation pay lines shall be performed at the expense of the contractor. Payment for compacting backfill about structures will be made at the unit price per cubic yard bid therefor in the schedule and will be in addition to the payment made for backfill about structures. The unit price bid in the schedule for compacting backfill about structures shall include the costs of furnishing water and moistening the materials.

2.1.6 Excavation and Backfill for Trenches

a. General--Excavation, backfill, and compacting backfill for trenches include all excavation, backfill, and compacting backfill required for trenches for water pipe, electrical cable, conduits, and grounding cables.

b. Excavation--All excavation for trenches shall be made to the lines, depths, and grades shown on the drawings or directed by the contracting officer. The bottom of the trench shall be finished accurately to the lines and grades shown on the drawings or established by the contracting officer and in a manner suitable

and as provided for the facility to be placed in the trench. The bottom of the trenches shall be prepared so as to provide a firm, even, and unyielding foundation. Trenches for small diameter pipe, conduit, or cable may be excavated by trencher but the backfill shall be compacted as provided for in this paragraph.

If at any point in excavation the material is excavated beyond the lines required, the overexcavation shall be filled with suitable materials and compacted in accordance with Paragraph 2.1.9 (Compacting Earth Materials). If at any point in excavation the natural foundation material is disturbed or loosened during the excavation process or otherwise, it shall be compacted in place, or where directed, it shall be removed and replaced with suitable material and compacted in accordance with Paragraph 2.1.9 (Compacting Earth Materials). Any and all excess excavation or overexcavation performed by the contractor for any purposes or reason, except for such additional excavation as may be prescribed by the contracting officer and, whether or not due to the fault of the contractor, shall be at the expense of the contractor. Fill and compaction of fill for such excess excavation or overexcavation shall be at the expense of the contractor.

c. Backfill--All backfill shall be placed carefully to give the pipe, conduit, or cable a continuous even bearing on the bottom and sides. Backfill shall not be dropped directly on the pipe, conduit, or cable. Rocks and clods, larger than 3 inches in maximum dimensions, shall not be placed within 6 inches of the pipe, conduit or cable.

d. Compacting backfill--All backfill in trenches under paving, structures, and where otherwise directed by the contracting officer, shall be compacted. All backfill shall be placed, moistened, and compacted in accordance with the applicable provisions of Paragraph 2.1.9 (Compacting Earth Materials). The backfill shall be compacted in layers having the same elevation on both sides of the pipe or cable to prevent unequal loading and displacement.

e. Costs--The cost of excavation for trenches, backfill for trenches, and compacting backfill for trenches shall be included in the prices bid in the schedule for other items of work, which prices shall include the cost of all labor and equipment required to perform the excavation, backfill and compacting backfill for the various trenches.

2.1.7 Disposal of Excavated Materials

All suitable material from required excavations, or as much thereof as may be needed, as determined by the contracting officer, shall be used for backfill, construction of fills, and for other required earthwork, as directed by the contracting officer. Material removed in excavation and not suitable for backfill or other required earthwork shall be wasted on right-of-way owned by the Government at such points as may be approved by the contracting officer. Unless otherwise directed, no material shall be wasted in drainage channels. Waste banks shall be left with reasonably even and regular surfaces as approved by the contracting officer. The cost of all work described in this paragraph for the disposal of excavated materials shall be included in the prices bid in the schedule for other items of work. Waste asphalt, concrete, or other than natural earth materials shall be wasted at special nearby disposal areas, as designated by the contracting officer, where such materials will not be exposed to public view or present an unsightly appearance from public roadways or regular places of travel.

2.1.8 Gravel Fills

a. General--The contractor shall be responsible for furnishing all materials and performing all work for placing gravel fills under the pump and tank slab. Gravel fills under the slab shall be covered with sheet polyethylene. The contractor shall furnish all gravel for gravel fills and the sheet polyethylene.

b. Materials--

(1) Gravel--The material for gravel fills shall be composed of hard, dense, durable rock particles, obtained from any approved source and shall range from 3/16 to 3/4 of an inch in size.

15

(2) Sheet polyethylene--The sheet polyethylene material shall be equal to 0.006 inch thick "Visqueen," as manufactured by the Visking Company, 6733 West 65th Street, Chicago, Illinois 60638.

c. Placing gravel fills--Before gravel is placed, the subgrades shall be leveled to a uniform cross section, free from depressions and soft spots. All gravel shall be placed to the lines and grades shown on the drawings or as directed.

Gravel fills under the concrete slabs shall be deposited and compacted as specified in Paragraph 2.1.9 (Compacting Earth Materials) and shall be covered with sheet polyethylene. Before the sheet polyethylene is placed, the surfaces of the gravel fills shall be prepared by any suitable means satisfactory to the contracting officer which will prevent protrusions that may cause damage to the sheet polyethylene. The sheet polyethylene shall be lapped 6 inches at all ends and edges with the top lap in the direction of the spreading of the concrete. The contractor shall exercise care in placing materials and in his operations so as not to damage the sheet polyethylene covering.

d. Payment--Payment for furnishing and placing gravel fills under concrete will be made at the unit price bid therefor in the schedule, which price shall include the cost of furnishing and placing gravel and sheet polyethylene, of all work required for loading, hauling, placing, spreading, and compacting the gravel; and the cost of preparing, shaping, and compacting the subgrade surface as necessary for a satisfactory base for the gravel fill.

2.1.9 Compacting Earth Materials

a. General--Where compacting of earth materials is required, the materials shall be deposited in horizontal layers and compacted as specified in this paragraph. The excavation, placing, moistening, and compacting operations shall be such that the material will be uniformly compacted throughout the required section and will be homogeneous, free from lenses, pockets, streaks, laminations, or other imperfections.

b. Compacting clayey and silty materials--Where compaction of earth materials containing appreciable amounts of clay or silt is required, the materials shall be deposited in horizontal layers. The thickness of each horizontal layer after compaction shall be not more than 6 inches. The excavation and placing operations shall be such that the materials when compacted will be blended sufficiently to secure the highest practicable unit weight and best impermeability and stability.

Prior to and during compaction operations, the materials shall have a moisture content of not greater than 2 percent wet or less than 2 percent dry of optimum moisture, as determined by the contracting officer and the moisture content shall be uniform throughout each layer.

Insofar as practicable, as determined by the contracting officer, moistening of the material shall be performed at the site of excavation but such moistening shall be supplemented by sprinkling at the site of compaction, if necessary. If the moisture content is less than optimum for compaction by more than 2 percentage points or is greater than optimum for compaction by more than 2 percentage points, the compaction operations shall not proceed, except with the specific approval of the contracting officer, until the material has been wetted or allowed to dry out, as may be required, to obtain optimum moisture content within the tolerances permitted above, and no adjustment in price will be made on account of any operations of the contractor in wetting or drying the materials or on account of any delays occasioned thereby.

When the material has been conditioned as hereinbefore specified, it shall be compacted by rollers or by hand or power tampers. Where hand or power tampers are used to compact soils in confined areas such as under pipe, they shall be equipped with suitably shaped heads to obtain the required density.

The density (dry) of the soil fraction in the compacted material shall not be less than 95 percent of the laboratory standard maximum soil density (dry) as determined by the Bureau of Reclamation Proctor Compaction Tests for the materials being compacted.

(1) Compaction test--The compaction tests will be made by the Government. The standard maximum soil density is the dry weight per cubic foot of the soil compacted at optimum moisture content of laboratory procedure. The compaction test is the same as ASTM designation: D 698, Method A, except that a 1/20-cubic-foot compaction mold is used and the rammer is dropped from a height of 18 inches, resulting in the same energy of compaction per unit volume.

c. Compacting cohesionless materials--

(1) Compacting cohesionless free-draining materials--Where compaction of cohesionless free-draining materials, such as sands and gravels, is required, the materials shall be deposited in horizontal layers and compacted to the relative density specified below. The excavating and placing operations shall be such that the materials, when compacted, will be blended sufficiently to secure the highest practicable unit weight and best stability. Water shall be added to the materials as may be required to obtain the specified density by method of compaction being used.

The thickness of the horizontal layers after compaction shall not be more than 6 inches if compaction is performed by tampers or rollers; not more than 12 inches if compaction is performed by treads of crawler-type tractors, surface vibrators, or similar equipment; and not more than the penetrating depth of the vibrator if compaction is performed by internal vibrators.

The relative density of the compacted materials shall be not less than 70 percent as determined by the standard Bureau of Reclamation relative density tests for cohesionless free-draining soils.

(a) Relative density test--The relative density tests will be made by the Government. The relative density of a cohesionless free-draining soil, expressed as a percentage, is defined as its state of compactness with respect to the loosest and most compact states at which it can be placed by laboratory procedures. The

relative density will be based on the following formula, wherein the maximum density is the highest unit weight of the soil, minimum density is the lowest unit weight of the soil, and in-place density is the unit weight of the soil in place. Tests for moisture content are made on the materials and the unit weights are expressed in terms of ovendry weights.

$$\text{Rel. Den. (\%)} = \frac{\text{max.den. x (in-place den. - min. den.)}}{\text{in-place den. x (max. den. - min. den.)}} \times 100$$

(2) Compacting cohesionless materials containing some clay and silt--Cohesionless materials containing clay and silt may not be free-draining. When compaction of cohesionless materials containing sufficient clay and silt as to impede free drainage is required, the material shall be placed and compacted in accordance with the provisions of c.(1) above. These materials shall be compacted to a dry density in accordance with either of the following control tests whichever shows the higher dry unit weight.

(a) Ninety-five percent of the laboratory standard maximum soil density (dry) as determined by the Bureau of Reclamation Proctor Compaction Test as prescribed in b.(1) above, or

(b) The dry density of the material at 70 percent relative density as determined by the relative density test as prescribed in c.(1)(a) above.

d. Costs--The costs of compacting earth materials as described in this paragraph shall be included in the prices bid in the schedule for other items of work.

DIVISION 3 -- CONCRETE

Section 3.1 -- Concrete

3.1.1 Concrete, General

The contractor shall construct the reinforced pump and tank slab and reinforced concrete pipe support, as shown on the drawings and herein specified.

All concrete construction shall conform to Paragraphs 3.1.1 (Concrete, General) to 3.1.9 (Measurement and Payment) inclusive.

All structures shall be built to the prescribed lines, grades and dimensions. The contractor shall place and attach to the structure all metal, or other accessories necessary for its completion as shown on the drawings. The cost of such work, for which specific prices are not provided in the schedule, shall be included in the unit price per cubic yard bid in the schedule for furnishing and placing concrete.

3.1.2 Materials

The contractor shall furnish all materials for use in concrete, including cement, water, sand and coarse aggregate, and air-entraining agent, and shall furnish all reinforcing bars and materials for curing concrete. Air-entraining agent and curing compound will be accepted on manufacturer's certification of compliance with specification requirements: Provided, That the Government reserves the right to require submission of and to perform tests on samples of the agent and/or compound prior to shipment and use in the work.

Except as hereinafter provided, cement shall be obtained from a commercial (non-Government tested) bin and shipped on manufacturer's certificate of

compliance with specification requirements, the certification to be accompanied by mill test report. If the cement company does not have a commercial bin of cement meeting the specified requirements and which they can certify, Government tested and approved cement may be shipped, if available at the cement plant concerned, in which case certification by the manufacturer will not be necessary. If cement is shipped under the foregoing conditions from a Government-tested bin, the contractor will be charged by deduction from payments due for the cost of testing of all such cement he obtains in excess of the quantity used in work under these specifications, which charge, including Government overhead, will be at the rate of 3.5 cents per cwt (hundredweight).

Permission to ship on manufacturer's certification shall in no way relieve the contractor of the responsibility for furnishing materials meeting specification requirements. The contractor shall be responsible for the accuracy and completeness of certifications and mill test reports furnished.

a. Cement.--Cement shall meet the requirements of Federal Specification SS-C-1960/3, for Type II portland cement and shall meet the false-set limitation specified therein. The cement shall be free from lumps and damaged cement when used in concrete.

b. Water.--Water shall be free from objectionable quantities of silt, organic matter, alkalies, salts, or other impurities.

c. Sand and coarse aggregate.--Sand and coarse aggregate shall be furnished from any approved source. The sand particles shall be clean, hard, dense, durable, uncoated rock fragments that will pass a screen having 3/16- or 1/4-inch-square openings. The sand shall be well graded from fine to coarse and shall be free from injurious amounts of dirt, organic matter, and other deleterious substances. The coarse aggregate shall consist of clean, hard, dense, durable, uncoated rock fragments, shall be free from injurious amounts of thin pieces, organic matter, or other deleterious substances, shall be reasonably well graded from 3/16 of an inch to 1 and 1/2 inches, and shall be separated into two sizes by an intermediate screen having 3/4-inch-square openings. Screens having openings of other sizes and shapes may be used, if equivalent results as determined by the contracting officer are obtained. The Government reserves the right to test the sand and coarse aggregate

and if required, the contractor shall submit, for preliminary tests and approval, representative samples of the sand and coarse aggregate proposed for use in the concrete work.

d. Air-entraining agent.--The air-entraining agent shall conform to ASTM Designation: C 260, except that the limitation and test on bleeding by concrete containing the agent and time of setting requirement shall not apply.

e. Reinforcing bars.--Reinforcing bars shall conform to ASTM Designation: A 615, Grade 60, or ASTM Designation: A 617, Grade 60.

f. Wax-base curing compound.--Wax-base curing compound shall be white-pigmented compound confroming to Bureau of Reclamation "Specifications for Wax-Base Curing Compound," dated May 1, 1973.

3.1.3 Composition

Sand and coarse aggregate shall be mixed in proportions as directed by the contracting officer. One and one-half-inch-maximum-size coarse aggregate shall be used where practicable from the standpoint of satisfactory placing and consolidation of the concrete. Concrete which contains 1 and 1/2-inch-maximum-size aggregate shall have a cement content of not less than 517 pounds per cubic yard, and concrete which contains 3/4-inch-maximum-size aggregate shall have a cement content of not less than 611 pounds per cubic yard. The net water-cement ratio of the concrete (exclusive of water absorbed by the aggregates) shall not exceed 0.47 by weight. The concrete shall develop a minimum compressive strength of 3,000 lb/in^2 at 28 days as determined by standard specimens. The compressive strength of the concrete will be determined by the Government through the medium of tests of 6- by 12-inch cylinders made and tested in accordance with Designations 29 to 33, inclusive, of the Seventh Edition of the Bureau of Reclamation Concrete Manual.

The use of calcium chloride in concrete will not be permitted.

Air-entraining agent shall be used in such amount as will effect the entrainment of from 4 to 6 percent of air, by volume, of the concrete as discharged from the mixer.

The slump of the concrete shall not exceed 2 inches for slabs, and 3 inches for all other concrete.

3.1.4 Batching and Mixing

The sand and coarse aggregate shall be weighed and shall be proportioned on the basis of integral bags of cement unless the cement is weighed. Weighing equipment of the beam type may be used. The contractor shall provide equipment and shall maintain and operate the equipment as required to accurately determine and control the amount of each separate ingredient entering the concrete. Batching shall be such that combined inaccuracies in feeding and measuring the materials will not exceed 1 and 1/2 percent for water and weighed cement and 2 percent for sand and each size of coarse aggregate. The concrete shall be uniform in composition and consistency throughout the mixed batch, and from batch to batch, except where changes in composition or consistency are directed. The mixing time shall be at least 1 and 1/2 minutes. Excessive overmixing requiring the addition of water to preserve the required consistency will not be permitted. The temperature of the concrete when it is being placed shall be not more than $90^{o}F$ and not less than $40^{o}F$ in moderate weather or $50^{o}F$ when the mean daily temperature drops below $40^{o}F$. Truck mixers will be permitted only when the mixers and their operation are such that the concrete throughout the mixed batch and from batch to batch is uniform with respect to consistency and grading. Any concrete retained in truck mixers so long as to require additional water to permit satisfactory placing shall be wasted.

3.1.5 Forms, Preparation for Placing, and Placing

Forms shall be sufficiently tight to prevent loss of mortar from the concrete and shall be maintained rigidly in position until the concrete has hardened sufficiently to prevent damage by form removal. All surfaces of foundations upon or against which concrete is to be placed shall be free from standing water, mud, and debris. The surfaces of absorptive foundations against which concrete is to be placed shall be moistened thoroughly so that moisture will not be drawn from the freshly placed concrete. The surfaces of construction joints shall be clean, rough, and surface dry when covered with

fresh concrete. Cleaning shall consist of the removal of all laitance, loose or defective concrete, coatings, sand, curing compound if used, and other foreign material. Unless otherwise directed in formed work, structural concrete placements shall be started with the oversanded mix containing 3/4-inch-maximum-size aggregate; a maximum net water-cement ratio of 0.47, by weight; 6 percent air, by volume of concrete; and having a maximum slump of 4 inches; placed several inches deep on the joint at the bottom of the placement.

The methods and equipment used for transporting concrete, and the time that elapses during transportation shall be such as will not cause appreciable segregation of coarse aggregate or slump loss in excess of 1 inch in the concrete as it is delivered into the work. Retempering of concrete will not be permitted. Any concrete which has become so stiff that proper placing cannot be assured shall be wasted. Formed concrete shall be placed in continuous approximately horizontal layers, the depths of which generally shall not exceed 20 inches. Concrete shall be vibrated until it has been consolidated to the maximum practicable density, is free from rock pockets of coarse aggregate, and closes snugly against all surfaces of forms and embedded materials.

Exposed unformed surfaces of concrete shall be brought to uniform surfaces and worked with suitable tools to a reasonably smooth wood-float or steel-trowel finish as directed.

3.1.6. Protection and Curing

The contractor shall protect all concrete against injury until final acceptance by the Government. The concrete shall be cured by water curing or by application of wax-base curing compound. If concrete is cured by water curing, the concrete shall be kept continuously moist for at least 14 days after being placed by sprinkling or spraying or by other methods approved by the contracting officer. If concrete is to be cured by application of curing compounds, the application of the curing compound shall be in accordance with the procedures contained in the Seventh Edition of the Bureau of Reclamation Concrete Manual for curing with sealing compounds.

3.1.7. Repair of Concrete

Any concrete that is damaged or defective from any cause; concrete that is honeycombed, fractured, or otherwise defective; and concrete which, because of excessive surface depressions, must be excavated and built up to bring the surfaces to the prescribed lines; shall be removed and replaced; and any imperfections and irregularities on concrete surfaces shall be corrected.

The removal and replacement of damaged or defective concrete, and the correction of surface imperfections and irregularities shall be made with concrete, dry pack, or mortar (portland cement mortar); or, at the option of the contractor, with epoxy-bonded concrete, or epoxy-bonded epoxy mortar; where as applicable for the type of repair involved, in accordance with Bureau of Reclamation "Standard Specifications for Repair of Concrete" dated November 15, 1970. The cost of all materials, labor, and equipment required in the repair of concrete and the correction of surface imperfections and irregularities shall be borne by the contractor.

3.1.8. Reinforcement

Steel reinforcing bars shall be placed in the concrete where shown on the drawings. Before reinforcement is placed, the surfaces shall be cleaned of heavy flaky rust, loose mill scale, dirt, grease, or other foreign substances. Reinforcement shall be accurately placed and secured in position so that it will not be displaced during the placing of the concrete. Welding or tack-welding of Grade 60 reinforcing bars will not be permitted except at locations shown on the drawings.

Unless otherwise shown on the drawings, the reinforcement shall be placed so that there will be a clear distance of at least 1 inch between the reinforcement and any anchor bolts, form ties, or other embedded metalwork.

The Government will not furnish supplemental bar-placing diagrams, bar lists, and bar-bending diagrams. Any such additional diagrams and bar lists of this type which the contractor may require to facilitate the fabrication and placement of reinforcement shall be provided by the contractor. The cost of preparing such additional diagrams and bar lists, if provided, shall be included in the lump sum price bid in the schedule for furnishing and placing reinforcement. Reinforcement will be inspected for compliance with requirements as to size, shape, length, splicing, position, and amount after it has been placed.

3.1.9. Measurement and Payment

Measurement, for payment, of reinforcement will be made only of the weight of the reinforcement placed in the concrete, in accordance with the drawings or as directed. Payment for furnishing and placing reinforcement will be made at the unit price per pound bid therefor in the schedule, which unit price shall include the cost of furnishing and attaching wire ties and metal or other approved supports, if used, and of cutting, bending, cleaning, and securing and maintaining in position all reinforcement as shown on the drawings or as directed.

Cement will be paid for on the basis of the cwt (hundredweight) of cement used in the work covered by these specifications. One bag of cement shall be considered as 0.94 cwt of cement. Measurement, for payment, of cement will be on the basis of the number of bags of cement used at the mixer, except that no payment will be made for cement used in wasted concrete, cement used in damaged or defective concrete, or cement used in concrete required as a result of careless excavation, or excavation intentionally performed by the contractor to facilitate his operations, as determined by the contracting officer. Payment for furnishing and handling cement will be made at the unit price per cwt bid therefor in the schedule.

Measurement, for payment, of furnishing and placing concrete will be on the basis of cubic yards of concrete having the dimensions shown on the drawings or prescribed by the contracting officer. Payment for furnishing and placing concrete will be made at the unit price per cubic yard bid in the schedule therefor, which unit price shall include the cost of all labor and materials except that payment for furnishing and handling cement, and payment for furnishing and placing reinforcement will be made at the respective unit price bid therefor in the schedule.

3.1.10 Concrete Floor Hardener

a. General--The contractor shall furnish and apply a liquid floor hardener to the surfaces of the pump and tank slab.

b. Materials--Fluosilicate crystals shall be used for floor hardener and shall be magnesium fluosilicate or zinc fluosilicate or a combination of both.

c. Applying liquid floor hardener--Two coats of liquid floor hardener shall be applied to the slab in a manner approved by the contracting officer. After the slab has been cured thoroughly and at such time as directed by the contracting officer, the surface shall be cleaned thoroughly of all dirt, grease, laitance, or other foreign matter and shall be allowed to dry, immediately after which the floor hardener shall be applied. The contractor shall prepare the hardener solution by dissolving fluosilicate crystals in the proportion of one-half pound of crystals per gallon of water for the first coat and 2 pounds of crystals per gallon of water for the second coat. The hardener solution shall be applied at a maximum coverage of 100-square-feet-per-gallon per coat. The solution shall be applied liberally by means of floor mops. Each coat shall be spread uniformly, and the presence of pools of the hardener solution shall be avoided. The first coat shall be allowed to dry thoroughly before the second coat is applied. After the second coat has dried, the floors shall be brushed and washed with water to remove any crystals which may have formed on the surface.

The contractor's cost for furnishing and applying liquid floor hardener and any work connected therewith shall be included in prices bid in the schedule for other items of work.

3.1.11 Grouting Mortar for Metalwork

a. General--Grouting mortar required to be placed under the baseplate of the pump shall be in accordance with this paragraph. The contractor shall furnish all materials.

b. Grouting mortar--Grouting mortar shall be composed of cement, water and sand. Cement, water and sand shall be in accordance with paragraph 3.1.2 (Materials), except that sand passing a No. 16 screen shall be used when clearances are such that the specified grading for sand is not suitable. Grouting mortar shall be mixed in the proportion of 1 part of portland cement to 2 and 1/2 parts of sand, by weight, and to the consistency prescribed by the contracting officer.

c. Preparation for placing, and placing--Before placing the grouting mortar, the surfaces of base concrete to which the mortar will be bonded shall be roughened and shall be cleaned of all laitance, loose or defective concrete, coatings, and other foreign material by effective means, followed by thorough washing with water. If any delay occurs between the washing of the concrete and placing of the mortar, the surfaces of the concrete shall be lubricated by washing with water immediately prior to placing of the mortar. Forms shall be used, where required, to confine the grouting mortar. The mortar shall be placed so as to completely fill spaces adjacent to equipment and metalwork as shown on the drawings.

d. Curing--The exposed surfaces of mortar shall be cured for 72 hours by keeping them covered with moist burlap, damp sand, or by other effective means approved by the contracting officer.

e. Cost--The costs of all work in connection with the grouting mortar operations and the cost of the cement, water and sand for mortar shall be included in the prices bid in the schedule for the items of work for which the mortar is required.

DIVISION 4 -- PIPE MANIFOLDS

SECTION 4.1--PIPE MANIFOLDS

4.1.1 Pipe Manifolds

a. General--The contractor shall furnish pipe appurtenances and fittings and construct the pipe manifolds as shown on the drawings and as herein specified.

During manufacturing, transporting, storing, and installing pipe and pipe fittings, the pipe and pipe fittings shall not be dropped or subjected to any unnecessary impact or other treatment that could damage the pipe.

Pipe shall not be stored in the yard or on the jobsite under conditions which would cause damage. Any length of pipe that, in the opinion of the contracting officer, is damaged beyond repair by the contractor by hauling, handling, unloading, storing or otherwise, shall be removed from the worksite and replaced by and at the expense of the contractor with another length of pipe of equal or greater strength.

b. Pipe--The contractor shall furnish and install steel pipe and fittings as specified in Paragraph 4.1.4 (Steel Pipe and Fittings).

Gaskets furnished with flanged fittings shall be suitable to withstand temperatures of 500°F.

c. Measurement and payment for pipe--Measurement, for payment, for furnishing and installing the 8-inch and 6-inch pipe manifolds will be made along the centerline of the pipe between ends of the pipe in place and will be continuous through bends and other fittings with no allowance for lap at joints. Measurement for payment, for furnishing the 3" and smaller galvanized standard weight pipe will be made in pounds of pipe furnished and installed.

Payment for furnishing and installing the 8-inch and 6-inch Schedule 40 steel pipe will be made at the unit price per linear foot bid therefor in the schedule, which price shall include the cost of furnishing all materials, manufacturing, transportation, installing the pipe, and furnishing meaintenance guarantee.

Payment for furnishing and installing 3-inch and smaller galvanized standard weight pipe will be made at the unit price per pound bid therefor in the schedule which price shall include the cost of all labor, materials, installation, testing, and furnishing guarantee.

4.1.2 Testing the Pipe Manifold

a. Pressure test--After the pipe manifold has been installed and all joints completed, the contractor shall subject the pipe to a hydrostatic pressure of 350 lb/in^2 for a period of not less than one hour. No leakage will be allowed and any and all leaks shall promptly be made watertight.

The contractor shall furnish all pumping equipment, labor, tools, pressure gages, and other equipment, and water required for making the tests.

All exposed piping, fittings, and joints shall be carefully examined during the test. Any cracked or defective piping or fittings discovered during the pressure test shall be removed and replaced by the contractor with sound material and the test repeated as required, all at the expense of the contractor.

All testing shall be done in the presence of a duly authorized representative of the contracting officer.

b. Cost--The entire cost of testing the pipe manifold and of furnishing all equipment, labor, and materials for making the tests shall be included in the respective unit price bid in the schedule for furnishing and installing 8-, and 6-inch Schedule 40 steel pipe.

4.1.3 Guarantee

The contractor shall furnish a guarantee against leakage of the pipeline for a period of one year from date of acceptance. Any leaks shall be corrected by the contractor, on notice from the contracting officer and at no cost to the Government. Any repairs to the pipeline shall be made in an acceptable manner as approved by the contracting officer.

In lieu of such guarantee the contractor may hydrostatically test the pipeline at 150 percent of the specified test pressure of the pipeline at the lowest point in the line. Any visible leaks shall be repaired. The installation will be considered acceptable when the specified test pressure has been maintained without loss for a period of not less than 2 hours or no leaks are observed during that period of time or such time as necessary for completing inspection of all joints along the pipeline.

4.1.4 Steel Pipe and Fittings

a. General--The contractor shall furnish, install, and insulate the steel piping, valves, appurtenances, and fittings for the pipe manifold complete with accessories in accordance with the requirements of these specifications and as shown on the drawings.

b. Materials--Materials shall be in accordance with the following requirements:

(1) 6-, and 8-inch steel pipe--ASTM, Type E or S, Class A53A (Schedule 40), plain end.

(2) 3-inch and smaller steel pipe--ASTM A120 Type S (Schedule 40) galvanized.

(3) Flange gaskets--flat, asbestos, metallic reinforced.

(4) Bolts and nuts--Bolts - FF-B-575C, Grade II, Type II, or stud bolts; Nuts - FF-N-836D, Type II (Hexagon), Style 4; UNC coarse thread series.

(5) Steel welding flanges--ASTM Designation A181, Grade I, 300# Class, raised face.

(6) Steel fittings--ASTM Designation A234, Schedule 40, long radius welding type, except where designated on the drawings. Fittings for 3-inch and smaller shall be Class 300 Malleable iron, screwed end.

(7) Insulation--Insulation for all brine steel pipe,fittings, valves, and appurtenances and tank, shall be equal to Johns-Manville "Metal-ON" aluminum-jacketed, calcium silicate insulation in nonimal 2" thickness as furnished by Johns-Manville, 22 East 40th Street, New York, New York, 10016, and shall comply with the requirements of

Federal Specification HH-1-523c, Type II, Class C. Insulation shall be installed in accordance with the manufacturer's recommendations. Pump need not be insulated.

(8) Gate valves--Shall be CS body, 50% exelloy and 50% stellite trim, OS&Y bolted bonnet, ASA 300 RF FLGD, Crane Model 33 X UF or approved equal.

(9) Bellows type stainless steel expansion joints--Expansion joints shall have a traverse of one inch. Expansion joints shall be of the multi-ply, laminated, corrugated bellows construction; constructed of type 347 stainless steel. Each expansion joint shall be provided with ends consisting of rigid joint shall be provided with ends consisting of rigid flanges with elongated bolt holes. Self-equalizing stainless steel contour rings shall be provided in each corrugation. Each expansion joint shall be so constructed as to require not more than one hundred pounds to compress through its full rated traverse. Expansion joints shall be designed for 300 pounds working pressure and provided with self-guiding internal liners or guides. Expansion joints when installed shall be protected against both end loading and torsional stresses. Expansion joints shall be type 308-1230 supplied by Keflex, Inc., General Offices, San Francisco, California, 94111, or approved equal.

(10) Flexible ball joints--Flexible ball joints shall be equal to BARCO, Type N, Style 7WEN-8WEN, 8-inch-diameter, schedule 20, weld end, carbon steel, with asbestos gaskets (Code 11N) as furnished by Aeroquip Corporation/BARCO Division, Barrington, Illinois 60010. Ball joints shall be certified as having passed environmental shock testing in accordance with test Specifications MIL-S-4456 or MIL-S-901C.

(11) 3-inch and smaller gate valves shall conform to Federal Specification No. WW-V-54D, Type I, Class C, Style 2.

(12) The surge tank shall be of the configuration and capacity indicated on Drawing No. 6821.22A-04 and shall be constructed and tested in accordance with ASTM code for unfired pressure vessels, as noted.

(13) Brine service check valves shall be poppet valve insert type, ASA 300, 316SS body and spring, teflon seats, 6-inch model FIV 30 SST 1/2, Check-All Valve Mfg. Co., or approved equal.

(14) Ball valves--8 inch ball valves shall be McCannaseal Model S301-CS-R-S6 Ball Valves, ANSI Class 300/ Flanged Ends/CS body stainless steel trim, reinforced teflon seats, top entry or approved equal.

(15) Flow Control Valves (FCV) shall be CAMFLEX model 35-35200 control valve with pneumatic actuator and handwheel Model 7600 positioner and No. 77-4 Airset or approved equal. Valve upstream of tank shall be air to open, flow to close and valve downstream of pump shall be flow to open, air to close. Both valve with flow to close with carbon steel body, flangeless connection, integral bonnet, 400C hardened stainless steel bearings, 316 stainless steel shaft, No. 6 Stellite plug and ring.

(16) Nitrogen pressurizing manifold system shall include tubing with pressure regulators, quick hookup connectors, shut off valves, gages, accessories for a National Cylinder Gas duplex manifold, or approved equal.

(17) Flow Switch, to mount on 8" pipeline, on @ 104 gpm and off @ 89 gpm, all wetted parts stainless steel, single Pole, double throw, UL approved, Vapor Proof, 1000 psig design, McDonnell & Miller Model FS7-4SV or approved equal.

(18) Miscellaneous materials -- Where materials are required but are not specified herein, the contractor shall furnish standard commercial quality material suitable for the intended use.

c. Fabrication--The steel pipe shall be fabricated in accordance with these specifications, the drawings and the requirments of the Amercian Water Works Association Standard C201. Where provisions of the AWWA Standards conflict with provisions of these specifications and/or drawings, the provisions of these specifications and/or drawings shall govern. The requirements of Section 5.1 to 5.4 inclusive of the AWWA Standard C201 are not a part of these specifications. The shell thickness of the pipe shall not be less
33 than 0.250 inches.

d. Installation--The steel pipe and fittings shall be assembled and erected in place as shown on the drawings. The contractor shall furnish and install such temporary supports and bracings as may be required to hold the pipe in place and prevent distortion during welding; however, the embedment of timber supports or the welding of temporary supports to the pipe shell will not be permitted. Expansion joints and pipe insulation shall be installed in accordance with the manufacturer's instructions.

e. Cleaning--Finished manifold shall be thoroughly cleaned and flushed with water or blown with steam or air to clear the pipe of dirt, mill scale, filings and other debris. Cleaning or flushing shall continue until no trash is evident in the exhaust or a clean stream of water is obtained at the outlet.

f. Measurement and payment--Measurement for payment and payment for furnishing and installing steel pipe will be made as provided in Subparagraph 4.1.1c (Measurement and Payment for Pipe).

Measurement, for payment, for furnishing and installing the pipe insulation will be made along the centerline of the pipe between ends of the pipe in place and will be continuous through bends and other fittings with no allowance for lap at joints.

Payment for furnishing and installing pipe insulation for the various sizes of pipe will be made at the respective unit price per linear foot bid therefor in the schedule, which unit price shall include the cost of furnishing all materials, transportation, labor, and incidental costs associated therewith.

Payment for furnishing and installing the various sizes of gate and ball valves will be made at the respective unit price per each bid therefor in the schedule which unit price shall include the cost of all labor, materials, and incidentals associated therewith.

Payment for furnishing and installing tank, nitrogen pressurizing system flexible ball joints and expansion joints will be made at the unit price each bid therefor in the schedule which unit price shall include the cost of all labor and materials and incidentals associated therewith.

Payment for furnishing and installing the miscellaneous steel pipe fittings, including but not limited to: tapers, tees, elbows, crosses, flanges, nuts, bolts, gaskets, and caps, will be made at the unit price per pound bid therefor in the schedule which unit price shall include the cost of all labor, materials, and incidentals associated therewith.

DIVISION 5 -- MISCELLANEOUS METALWORK

SECTION 5.1 -- MISCELLANEOUS METALWORK

5.1.1 Miscellaneous Metalwork

a. General--The contractor shall furnish and install the shims, service-line straps, hangers, pipe supports, pipe anchor chairs, and protection saddles, as shown on drawings as miscellaneous metalwork.

b. Materials--Materials shall conform to the following requirements:

(1) Structural steel--Structural shapes, plates, and bars shall conform to Federal Specification QQ-S-741D, ASTM Designation: A36.

(2) Steel pipe--ASTM A120, seamless black steel.

(3) Bolts and nuts--Bolts shall conform to Federal Specification FF-B-575C, Type I or II; Nuts - FF-B-836D, Type I or II, Style 1 or 4.

(4) Pipe roller supports--Pipe roller supports for Type A pipe supports shall be equal to No. 177 as offered by the ITT Grinnell Corp.(Catalog PH-76).

(5) Protection saddles--Saddles for the protection of the pipe insulation at pipe supports shall be ITT Grinnell Corp. (Catalog PH-76). No. 162 protection saddle for 2-inch insulation, or approved equal.

(6) Materials for miscellaneous metalwork not specifically covered herein by detailed specifications shall be of good commercial quality approved by the contracting officer.

c. Fabrication--Metalwork shall be fabricated in accordance with the drawings and with the applicable provisions of the "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction.

d. Zinc coating (galvanizing)--Zinc coating (galvanizing) shall conform to ASTM Designations: A123 and A153.

e. Welding--Welding shall conform with the requirements of the American Welding Society Code AWS D1.0.

f. Measurement and payment--Measurement, for payment, for miscellaneous metalwork shall be made in pounds of metalwork incorporated into the work.

Payment for supports, pipe anchor chairs, and pipe protection saddles will be made at the unit price per pound bid therefor in the schedule, which price shall include the cost of all labor, materials, fabricating, installing and any incidentals associated therewith.

Payment for furnishing and installing all other metalwork for which unit prices are not provided in the schedule will be made as miscellaneous metalwork at the unit price per pound bid therefor in the schedule, which price shall include the cost of all labor, materials and incidentals associated therewith.

DIVISION 6 -- INSTRUMENTATION

SECTION 6.1--INSTRUMENTATION

6.1.1 General

The contractor shall furnish all plant, labor, equipment, appliances and materials and perform all operations in connection with the construction of mechanical and pneumatic instrumentation in accordance with this section and Drawing No. 6821.22A-02.

All materials furnished shall be as specified herein. No departures shall be made without written approval. All workmanship shall be of the highest quality. In general, all lines shall be square with the structure and with sufficient clearance to permit easy installation, removal and maintenance. Lines shall be pitched in the direction of flow for drainage.

All installation shall be performed in accordance with information in this specification, Instrument Society of America Recommended Practices, or as indicated on the drawings. Flow transmitters shall be installed in such a manner that the pipe design eliminates dead pockets and is self-draining. Care shall be taken to keep tubing and conduit runs away from hot pipes and under no circumstances shall they be less than six inches from any such pipe.

Tubing shall not touch each other or pipes or fixtures except as support joints. Tubing shall be supported within one foot of each joint. The distance between supports shall not exceed three feet. Supports shall be made of aluminum or a patented commercial type. All indicators and controllers shall be rigidly mounted and shall be readable at normal standing level.

Clamps, brackets, supports, etc., shall not be welded to process piping, electrical conduit, vessels or equipment. "U" bolts or other types of approved clamps shall be used.

6.1.2 Testing

Nitrogen test entire system at 1-1/2 times the working pressure or 100 psi, whichever is greater. Disconnect all instruments and cap tubing before applying test pressures. Liquid soap shall be applied to each connection and checked for leaks. Leaks as detected shall be corrected as described in Section 4.1.2.

6.1.3 Cleaning

Tubing, valves and fittings shall be cleaned in accordance with Section 4.1.4e of these specifications.

6.1.4 Materials

a. Tubing--Shall be 1/4 inch and 1/2 inch O.D., 0.03 inches or 0.032 inches wall seamless copper tubing ASTM B68 or B75, light or soft Anneal Temper covered with PCV sheath.

b. Fittings--Shall be Imperial Eastman "Hi-Seal" brass or equal. Elbows and tees shall be brass forgings - SAE CA 377. Connectors, unions, sleeves and nuts shall be stress relieved brass bar stock - SAE CA 360. Outside joints shall be covered with PVC tape.

c. Needle Valves--Needle valves shall be provided at air supply tubing connections to instruments and shall be same size as tubing and be similar to Imperial "Hi-Seal" series 700 with cadmium plated steel bar stock body and "O" ring seal.

6.1.5 Instruments

a. Temperature indicators--T - 1 Brine Service, Bi-metal 5" dial adjustable thermometer, 304 ss case and stem - 2-1/2" long, 0-500°F RN, 1/2" NPT male conn., with 1/2" x 3/4" NPT thermowell. Rochester R-1849 or approved equal.

b. Pressure Indicators--P - 1 Brine Service, 316 ss Bourdon tube and case, 4-12/" Dial, 0-400 psi range, 1/4" NPT bottom conn. Marsh Model E 5460 type 100-3SS-MS or approved equal.

c. Flow Orifices--Orifice flange union, welding neck, raised face, carbon steel complete with 1/2" NPT pressure taps, bolts, nuts and tab type 1/8" AISI type 304 stainless steel orifice plate as supplied by the Foxboro Co. or approved equal.

Brine Service shall be ANSI Class 300, 350°F and 200 psig, S.G. of 0.89 and viscosity of 0.15 cp.

Manufacture to determine orifice plate bore size, with a minimum pressure drop, for 8" pipe size with flows of 400 to 1000 GPM.

d. Flow transmitter--Transmitter, d/p cell, 20 to 250 in. H_2O span adjustability, Cadmium-plated carbon steel, tapped for 1/2" NPT process connections, 3 to 16 psi output signal and 20 psi supply pressure, calibrated range to be as listed for 400 to 1000 GPM, bracket for 2-inch pipe mounting, Model 13A1 Foxboro, or equal.

e. Square Root Extractor--Square root extractor to linearize dp 3-15 psi signals from transmitter. To operate with 20 psig air supply, 0.5 percent of span accuracy, in weather-proof and corrosion resistant case. Foxboro Model 557 or approved equal.

f. Flow Indicating Gauge--Receiver gage to receive 3-15 psi, signal from square root extractor and indicate flow rate in GPM. 270 degree concentric 6 inch dial, calibrated range of 400 to 1000 GPM $\pm$ 1 percent of full scale accuracy, 1/4 inch NPT male lower back connection, Foxboro Model P-105-TB or approved equal.

g. Pressure Indicating Controller--Pneumatic indicating pressure controller, proportional plus reset, 3 to 15 psi signal, 20 psig air supply, 316 stainless steel spiral receiving element, function to manually or automatically control pneumatically actuated flow control valve with a pressure signal received from process fluid upstream or downstream of FCV as indicated on drawings, increasing measurement increases air output, measurement range 3-15 psi, scale range to be 0-400 psi, glass fiber reinforced polyester case, pipe field mounting, Foxboro Model 43AP or approved equal.

h. Liquid Level Gage--Penberthy No. 205 Series, Cat 36B, Sec C, pp. 1 3/4-inch NPT Conncetion, 3/4-inch Glass, 30-inch center to center.

6.1.6 Instrument and Control Calibration and Adjustment

a. All instruments shall be checked for accuracy of calibration to manufacturer's nameplate data. Adjustments and recalibration shall be made to the satisfaction of the Contracting Officer, whether installed by the contractor or others.

b. All control instruments, switches, remote manual controls, and signal-producing devices shall be adjusted for correct control action and connection to provide completely workable operation. Restrictions and speed regulating accessories shall be installed to provide proper operation.

c. All control valves, cylinders, drives, and connecting linkages shall be stroked and adjusted to the satisfaction of the Contracting Officer.

d. The Contractor shall make such personnel available during the final testing of equipment as is considered necessary by the Contracting Officer to make immediate adjustments or repairs.

6.1.7 Nameplates

The Contractor shall supply and install permanent nameplates on all locally mounted instruments, and control valves.

All instruments and valves shall be tagged with corresponding numbers as indicated on Drawing No. 6821.22A-02.

6.1.8 Payment

Payment for furnishing and installing instrumentation will be made at the lump sum price bid therefor in the schedule.

DIVISION 7 -- PUMP

SECTION 7.1--PUMP

7.1.1 Pump

a. General--The contractor shall furnish and install the pump in accordance with these specifications and as shown on Drawing No. 6821.22A-02.

b. Performance--The pump shall deliver 500 GPM of 350°F geothermal brine, at 0.89 specific gravity, with a suction pressure of 150 psig and a discharge pressure of 350 psig.

c. Materials--Pump shall be equal to Buffalo Pump, Size 4RR, 2-stage centrifugal pump, iron fitted, with 17-4 PH stainless steel shaft sleeves, water cooled stuffing boxes, Falk No. 80T flexible coupling, coupling guard and 100 HP, 3 phase, 60 Hz, 460 V, 3500 RPM, TEFC Motor.

d. Payment--Payment for furnishing and installing the pump will be made at the unit price bid therefor in the schedule, which price shall include the cost of furnishing all labor, materials and incidentals required to complete the installation of the pump.

DIVISION 8 -- ELECTRICAL SYSTEM

SECTION 8.1--ELECTRICAL SYSTEM

8.1.1 General

a. General--The contractor shall furnish and install all electrical equipment and materials to complete and make ready for service the electrical service to injection pump, including the providing of all control wiring between motor starter and piping instrumentations.

The contractor shall place accurately in position, level and plumb, connect, adjust, and make ready for service the motor starter, grounding system, conduit system, insulated electrical wires and cables, and all other equipment and materials required by these specifications. All installations, assembly operations, and adjustments shall be in accordance with the following, and in the event of conflicting requirements, precedence is established by the order of the following:

(1) The latest edition of "National Electrical Code", the National Electrical Safety Code, and the adopted electrical code of the county and state in which the construction will be performed.
(2) Manufacturer's instruction data furnished with the equipment.
(3) These specifications and the drawings included herein or as directed by the contracting officer.
(4) The Bureau of Reclamation Design Standards No. 5, "Field Procedures for Electrical Installation", a copy of which will be furnished to the contractor upon request.

The electrical system shall be maintained and protected by the contractor in a satisfactory condition until final acceptance by the Government. Defective materials and equipment damaged in the course of installation or testing shall be replaced or repaired by and at the expense of the contractor in a manner meeting the approval of the contracting officer.

Temporary lighting equipment, if required or necessary to accommodate and facilitate the contractor's work operations, shall be provided, installed, and removed by and at the expense of the contractor.

b. Earthwork--The excavation of trenches, backfill and compacting of backfill in trenches for conduit shall be performed in accordance with the provisions of Paragraph 2.1.6 (Excavation and Backfill for Trenches). Conduits shall be buried to a minimum depth of 18 inches unless otherwise shown on the drawings or directed by the contracting officer. Suitable select backfill shall be placed around all conduit and all backfill compacted as provided in Paragraph 2.1.6 (Excavation and Backfill for Trenches). Timber protection above the low voltage distribution direct burial cable will not be required. No direct payment will be made for earthwork for burying conduit and cable but the cost thereof shall be included in the prices bid in the schedule for related items of work.

c. Payment--Payment will be made in accordance with Paragraph 8.1.9 (Payment).

8.1.2 Acceptance of Electrical Systems

After the work required under these specifications has been completed, the systems will be tested and operated, by and at the expense of the Government. These acceptance tests are exclusive of the operational tests covered under other paragraphs of these specifications. The tests may be witnessed by the contractor or his representative. Final payment under the contract will not be made until each item is completed and accepted in its entirety, these tests are completed, and the contracting officer has determined that the requirements of these specifications have been fulfilled: Except, that if the Government, through no fault of the contractor or of the materials furnished by the contractor is delayed in making the acceptance tests beyond a period of 30 days from the date of final completion of the installation of all equipment, payment of the balance due under the contract will be made at the end of the 30 day period.

8.1.3 Drawings and Data to be Furnished by the Contractor

a. Approval drawings and data--Within fortyfive (45) calendar days after date or receipt of notice to proceed and before proceeding with procurement of materials, the contractor shall submit to the Government five sets of drawings and data for approval. The drawings and data shall include:

(1) Manufacturer's detailed drawings, data, and description of the motor starter.

(2) Catalog number and sheet or bulletins for No. 2/0 motor feeder cable.

(3) Manufacturer's data and description of circuit breaker.

Any material shipped before approval of drawings and data will be at the contractor's risk. The Government shall have the right to require the contractor to make any changes in the equipment design and installation details which may be necessary to make the equipment conform to the requirements and intent of these specifications without additional cost to the Government. Approval of drawings and data by the Government shall not be held to relieve the contractor of any part of the contractor's obligation to meet all of the requirements of these specifications nor of the responsibility for the correctness of the drawings and data submitted.

The submittal of data required under this paragraph shall be complete, shall be made at one time, and shall include all data required to be submitted under the provisions of this paragraph. Three copies of all data required above shall be forwarded by the contractor and not by subcontractors, to the Construction Engineer, Yuma Projects Office, P.O. Bin 5569, Yuma, Arizona 85364. The contractor shall forward a copy of his transmittal letter with the other two copies to the Regional Director, Lower Colorado Region, P.O. Box 427, Boulder City, Nevada 89005.

b. Cost--The cost of submitting drawings and data to the Government shall be included in the lump sum price bid in the schedule for furnishing and installing electrical systems.

8.1.4 Grounding

a. General--The grounding system shall be in accordance with Drawing No. 6821.22A-01 and as specified herein.

The contractor shall furnish and install the grounding system, consisting of bare stranded copper cables, and accessories. Accessories shall include cable clamps, connectors, and other incidentals. The grounding system shall be connected to the existing ground plate at test station No. 8.

b. Materials--

(1) Ground cables--All ground cables shall be annealed, bare copper cable, concentric stranded, and in accordance with ASTM Designation: B 8, Class B. The solid wires used in forming the cables shall be in accordance with ASTM Designation: B 3.

(2) Cable fittings, lugs, and connectors--All cable fittings shall be of the solderless type and shall have current-carrying capacity equal to that of the copper cable with which they are used. All cable fittings, lugs, connectors, together with the bolts, nuts, and washers used therewith and the bolts, nuts, and washers which are used to make the connection to the equipment, shall be of copper alloy, containing not more than 4 percent zinc.

c. Installation--

The contractor shall make all necessary connections for the complete grounding system. Motor frames and metallic enclosures of all electrical equipment shall be connected to the ground plate at test station No. 8 by means of No. 2 AWG copper grounding conductors.

Grounding conductors shall be embedded, buried or concealed insofar as possible. All paint, scale, and enamel shall be removed from the points of contact on metal surfaces before ground connections are made. Where the finish has been removed from equipment to install ground connections, the finish shall be repaired in accordance with Section 9.1 (Painting).

d. Cost--The cost of furnishing and installing the grounding system shall be included in the lump sum price bid in the schedule, for furnishing and installing electrical systems, which lump sum price shall include the cost of all materials, labor, and equipment, including earthwork, to install the grounding system.

8.1.5 Electrical Conduit System

a. General--The contractor shall furnish and install all electrical rigid steel conduit and accessories required for the power system as shown on the drawing.

Conduit accessories shall include conduit fittings, bushed elbows, nipples, chase nipples, connectors, reducers, outlet bodies, outlet body extensions, 1/2 inch pipe extensions for conduit drains, outlet boxes, outlet box extensions, caps, pipe plugs, locknuts, bondnuts, bushings, pull boxes, concrete yard pull boxes, junction boxes, junction box extensions, octagonal concrete rings and backplates, adapters, adhesive, sealing varnish, threaded joint compound, expansion couplings, sealtight conduit fittings, materials for sealing the ends of conduits terminating at outdoor equipment, and all other incidentals required to complete the conduit system, and to fasten, clamp, attach, and support conduit in place.

b. Materials--Materials for the electrical conduit installations shall conform to the standards of Underwriters' Laboratories, Inc., and to the latest edition and amendments of the following specifications:

(1) Rigid steel conduit-WW-C-581d(3), zinc coated.

(2) Flexible metal conduit--Shall be galvanized steel core with a copper bonding conductor between the spiral segments and with an extruded synthetic jacket overall to insure a watertight conduit. Conduit shall be American Brass "Sealtite" Type UA or equal with grounding-type fittings approved for this type of flexible conduit.

(3) Conduit Fittings--W-F-406b(1) and W-F-408c(1).

(4) Plastic-coated conduit and plastic-coated conduit fittings--Shall be rigid steel conduit WW-C-581d(3), W-F-406b(1), and W-F-408c(1), zinc coated, with factory-applied plastic-compound protective coat at least .040 inch thick and placed uniformly around the conduit and equal to Republic Steel Corporation DEKORAN, Pittsburg Standard PLASTI-BOND, General Electric Company plastic-jacketed rigid conduit, or OCAL, made by Occidental Coating Company. All joints of plastic-coated conduit shall be taped so that a complete and positive seal is assured (see Subparagraph (10) below).

(5) Protective varnish--Protective varnish shall conform to General Electric Company "Glyptal" No. 1201-B, Westinghouse Electric Corporation No. B-6-614, or equal.

(6) Outlet bodies--W-C-586b, cast iron, malleable iron, or cast aluminum, Class 1 for embedded conduit systems. Covers for outlet bodies shall be metal and covers on bodies exposed to moisture shall be provided with gaskets.

(7) Junction boxes; junction box extensions; and junction box covers (steel, cadmium, or zinc coated)--W-J-800c(3).

(8) Pull boxes, terminal boxes, and junction boxes--Unless stated otherwise in these specifications, these boxes shall be constructed of sheet steel of not less than No. 10 United States Standard gage and shall be thoroughly cleaned and have a primer coat of red vinyl resin paint followed by a coat of gray vinyl resin paint. Terminal blocks shall be provided where required.

(9) Expansion couplings--Except as otherwise provided, expansion couplings for conduit systems shall be employed at expansion and contraction joints. For 2-inch metal conduit and smaller, couplings shall be equal to Dresser Manufacturing Company's Type 65A. For 2-1/2 inch metal conduit and larger, couplings shall be equal to Dresser Manufacturing Company's Type 38.

(10) Tape--Tape for wrapping the joints of plastic-coated conduit shall be not less than 2 inches wide and not less than 0.01 inch thick and shall consist of a polyvinyl-chloride or polyethylene film having high-strength and close-molding properties and having a pressure-sensitive adhesive.

c. Installation--All conduit shall be installed with necessary fittings and supports, and all bends shall be gradual and smooth to permit the pulling of insulated electrical wires and cables without undue stress or damage to the insulated electrical wires and cable sheath or to the conduit. All conduit runs and bends shall be entirely free from kinks, indentations, or flattened surfaces. All metal conduit bends made in the field shall be bent cold to prevent damage to the protective coating. Burrs and sharp corners at the ends of each piece of metal conduit shall be removed.

The male threads of rigid conduit joints shall be coated with a suitable sealing material before making joints and shall be tightened securely to prevent the entrance of moisture or any other foreign material. For steel conduit, the completed joints and terminations, all wrench marks, and all other places where the zinc covering is damaged shall be covered entirely with a protective varnish to provide protection from corrosion. Bushings or chase nipples shall be installed on the ends of conduit to protect the insulation or sheath of the wires or cables from abrasion; and locknuts and bondnuts shall be installed to provide tight ground connections between conduit boxes, and cabinets.

Where conduits cross expansion or contraction joints, the required special fittings or expansion couplings shall be installed.

The exposed conduit runs shall be straight and shall be parallel with each other and with the centerline of the manifold piping support rack, unless otherwise directed. All exposed conduits shall be rigidly supported at intervals of not more than 10 feet, unless otherwise specified or directed. The supports shall be of a design acceptable to the contracting officer. The installation of exposed conduit shall include, where required, the drilling of holes in the bottom and top of enclosures or plates and in the side of enclosures of electrical equipment. The contractor shall drill all

holes in concrete or structural members required for installation of expansion anchors or clamps for exposed conduit runs. All exposed conduit shall be tightened securely and shall be supported rigidly in place. Flexible conduit shall be used to make conduit connections to electrical equipment such as motors and equipment where shown. All flexible conduit and connectors shall be approved grounding type.

All metal conduit buried directly in earth shall be protected by a factory-applied plastic coat. All joints of plastic-coated conduit shall be made with watertight fittings which shall be taped with polyvinyl-chloride or polyethylene tape or covered in accordance with the manufacturer's instructions and any damaged portions of the protective coat shall be repaired or covered in accordance with the manufacturer's instructions. The covering shall extend at least 3 inches above the ground surface, as applicable.

Bending of plastic-coated conduit shall be performed in accordance with the manufacturer's recommendations. Where the manufacturer warns of possible damage to plastic coating when bending the larger size of conduit, factory bends shall be used.

Buried electrical conduit shall have 2 inches of sand or fine earth around each conduit. The remaining portions of the trenches shall be backfilled and compacted as provided in Paragraph 2.1.6 (Excavation and Backfill for Trenches).

At electrical equipment enclosures not equipped with threaded hubs, conduits shall be terminated with double locknuts and end bushing.

Conduit low points shall be drained where and as directed by the contracting officer. Conduits used solely as drains shall be 1/2 inch.

8.1.6 Insulated Electrical Wires and Cables

a. General--The contractor shall furnish and install all single-conductor insulated electrical wires, cables, and cable installation accessories for the electrical system. Cable installation accessories shall include marking

tags, insulating tape, connectors, fittings, and other incidentals required for completing the installations. Aluminum connectors using aluminum screws will not be permitted.

For the electrical installation, the term "wire" applies only where a single solid insulated electrical conductor is used and the term "cable" shall apply to either a stranded electrical conductor (single-conductor cable) or a combination of electrical conductors insulated from one another (multiple-conductor cable), except grounding cable shall be uninsulated.

All wire and cable sizes shall be as shown on the drawings and as specified herein.

b. Materials--Insulated electrical wires and cables shall be "National Electrical Code" grade of the types listed below and shall have been manufactured within 24 months prior to receipt of notice to proceed. Unless otherwise specified, conductors shall be soft annealed, Class B, stranded copper. All conductors No. 6 AWG and larger shall be stranded.

(1) 600-volt, single-conductor, copper:
  (a) For 75°C conductor temperature, general use service: Type THW.
  (b) For 90°C conductor temperature: Types THHW or XHHW.

c. Installation--The contractor shall install the wires and cables in conduits, wireways, or enclosures, where required.

Sufficient length shall be left at the ends of wires and cables to make connections conveniently to the equipment and devices.

Wire and cables shall not be pulled into conduits until the conduit runs have been cleaned and are free from obstructions and sharp corners. A clean, dry, tight-fitting rag shall be drawn through the conduit immediately before installing the wire or cable. The wires and cables shall be installed so that there will be no cuts or abrasions in the insulation or protective

covering or kinks in the wires and cables. No splices shall be made in wires or cables, except at boxes, wireways, outlets, or electrical equipment enclosures. Only gradual and uniform pulling stresses will be permitted on wires and cables. Where a lubricant is needed as an aid to the pulling of wires and cables, only soapstone or other approved material not injurious to the wire or cable sheath shall be used. Any wire or cable damaged during installation shall be removed and replaced with equivalent wire or cable at the contractor's expense.

All wires and cables shall be marked with circuit designation at each end and where the wires or cables are connected to terminals, terminal blocks, or connectors. The designations shall be applied to the wire or cable ends by using identification markers similar to the W.H. Brady Company No. B-500 vinyl-cloth tape with a silicone-plastic overcoating.

All runs, connections, and taping of wires and cables shall be made carefully and neatly. Bolted solderless-type terminal lugs and connectors shall be used for joining or connecting cables larger than No. 8 AWG. All terminal lugs and connectors shall have current-carrying capacity equal to that of the conductor with which they are used. No. 8 AWG and smaller stranded cables shall have suitable solderless lugs for connecting to terminal blocks and terminal studs. When No. 8 AWG and smaller size wires and cables are spliced, they shall be joined so as to be mechanically and electrically secure. All insulated wire and cable splices and terminations shall be performed in accordance with the cable manufacturer's recommendations and in all cases the contractor shall obtain this information for each type and size of cable being furnished, and shall submit copies of such information to the contracting officer.

8.1.7 Motor Starter

a. General--The contractor shall furnish and install one motor starter for control of the injection pump.

b. Equipment--Starter shall be non-reversing, combination reduce voltage autotransformer type and non-fusible disconnect switch, manufactured in accordance with the latest published NEMA standards, sizes, and horsepower ratings. Combination starter shall be mounted in NEMA 4 enclosure.

Starter shall be 3-pole, 480 volt, 3-phase, NEMA Size 4, equipped with three overload relays. Overload relays shall be ambient compensating or of adjustable type to compensate for ambient conditions. Starter shall be provided with 2 NO and 2 NC auxiliary contacts in addition to the hold-in interlock. Starter shall also be provided with H-O-A selector switch and indicating lights mounted on the door of the enclosure. The starter shall have 120 volt coil.

Autotransformer shall have two coil construction with taps for 50, 65, and 80% starting voltage. Close transition shall be provided.

Operating handle for disconnect switch shall not be mounted on the door of the enclosure but to the side of the door and shall be always in control of the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is ON or OFF.

c. Installation--The motor starter shall be installed at the location shown on the drawing. The starter shall be securely mounted on steel frame welded to existing pipe support rack, as detailed on the drawing. Painting removed from pipe support rack in the process of welding shall be restored to its original condition.

8.1.8 Circuit Breaker

a. General--The contractor shall furnish and install in the distribution section of the unit substation one circuit breaker for overcurrent protection of injection pump feeder.

b. Circuit Breaker--Circuit breaker shall be manufactured in accordance with the latest NEMA standards (Publication No. ABI) Molded Case Circuit Breakers, with number of poles and trip rating as indicated on the drawing. The circuit breaker shall be trip free and furnished with thermal and instantaneous overload devices. It shall be compatible with the secondary distribution section of the unit substation and shall have an interrupting rating of not less than the short circuit current available at the unit substation. The contracting officer shall furnish to the contractor the available short circuit current at the substation.

c. Installation--The circuit breaker shall be installed in the secondary distribution section of the unit substation. Installation work at the substation shall be coordinated with the contracting officer.

8.1.9 Motor Control

8.1.9.1 Cavitation Control -- Pump protector underload (cavitation) power sensing analog control KRATOS part no. 85.319 or approved equal.

8.1.9.2 Flow Switch -- Mounted on 8-inch pipeline - On @ 104 GPM & Off @ 89 GPM, all welded parts stainless steel, single pole, double throw, UL approved, vapor proof, 1000 psi g design, McDonnell and Miller Model F57-4SV or approved equal.

8.1.10 Payment

Payment for furnishing and installing the elctrical service for injection pump shown on the drawing and herein specified will be made at the lump sum price bid therefor in the schedule, which price shall include all labor, materials, motor starter, conduit and wiring, earthwork, transportation, and all incidentals required for complete installation of the electrical system including the furnishing and installation of one circuit breaker in the distribution section of the unit substation, all control wiring between motor starter and piping, instrumentations, and grounding of motor frame and starter enclosure to existing ground plate at test station No. 8.

DIVISION 9 -- PAINTING

SECTION 9.1--PAINTING

9.1.1 Painting

a. General--The contractor shall furnish all materials, clean surfaces and apply the paint and protective coatings listed in Paragraph 9.1.2. (Painting Tabulation) and in accordance with Paragraph 9.1.3. (Color Schedule for Painting).

Items or surfaces not required to be painted or coated but which are adjacent to surfaces to be cleaned and painted shall be protected against contamination and damage during the cleaning and painting operations. The cleaning and painting operations shall be so conducted that dust or other contamination from the cleaning process will not fall on wet, newly painted surfaces, and newly painted metalwork shall not be moved until the paint is dry hard. All contractor-applied coatings exposed to view, including any touchup repair painting, shall present a uniform color-matched appearance. Any items or surfaces damaged or contaminated by painting operations shall be returned to their original condition by and at the expense of the contractor. Before topcoating any coated surfaces, the contractor shall reclean any exposed metal and apply paint as necessary to restore to the specified condition all previously applied paint in areas which are defective or damaged. Materials which have been painted shall be handled with care and protected as necessary to preserve the coating in good condition.

Temporary or permanent welding for the convenience of the contractor will not be permitted on areas where the welding will damage paint or other protective coatings unless the areas of coatings which would be damaged thereby are accessible for repairing and inspection. Unless otherwise specified, the contractor will not be required to disassemble machinery, equipment or other metalwork for the purpose of painting the interiors. The contractor shall provide adequate ventilation, lighting and the necessary safety equipment for the protection of the workmen during painting and coating operation.

b. Preparation of surfaces--Surface preparation shall be in accordance with one of the following methods. The method to be used for each item is indicated in the painting tabulation. Weld spatter, slag burrs, or other objectionable surface irregularities shall be removed or repaired before cleaning. Any contaminants to the paint coating, from cleaning operations or other sources, shall be removed before the surface are painted. Cleaning solvent shall be mineral spirits or xylol. Cleaning cloths and solvents shall be discarded before they become contaminated to the extent that a greasy film would remain on the surface after preparation of the surface. In the event that rust forms or the surfaces become otherwise contaminated in the interval between cleaning and painting, or between coats of paint, recleaning will be required. Any coatings not required by and not shown in the painting tabulation shall be removed from the surfaces by suitable and effective means, unless otherwise directed.

Method A All oil, grease, and dirt shall be removed by the use of clean solvent and clean, lint-free wiping material or other effective means. Surfaces with gloss or semigloss paints shall also be sanded lightly.

Method B All oil and grease shall be removed by the use of clean solvent and clean, lint-free wiping materials. Following the solvent cleaning, the surfaces shall be cleaned of all defective or damaged areas of existing paint, and of all loose rust, loose mill scale, and other foreign substances by scraping, chipping, wire brushing, grit-blasting, commercial grade sandblasting, or other effective means.

c. Preparation of other surfaces--All surfaces not covered by the above sub-paragraphs shall be prepared by methods common to good practice for the particular surface being prepared.

d. Application--Materials shall be thoroughly mixed at the time of application. Surfaces shall be clean and free from moisture at the time of application. Items to be painted that are not thoroughly dry at the time of paint application shall be heated to a sufficient temperature (80°F) to drive off any moisture present before paint is applied. Effective means shall be provided for removing free oil and moisture from the air-supply lines of all spraying equipment. Care shall be exercised during spray application to hold the nozzle sufficiently

close to the 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. Nozzle pressure consistent with acceptable finish results shall be employed when spray painting.

Each coat shall be applied in such a manner as to produce an even film of uniform thickness which will completely cover irregularities, fill crevices, and be tightly bonded to the metal or previous coat. Each coat shall be free from runs, pinholes, and sags.

Each coat shall be allowed to dry or to harden before the succeeding coat is applied. Thicknesses shall be measured by an approved dry-film thickness gage and shall be not less than the minimum specified thickness at any point on the coating. Acceptance will be based on the total dry-film thickness as measured by an Elcometer, Mikrotest, or other suitable dry-film thickness gage, after the complete paint system has thoroughly dried.

Red lead priming paint, regular aluminum paint, and enamels, and oil base paints may be thinned if necessary to permit satisfactory application, in which event mineral spirits shall be used and the amount of thinner shall be kept to a minimum but in no event shall it exceed 1 pint per gallon of paint.

If necessary to improve application properties, cold-applied paints may be heated by means of a hot-water bath to temperatures not to exceed 100°F. Paint shall not be applied when the temperature of the item to be painted or the surrounding air is under 45°F., except that vinyl resin paints shall not be applied when metal or air temperatures are above 110° or below 40°F. Painting shall proceed only when the humidity and the temperatures of atmosphere and of surfaces to be painted are such that evaporation rather than condensation will result. Brush coats may be applied by the conventional brushing procedure, or the paint may be delivered to the surface in a fluid stream by means of spray equipment employing air pressure only on the material and the paint then spread immediately by brushing to an even smooth coating.

Tinting, where required for color contrast, shall be accomplished by using not more than 3 ounces of tinting color per gallon of paint.

Application of specific materials shall be as follows:

(1) Red lead priming paint shall be applied at a maximum coverage of 500-square-feet-per gallon per coat for Type II but the dry film thickness shall be not less than 1.0 mil for the first coat. Zinc-dust-zincoxide paint shall be applied at a maximum coverage of 500-square feet-per-gallon per coat. Following the first coat of red lead paints, an additional tinted coat shall be applied over all rivets, welds, bolts, seams, sharp corners, and edges before subsequent painting. Alternate coats shall be tinted for color contrast using 1B black. The first coat shall be applied by brush or roller and subsequent coats shall be applied by either brush, roller, or spray, except that Type II red lead priming paint may be applied by spraying when Method B surface preparation is specified and the surface is cleaned by "commercial" grade blast cleaning.

(2) Aluminum paints shall be applied by spraying at a maximum coverage of 500-square-feet-per-gallon per coat for regular aluminum paint. The paints shall be prepared by mixing 2 pounds of aluminum paste per gallon of mixing varnish and only enough paint for each day's use shall be prepared at one time. The first coat shall be tinted for color contrast using 2A blue. The final coat of aluminum paint shall be "stripe free" with a uniform appearance.

(3) Enamels, and oil base paints, shall be applied by brush, roller, or spray at a maximum coverage of 500-square-feet-per-gallon per coat.

e. Materials--All pigmented paints and primers shall be purchased in containers not larger than 5 gallons as packaged by the manufacturer. Colors of finish paints shall be as directed in accordance with Federal Standard No. 595a. All colors shall be factory mixed and ground. Tinting with universal tinting colors will not be permitted, and tinting with colors-in-oil is permitted only where specified for slight contrast between coats. Materials shall be in accordance with the following specifications, or may be in accordance with the subsequent revisions thereto: Provided, that the samples or certifications are identified with the proper specifications revision:

Group I

(1) Federal Specifications--

(a) Red lead priming paint, TT-P-86g, Type II.

(b) Mixing varnish for regular aluminum paint, TT-V-81d, and aluminum paste, TT-P-320c, Type II, Class 2.

(c) Zinc dust-zinc oxide primer, TT-P-641f, Type II.

(d) Primer coating, zinc cust, chlorinated rubber, TT-P-001046(1), (Galvanizing repair compound.)

(e) Enamel, gloss, TT-E-489f(1), Class A.

(2) Miscellaneous Specifications--

(a) Paint and coating materials required to be used on work covered by these specifications and which are not covered by this paragraph will be classified as Group I materials, unless otherwise indicated.

Group II

(1) Federal Specifications--

(a) Pigment-in-oil (tinting colors), TT-P-381E(1). Colors 1B black and 2A blue, or equal tinting color in oil.

(b) Mineral spirits, TT-T-291E, Grade 1.

(c) Xylol (xylene), TT-X-916b, Grade A or B.

f. Sampling, testing, and certification of materials--The Government will test or require certification of each batch, type, or color of paints or related materials prior to use of application. However, acceptance of the material under the clause of the General Provisions entitled "Inspection and Acceptance" will not be made until the material has been satisfactorily applied and the equipment installed at the jobsite.

The contractor shall furnish copies of all purchase orders for paint or related materials to the contracting officer. Copies of purchase orders shall be furnished far enough in advance of planned use so that the samples, if required, will be available to the Government to allow a testing period of at least 45 days. The Government will then inform the contractor in writing whether materials covered by each purchase order will be tested or whether the manufacturer's certification will be required.

The Government will act on certifications as to paint conformance within 16 days after receipt of the certifications by the Government, and will notify the contractor. Purchase orders and the required certifications or samples shall be furnished by the contractor to the Bureau of Reclamation Construction Engineer, Yuma Projects Office, P.O. Bin 5569, Yuma, Arizona 85364, shipping costs prepaid, and copies of all correspondence shall be sent to the authorized representative of the contracting officer at the jobsite.

Certifications for each type, batch, or color of Group I materials shall include detailed results of laboratory tests covering all of the applicable specifications requirements and a general statement that the materials comply with the requirements of the specifications. Certifications for quantities of 10 gallons or less of each type, batch, or color of Group I materials may be furnished with only the manufacturer's quality control and composition data, and a general statement that the materials comply with the requirements of the specifications. The certifications shall also contain specific identification data as to material identification, batch number, date of manufacture, quantity being furnished, and the Bureau of Reclamation specifications number. Certifications for Group II materials need not include detailed laboratory testind data but shall comply in other respects with the requirements stated above. The Government reserves the right to test any materials furnished on certification when in the opinion of the Government, such tests are necessary. The contractor shall be responsible for the accuracy of all certifications submitted or data contained therein whether submitted by him, a manufacturer, a supplier, or a subcontractor.

The contractor shall purchase the total quantity of each item of material that is expected to be used in a reasonable length of time to avoid repetitive purchases that would impose additional testing expense on the Government. The costs and delays from additional testing required as a result of either unnecessary small purchases or rejection of the materials submitted shall be the responsibility of the contractor.

g. Costs--The cost of furnishing, preparing, and applying all materials for the cleaning, painting, or coating operations shall be included in the applicable prices bid in the schedule for the items of work requiring painting.

9.1.2 Painting Tabulation

Contractor furnished items shall receive the cleaning and coating systems shown in the tabulation following. Coatings shall be applied as required under Paragraph 9.1.1 (Painting).

No.	Item	Surface Preparation Method	Paint or Coating Material	Number of Coats
1	Damaged areas of paint on metalwork and equipment which are furnished complete painted or coated including:	Repair damaged areas to equal and color match undamaged contiguous areas.		
2	Damaged areas of galvanized surfaces that do not require finish painting	B	Zinc dust-zinc-oxide paint	2
3	Exterior exposed metalwork and exposed piping	B	Red lead priming paint, Type II	1
	a. Structural steel manifold piping supports		Regular aluminum paint	2
	b. Tank			

9.1.3 Color Schedule for Painting

The colors and gloss of finish coats of paints will be as selected by the contracting officer except as provided in Paragraph 9.1.2 (Painting Tabulation). If items are furnished with a manufacturer's finish painting, the color and gloss of which are acceptable to the contracting officer and which meet the cleaning and painting requirements of Paragraph 9.1.1. (Painting), such items will not require field painting except for repair of damaged painted surfaces.

Color schedules for painting will be provided by the contracting officer.

DIVISION 10 -- DRAWINGS

SECTION 10.1--DRAWINGS

10.1.1 Drawings, General

a. General--In the event there are minor differences as determined by the contracting officer between details and dimensions shown on the drawings and those of existing features at the site, the details and dimensions of existing features at the site shall govern.

The contractor shall check all drawings carefully and advise the contracting officer of any errors or omissions discovered.

b. Additional or revised drawings--Except as otherwise provided in these specifications for drawings to be furnished by the contractor, the specifications drawings will be supplemented by such additional or revised general and detail drawings as may be necessary or desirable as the work progresses; and the contractor will be required to perform the work in accordance with the additional general and detail drawings or revisions furnished by the Government at the applicable prices bid in the schedule for such work.

c. Additional copies of drawings--The contractor will be furnished such additional copies of the specifications and drawings as may be required for carrying out the work.

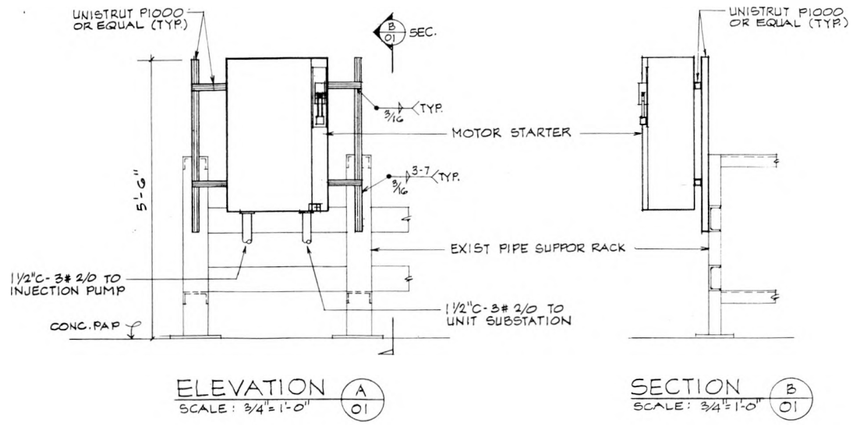
d. Mailing address--All drawings and data submitted by the contractor for which a specific mailing address is not given in these specifications shall be submitted to the Construction Engineer, Bureau of Reclamation, Yuma Projects Office, 3800 Avenue 3 East, P.O. Bin 5569, Yuma, Arizona 85364.

10.1.2 List of Drawings

The following drawings are made a part of these specifications:

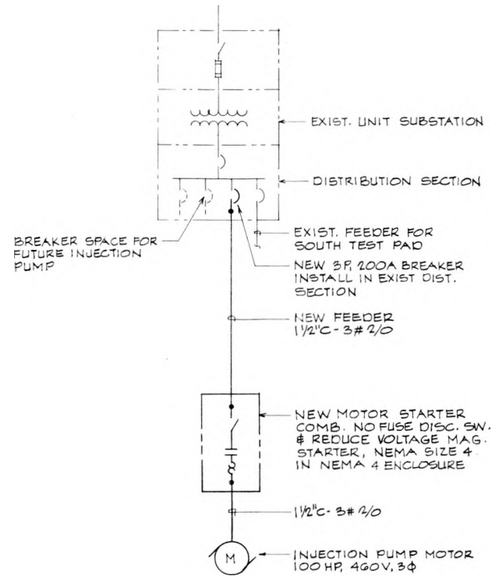
INJECTION PUMP SYSTEM

6821.22A-01	Site Plan and Electrical Details
6821.22A-02	Piping Plan and Details
6821.22A-03	Structural Details

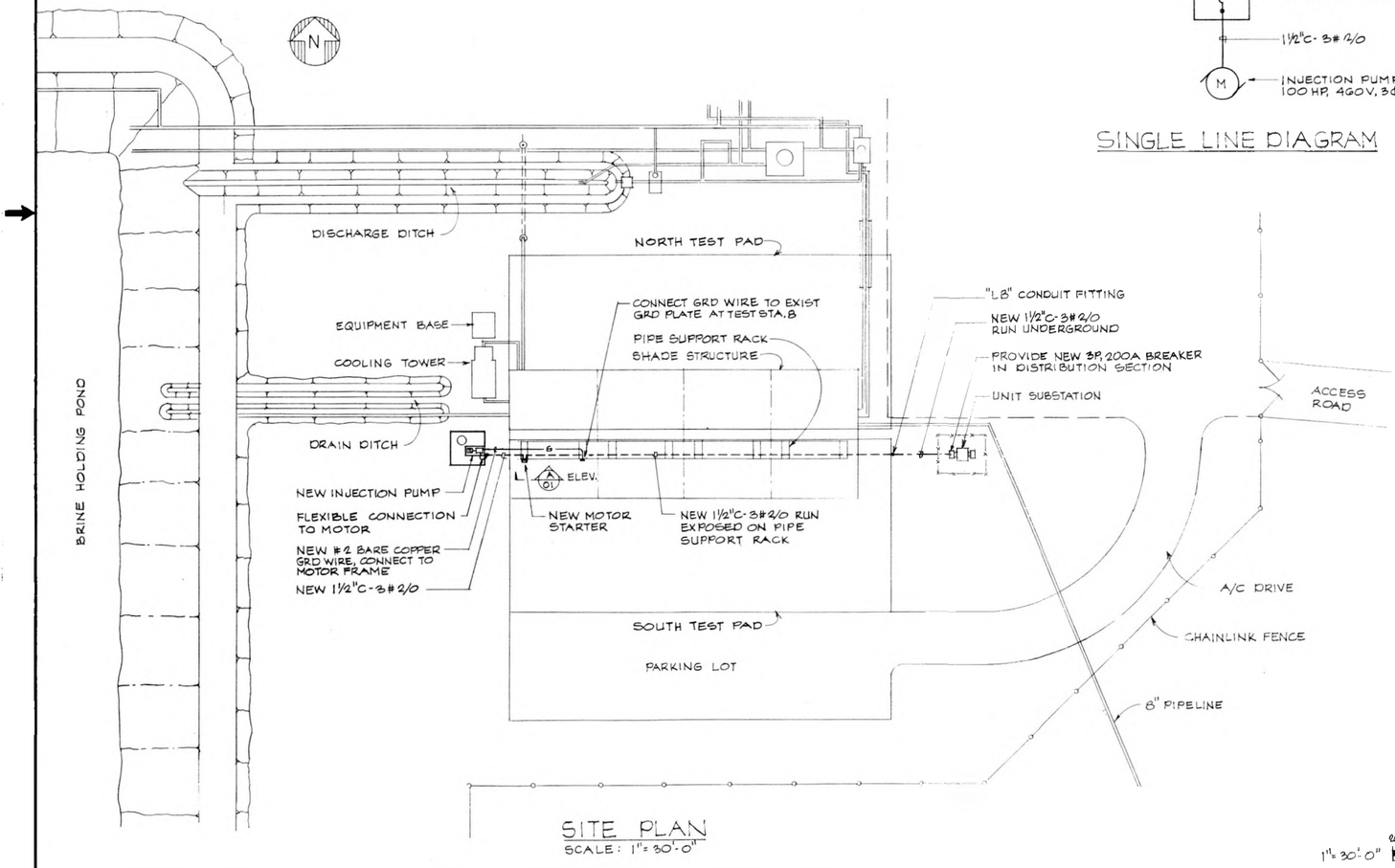


ELEVATION A/01
SCALE: 3/4"=1'-0"

SECTION B/01
SCALE: 3/4"=1'-0"



SINGLE LINE DIAGRAM



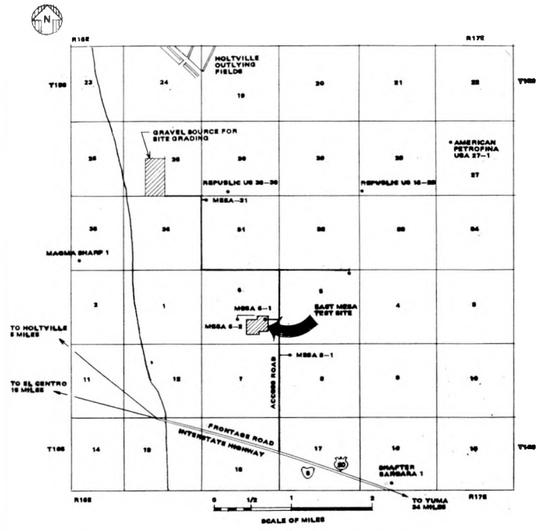
SITE PLAN
SCALE: 1"=30'-0"

1"=30'-0" 0 10 20 30 40 50 60 70 80 90 100 FEET

INJECTION PUMP SYSTEM

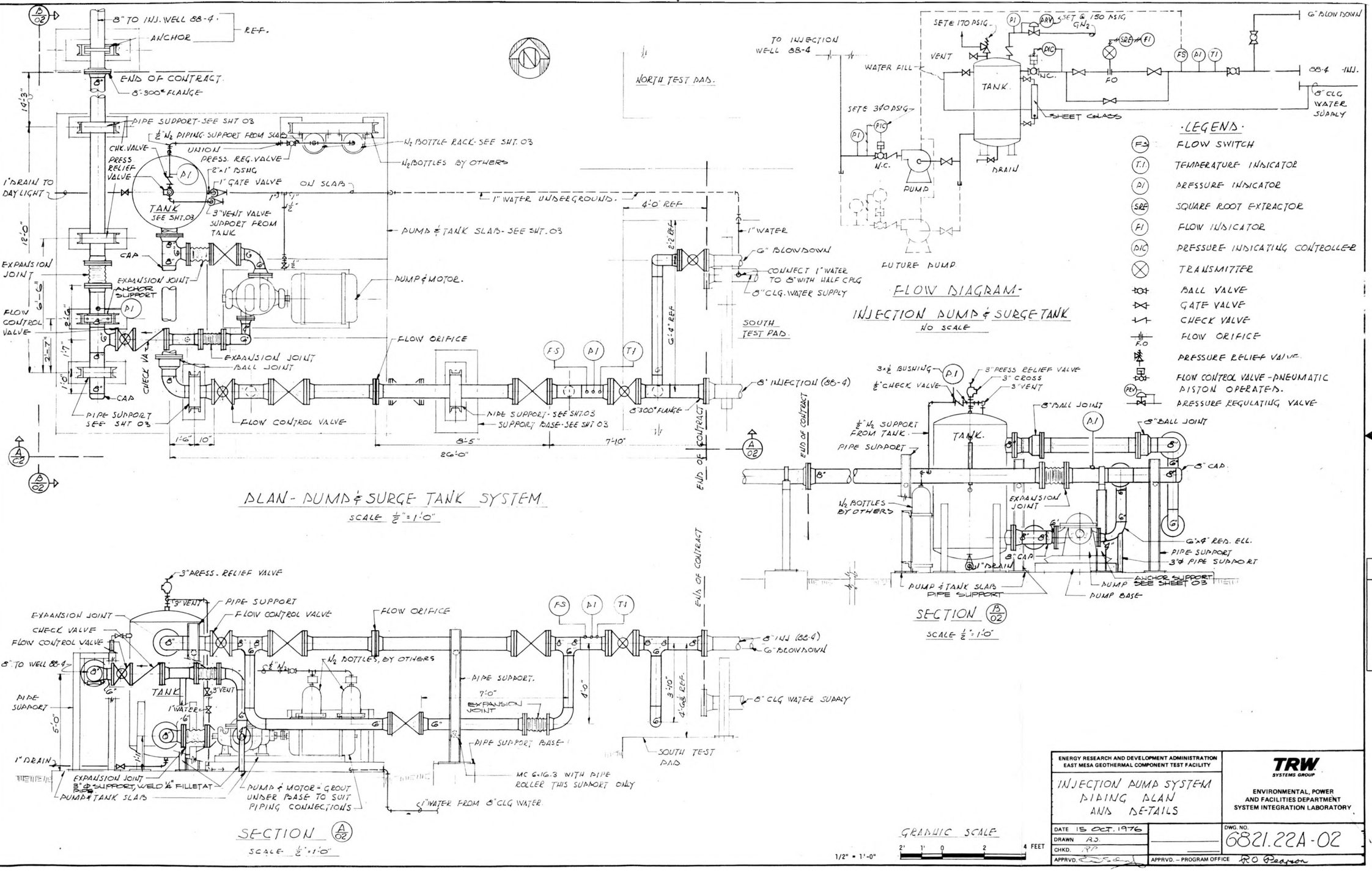
DRAWING INDEX

DRAWING NO.	TITLE
6821.22A-01	SITE PLAN AND ELECTRICAL DETAILS
6821.22A-02	PIPING PLAN AND DETAILS
6821.22A-03	STRUCTURAL DETAILS



LOCATION PLAN

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY		TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
INJECTION PUMP SYSTEM SITE PLAN AND ELECTRICAL DETAILS		
DATE 15 OCT. 1976 DRAWN E.O. CHKD. RP APPRVD		DWG. NO. 6821.22A-01 APPRVD – PROGRAM OFFICE RO Pearson



PLAN - PUMP & SURGE TANK SYSTEM

SCALE ½" = 1'-0"

FLOW DIAGRAM -
INJECTION PUMP & SURGE TANK
NO SCALE

SECTION (B/02)

SCALE ½" = 1'-0"

SECTION (A/02)

SCALE ½" = 1'-0"

GRAPHIC SCALE

1/2" = 1'-0"

2' 1' 0 2 4 FEET

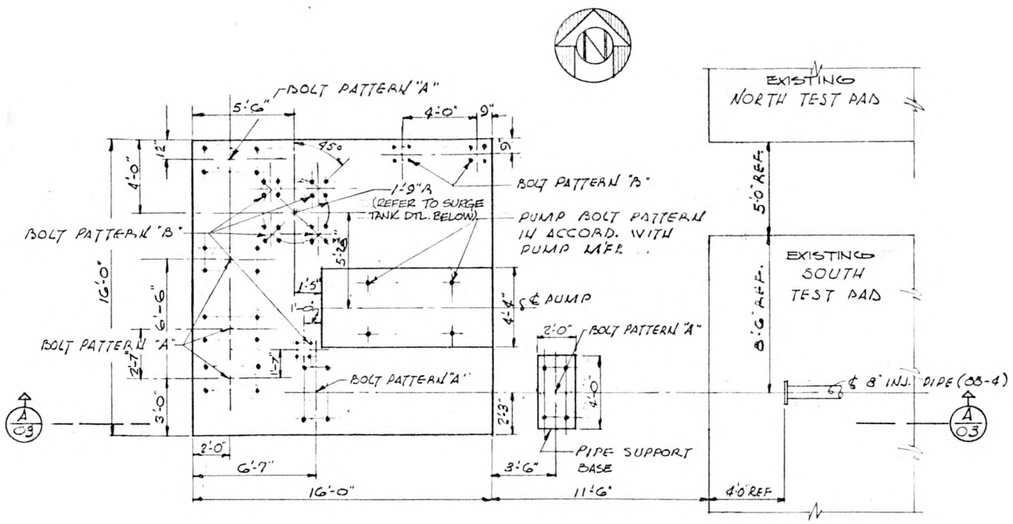
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

INJECTION PUMP SYSTEM
PIPING PLAN
AND DETAILS

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

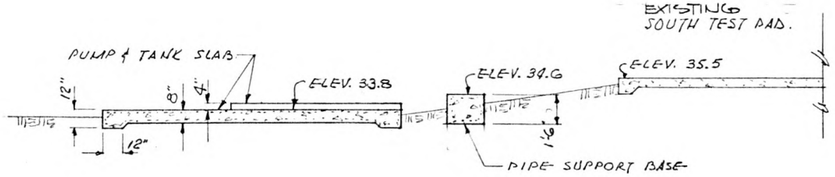
DATE 15 OCT. 1976
DRAWN A.J.
CHKD. RP
APPRVD.
APPRVD. – PROGRAM OFFICE RO Pearson

DWG. NO. 6821.22A-02



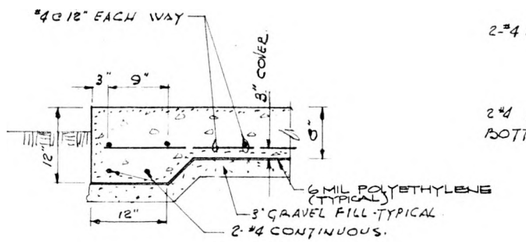
PLAN - PUMP & TANK SLAB

SCALE 1/4" = 1'-0"



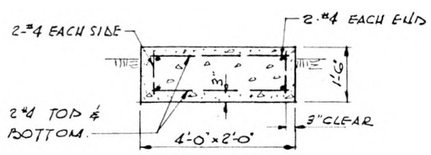
SECTION (A/03)

SCALE 1/4" = 1'-0"



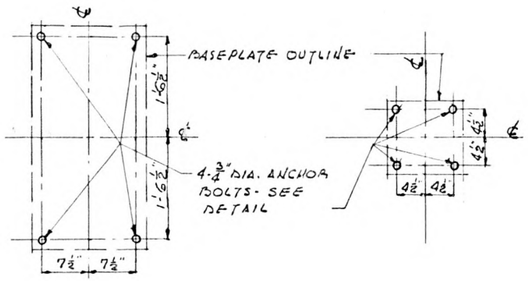
EDGE DETAIL - TYPICAL FOUR SIDES

SCALE 1" = 1'-0"



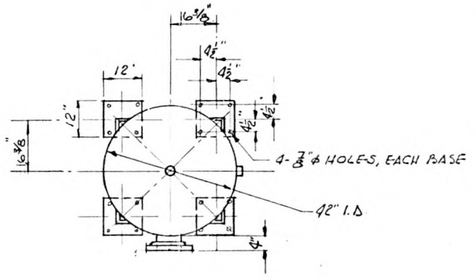
PIPE SUPPORT BASE

SCALE 1/2" = 1'-0"



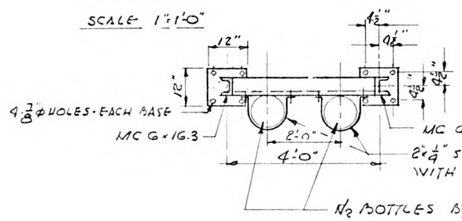
ANCHOR BOLT PATTERN "A"

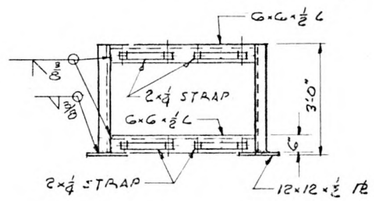
SCALE 1" = 1'-0"



ANCHOR BOLT PATTERN "B"

SCALE 1" = 1'-0"



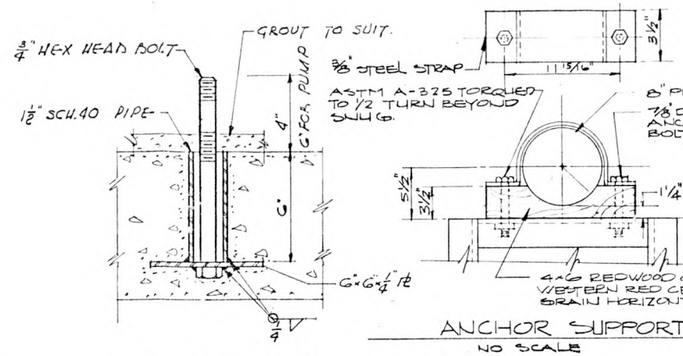


N2 BOTTLE RACK

SCALE ½" = 1'-0"

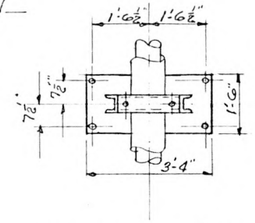
TYPICAL ANCHOR BOLT

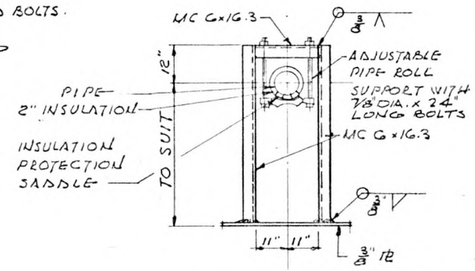
SCALE 3" = 1'-0"



ANCHOR SUPPORT

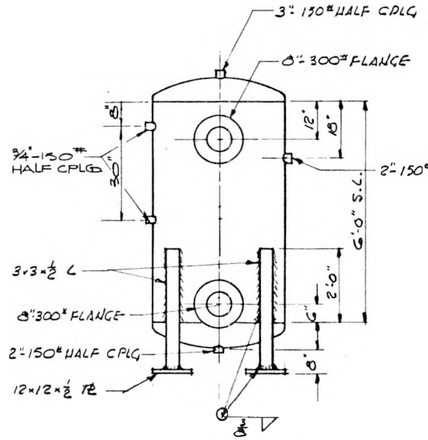
NO SCALE





TYPICAL PIPE-SUPPORT

SCALE ½" = 1'-0"



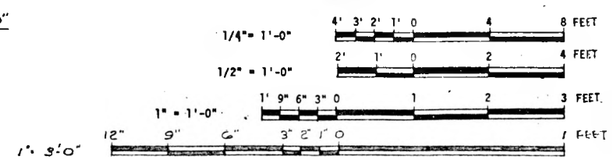
SURGE TANK

SCALE ½" = 1'-0"

NOMINAL CAPACITY	450 GALS.
SHELL LENGTH	G'-0"
DIAMETER	42"
HEAD	FLANGED & DISHED
SHELL THKNS	⅜"
HEAD THKNS	½"
DESIGN PRESSURE	1GO PSI
TEST PRESSURE	240 PSI

CONSTRUCTED & TESTED IN ACCORDANCE WITH ASTM CODE FOR UNFIRED PRESSURE VESSELS.

GRAPHIC SCALES



ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
INJECTION PUMP SYSTEM STRUCTURAL DETAILS	
DATE 15 OCT. 1976 DRAWN AJ CHKD. APPRVD.	DWG. NO. 6821.22 A-03 APPRVD. – PROGRAM OFFICE R.O. Pearson

ENERGY RESEARCH and DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Contract No. E(04-3)-1140

TASK 4.1.2

INJECTION PIPELINE

TEST SITE TO WELL ERDA US 52-2

SPECIFICATION 6821.22B-S

Prepared by:

ENVIRONMENTAL, POWER
AND FACILITIES DEPARTMENT

TRW
SYSTEMS GROUP

FOREWORD

The work is situated approximately 10 miles east of Holtville, California in Imperial County, and is accessible by primary and secondary roads. Work under these specifications consists of the construction of a buried and above ground 8-inch pipeline to convey geothermal brine from the test site to injection well ERDA US 52-2

Features of the work include clearing, excavation and compaction of earth for pipe trenches, anchors and expansion pits, furnishing and placing concrete for pipe anchors and expansion pits, and constructing approximately 7900 linear feet of 8-inch diameter Schedule 20 welded steel pipeline complete with pipe coating, flexible ball joints, pipe anchors, pipe supports, and insulation.

DESCRIPTION OF THE WORK

The work required under these specifications is the construction of an 8-inch steel pipe pipeline from the Test Site to Injection Well ERDA US 52-2

Principal components of the work to be performed under these specifications include the following:

a. Clearing, excavation, embankment, and compaction of earth for buried pipeline, for concrete pipe anchors and supports, expansion pits and drain pits.

b. Furnishing and constructing approximately 7900 linear feet of 8-in diameter, Schedule 20, welded steel pipe, complete with flexible ball joints, pipe supports, anchors, drains, and air valves.

c. Furnishing and installing 2-inch pipe insulation on 8-inch diameter steel pipe and fittings above ground. Furnishing and installing 1-inch insulation on all drain and vent piping and fittings.

d. Furnishing and placing reinforced concrete for concrete expansion pits, pipe supports, pipe anchor chairs, and pipe protection saddles.

e. Furnishing and installing miscellaneous carpentry including expansion pit covers and pipeline marker posts.

f. Furnishing and installing concrete block for expansion pits and drain pits.

INJECTION PIPELINE
TEST SITE TO WELL ERDA US 88-4

Bids will be considered on the following schedule, but no bid will be considered for only a part of the schedule.

SCHEDULE

Item	Work or Material	Quantity and Unit	Unit Price	Amount
1.	Excavation for pipe trenches	4370 cu. yd.	$_____	$_____
2.	Excavation for structures	1040 cu. yd.	_____	_____
3.	Backfill Pipe Trench	4250 cu. yd.	_____	_____
4.	Backfill about structures	790 cu. yd.	_____	_____
5.	Compacting backfill about structures	790 cu. yd.	_____	_____
6.	Compacting backfill in pipe trench	4250 cu. yd.	_____	_____
7.	Furnishing and placing concrete	51 cu. yd.	_____	_____
8.	Furnishing and handling cement	312 cwt.	_____	_____
9.	Furnishing and placing reinforcement	2444 lb.	_____	_____
10.	Furnishing and installing 8-inch Schedule 20	7916 lin.ft.	_____	_____
11.	Furnishing and installing 8-inch flexible ball joints	32 each	_____	_____
12.	Furnishing and installing pipe insulation	150 lin.ft.	_____	_____
13.	Furnishing and installing 2-inch gate valve	2 each	_____	_____
14.	Furnishing and installing 1-inch air relief valve	13 each	_____	_____
15.	Furnishing and installing 8-inch gate valve	1 each	_____	_____
16.	Furnishing and installing miscellaneous metal work	FOR THE LUMP SUM OF ---		_____

SCHEDULE (continued)

Item	Work or Material	Quantity and Unit	Unit Price	Amount
17.	Furnishing and installing expansion pit covers	15 each	$_____	$_____
18.	Furnishing and installing pipeline marker posts	79 each	_____	_____
19.	Furnishing and installing concrete block	33.2 per 100	_____	_____
20.	Furnishing and installing 12-inch corrugated metal culvert pipe	456 lin.ft.	_____	_____
21.	Furnishing and installing 2-inch Schedule 40 and 1-inch Schedule 40 pipe and fittings	35 lbs.	_____	_____
22.	Furnishing and installing drain pit covers	2 each	_____	_____

INJECTION PIPELINE
GENERAL OUTLINE

DIVISION 2 -- EARTHWORK

Section 2.1-- EARTHWORK

- 2.1.1 Classification of Excavation
- 2.1.2 Excavation for Pipe Trenches
- 2.1.3 Backfill in Pipe Trenches
- 2.1.4 Excavation for Structures
- 2.1.5 Backfill about Structures
- 2.1.6 Compacting Backfill about Structures
- 2.1.7 Compacting Earth Materials
- 2.1.8 Disposal of Excavated Materials

DIVISION 3 -- PIPE

Section 3.1-- PIPE

- 3.1.1 Pipe
- 3.1.2 Testing the Pipeline
- 3.1.3 Guarantee
- 3.1.4 Steel Pipe and Fittings

Section 3.2--MISCELLANEOUS METALWORK

DIVISION 4 -- CONCRETE

Section 4.1--CONCRETE

- 4.1.1 Concrete, general
- 4.1.2 Repair of Concrete
- 4.1.3 Reinforcement
- 4.1.4 Measurement and Payment

Section 4.2--MASONRY CONSTRUCTION

DIVISION 5 -- PIPE CULVERT

Section 5.1-- PIPE CULVERT

- 5.1.1 Pipe Culvert
- 5.1.2 Corrugated Metal Pipe

DIVISION 6 -- CARPENTRY

Section 6.1-- CARPENTRY

DIVISION 7 -- PAINTING AND COATING

Section 7.1 -- PAINTING AND COATING

7.1.1 Painting and Coating
7.1.2 Painting and Coating Tabulation

DIVISION 8 -- DRAWINGS

Section 8.1 -- DRAWINGS

8.1.1 Drawings, General
8.1.2 List of Drawings

DIVISION 2--EARTHWORK

SECTION 2.1--EARTHWORK

2.1.1 Classification of Excavation

a. General.--Materials excavated will not be classified for payment. Except as otherwise provided in these specifications, material excavated will not be measured and the cost of excavation of all materials required to be excavated shall be included in the prices bid in the schedule for various items of work. No additional allowance will be made on account of any of the material being wet or frozen. Bidders and the contractor must assume all responsibility for deductions and conclusions as to the nature of the materials to be excavated and the difficulties of making and maintaining the required excavations.

b. Clearing.--That portion of the pipeline right-of-way, where required for access to and for constructing the work under these specifications, shall be cleared of all brush, rubbish, and other objectional matter. Such cleared materials shall be destroyed, burned when permitted, disposed of by use of chippers, buried, or removed from the site of the work before the date of completion of the contract as provided in Paragraph 1.6.5 (Cleanup and Disposal of Waste Materials). If removal of the materials from the stie is approved, the materials shall become the property of the contractor upon removal and shall be disposed of by the contractor as he sees fit.

In lieu of burning combustible materials, the material may be reduced to chips of one-half inch maximum thickness. The chips shall be distributed uniformly on the ground surface between the slope lines and right-of-way lines as approved by the contracting officer. The chips shall be mixed with the underlying earth so that they will not support combustion.

c. Costs--The costs of clearing and of all work incident thereto shall be included in the unit prices bid in the schedule for excavation for pipe trench.

2.1. 2 Excavation for Pipe Trenches

a. General--Excavation for pipe trenches shall be to the lines, grades, and dimensions shown on the drawings. Typical trench sections are shown on Drawing No. 6821.22B-03. The bottom of the trench shall be finished to the lines and grades shown on the drawings or established by the contracting officer. The minimum trench width permitted is 24 inches.

If deemed necessary by the contracting officer, material for backfill and refill about pipe shall be selected during trench excavation and stockpiled. All costs thereof shall be included in the price bid in the schedule for excavation for pipe trenches.

b. Safety--All excavation over 5 feet in depth, unless in solid rock, hard shale, or cemented sand and gravels, shall be either shored, sheeted, braced, or sloped from the bottom of the trench. Shoring and sloping shall be in accordance with Section 1518.652, General Trenching Requirements, of the Bureau of Reclamation's publication, "Safety and Health Regulations for Construction," except that sloping shall be carried from the bottom of the trench unless soil-cement bedding is used. When soil-cement bedding is used, the required slope shall extend from the point in the excavation that is 8 inches above the bottom of the pipe. Should any question arise over the sloping or the installation of shoring for safety of personnel, the decision of the contracting officer shall be final. Payment for excavation shall be as set forth in Subparagraph d. below regardless of whether the trench is shored or sloped.

c. Foundation for pipe--The contractor shall place 6 inches of sand bedding under the pipe as shown on Drawing No. 6821.22B-03. The backfill below the pipe shall be placed and compacted as specified in Paragraph 2.1.7 (Compacting Earth Materials). Payment for placing and compacting sand bedding will be made at the unit prices bid in the schedule for backfill in pipe trenches and compacting backfill in pipe trenches.

Any and all excess excavation or overexcavation performed by the contractor for any purpose or reason except for additional excavation as may be prescribed by the contracting officer, and whether or not due to the fault of the contractor, shall be at the expense of the contractor. Fill and compacting of fill for such excess excavation or overexcavation shall be at the expense of the contractor.

d. Measurement and payment--Measurement for payment for excavation for pipe trenches will be made to pay lines shown on Drawing No. 6821.22B-03 and to trench lengths shown on the drawings.

Measurement, for payment, of excavation for pipe trenches will be continuous through bends, tees, and expansion pits.

Measurement, for payment, of excavation for concrete in the above installations that is outside the trench excavation pay lines will be made to lines and dimensions shown on the drawings or to the neatlines of the concrete.

Where excavation is performed in backfill placed under these specifications, no payment will be made for excavation, backfill, and compacting backfill occasioned thereby.

Payment for excavation for pipe trenches will be made at the unit price per cubic yard bid therefor in the schedule. The unit price bid in the schedule for excavation for pipe trenches shall include the cost of all labor and materials for sheeting, bracing, timbering, safety sloping, and other temporary construction, of all pumping and unwatering, of all work necessary to maintain the excavations in good order during construction, or removing such temporary construction where required, and disposal of unused or unsuitable excavated materials.

2.1.3 Backfill in Pipe Trenches

a. General--Backfill in pipe trenches shall be placed to the lines shown on the drawings. Backfill required to be compacted shall be placed as specified in Paragraph 2.1.7 (Compacting Earth Materials). The type of material used for backfill, the amount thereof, and the manner of depositing the material shall be subject to the approval of the contracting officer.

Insofar as practicable, backfill material shall be obtained from material moved in excavating for pipe trenches, but when sufficient, suitable material is not available from this source, additional material shall be obtained from approved borrow pits.

Backfill shall not be dropped directly on the pipe. Rocks and clods larger than 3 inches in maximum dimension shall not be placed within 6 inches of the pipe.

All backfill shall be carefully placed and spread in uniform layers so that all space about rocks and clods will be filled. Backfill shall be placed to about the same elevation on both sides of the pipe to prevent unequal loading and displacement of the pipe. The difference in elevation of the backfill on both sides of pipe shall not exceed 6 inches at any time. Backfill above compacted backfill may be placed as soon as compacting of backfill is completed. Provided, that the placing of this backfill shall be delayed at locations designated by the contracting officer for the procurement of samples of compacted backfill for testing. Provided further that if the tests indicated insufficient density of the compacted backfill about the pipe, the contractor may be required to remove the backfill above the compacted backfill, continue compacting the backfill until the proper density is obtained, and replace the backfill above the compacted backfill, all at the contractor's expense. Backfill shall be placed to a minimum depth of 24 inches above the top of the pipe before power-operated hauling or rolling equipment is used over the pipe.

b. Measurement and payment--Measurement, for payment of backfill in pipe trenches will be made in place to the excavation pay lines for pipe trenches, to lines and trench lengths shown on the drawings, and as specified in this paragraph: Provided that the volume of pipe will be deducted. Backfill material mounded or spread over the trench above the original ground surface will not be measured for payment as backfill in pipe trenches.

Payment for backfill in pipe trenches will be made at the unit price per cubic yard bid therefor in the schedule which unit price shall include the cost of all work connected therewith including the excavation and haul of the necessary material: Provided that material from required excavation used for backfill in pipe trenches will be paid for, both as excavation when removed from original position and as backfill when placed. Where additional material is obtained from approved borrow pits and used for backfill in pipe trenches, payment will be made for the backfill only, and the costs of excavating and hauling of such material shall be included in the unit price bid in the schedule for backfill in pipe trenches.

Backfill of excavation performed outside of the established pay lines for excavation for pipe trenches shall be placed in the same manner as specified for the adjacent backfill and shall be placed by and at the expense of the contractor.

2.1.4 Excavation for Structures

a. Measurement for payment--Excavation for structures will include excavation for expansion pits, drain pits, and anchor blocks and will be measured for payment to excavation pay lines shown on the drawings, or if not shown on the drawings to pay lines in accordance with the provisions of this paragraph. Regardless of quantities removed, measurement for payment will be made to the prescribed pay lines: Provided that for purposes of safety or other practicable reasons in connection with individual structures the Government reserves the right to require the contractor to excavate to the prescribed pay lines. No payment will be made for excavation or removal of material which is outside of the prescribed pay lines.

Measurement of excavation will be in accordance with the following:

(1) Measurement of excavation for structures will include all required excavation for the structure below the surface of the pipe bed and between vertical planes at the upstream and downstream ends of the structure. Measurement of excavation upstream

and downstream of the vertical planes and measurement between the vertical planes will be made to dimensions one foot outside of the foundations of the structures and to slopes of 1:1 to ground surface.

b. Foundations for structures--Excavation for the foundation of structures shall be to the elevations shown on the drawings or established by the contracting officer. The contractor shall prepare the foundations at structure sites by methods which will provide firm foundations for the structures. The bottom and side slopes of common excavation, upon or against which the structure is to be placed, shall be finished to the prescribed dimensions, and the surfaces to be prepared shall be moistened and tamped with suitable tools to form firm foundations upon or against which to place the structure.

Where unsuitable material is encountered in the foundation for a structure, the contracting officer will direct additional excavation to remove the unsuitable material. This additional excavation shall be made to provide a minimum clearance between the undisturbed foundation and the underside of the structure and the additional excavation shall be refilled with compacted backfill to provide a firm foundation for the structure. Measurement and payment for excavation, backfill, and compacting backfill will be made to depths and dimensions prescribed by the contracting officer.

If at any point in common excavation the foundation material is excavated beyond the lines required to receive the structure, the overexcavation shall be filled with suitable materials and compacted in accordance with Paragraph 2.1.7(Compacting Earth Materials). If at any point in common excavation, the natural foundation material is disturbed or loosened during the excavation process or otherwise, it shall be compacted in place or, where directed, it shall be removed and replaced with suitable material and compacted in accordance with Paragraph 2.1.7 (Compacting Earth Materials). Any and all excess excavation or overexcavation performed by the contractor for any purpose or reason except for additional excavation as may be prescribed by the contracting officer, and whether or not due to the fault of the contractor, shall be at the expense of the contractor. Fill and compacting of fill for such excess excavation or overexcavation shall be at the expense of the contractor.

81

c. Payment--Insofar as practicable, the material moved in excavation for structures shall be used for backfill and embankments, otherwise it shall be wasted as directed. Payment for excavation for structures will be made at the unit price per cubic yard bid therefor in the schedule. The unit price bid in the schedule for excavation for structures shall include the cost of all labor and materials for excavating for masonry boxes, concrete anchors, and concrete pipe support bases, and shall include the cost of disposal of the excess material.

2.1.5 Backfill about Structures

a. General--Backfill about structures shall be placed to the lines shown on the drawings, as prescribed in this paragraph, or as directed. The type of material used for backfill, the amount thereof, and the manner of depositing the material shall be subject to approval. Insofar as practicable, backfill material shall be obtained from material moved in excavating for structures, but when sufficient suitable material is not available from this source or from adjacent excavation, additional material shall be obtained from approved borrow pits. Except as otherwise provided in Paragraph 2.1.6 (Compacting Backfill about Structures), special compaction of the backfill will not be required.

b. Measurement and payment--Excavation refill required to be placed about structures that is within the pay line limits for excavation for the structure will be measured in place for payment as backfill about structures. In addition, material placed within the structure excavation pay lines extended to their intersection with the finished surface of earth lining will be measured and paid for as backfill.

Measurement, for payment, of backfill about structures will be made only for the quantities actually placed within the limits of the established pay lines.

Payment for backfill about structures will be made at the unit price per cubic yard bid therefor in the schedule, which unit price shall include the cost of all work connected therewith, including the excavation and haul of the necessary material: Provided that material from required excavation used

for backfill about structures will be paid for both as excavation when removed from original position and as backfill when placed. Where additional material is obtained from approved borrow pits and used for backfill about structures, payment will be made for the backfill only, and the costs of excavating and hauling of such material shall be included in the unit price bid in the schedule for backfill about structures.

2.1.6 Compacting Backfill about Structures

a. General--Unless otherwise shown on the drawings, backfill about structures shall be compacted as prescribed in this paragraph or as directed.

To provide adequate protection for compacted backfill about a structure, the Government reserves the right to direct the contractor to place a sufficient amount of backfill or embankment material over the compacted backfill within 72 hours after compacting of the backfill has been completed.

The 1:1 slopes specified below shall extend from the top of the masonry walls to their intersection with the surfaces of the excavation or embankment as the case may be.

b. Location of compacted backfill--

(1) Backfill about the expansion pits and concrete anchors shall be compacted to slopes of 1:1 from the top of the concrete walls or from the ground-surface elevation where directed by the contracting officer.

c. Material and compacting--The material used for backfill to be compacted shall be selected material, containing no stones larger than 3 inches in diameter, approved by the contracting officer, and obtained from required excavation or approved borrow pits. To prevent unequal loading and displacement of structures, the backfill shall be placed and compacted in layers having essentially the same top elevation on each side of the structures. All materials in backfill to be compacted shall be placed, moistened, and compacted as provided in Paragraph 2.1.7 (Compacting Earth Materials).

d. Measurement and payment--Measurement for payment for compacting backfill about structures will be made in place to the lines shown on the drawings, as prescribed in this paragraph, or as directed by the contracting officer and will be made only for the quantities actually compacted within the limits of the established pay lines for backfill about structures, and the compacting of refill outside of excavation pay lines shall be performed at the expense of the contractor. Payment for compacting backfill about structures will be made at the unit price per cubic yard bid therefor in the schedule and will be in addition to the payment made for backfill about structures. The unit price bid in the schedule for compacting backfill about structures shall include the costs of furnishing water and moistening the materials.

2.1.7 Compacting Earth Materials

a. General--Where compacting of earth materials is required, the materials shall be deposited in horizontal layers and compacted as specified in this paragraph. The excavation, placing, moistening, and compacting operations shall be such that the material will be uniformly compacted throughout the required section and will be homogeneous, free from lenses, pockets, streaks, laminations, or other imperfections.

b. Compacting clayey and silty materials--Where compaction of earth materials containing appreciable amounts of clay or silt is required, the materials shall be deposited in horizontal layers. The thickness of each horizontal layer after compaction shall be not more than 6 inches. The excavation and placing operations shall be such that the materials when compacted will be blended sufficiently to secure the highest practicable unit weight and best impermeability and stability.

Prior to and during compacting operations, the materials shall have a moisture content of not greater than 2 percent wet or less than 2 percent dry of optimum moisture, as determined by the contracting officer and the moisture content shall be uniform throughout each layer.

Insofar as practicable, as determined by the contracting officer, moistening of the material shall be performed at the site of excavation but such moistening shall be supplemented by sprinkling at the site of compaction, if necessary. If the moisture content is less than optimum for compaction by more than 2 percentage points or is greater than optimum for compaction by more than 2 percentage points, the compaction operations shall not proceed, except with the specific approval of the contracting officer, until the material has been wetted or allowed to dry out, as may be required, to obtain optimum moisture content within the tolerances permitted above, and no adjustment in price will be made on account of any operations of the contractor in wetting or drying the materials or on account of any delays occasioned thereby.

When the material has been conditioned as hereinbefore specified, it shall be compacted by rollers or by hand or power tampers. Where hand or power tampers are used to compact soils in confined areas such as under pipe, they shall be equipped with suitably shaped heads to obtain the required density.

The density (dry) of the soil fraction in the compacted material shall not be less than 95 percent of the laboratory standard maximum soil density (dry) as determined by the Bureau of Reclamation Proctor Compaction Tests for the materials being compacted.

(1) Compaction test--The compaction tests will be made by the Government. The standard maximum soil density is the dry weight per cubic foot of the soil compacted at optimum moisture content of laboratory procedure. The compaction test is the same as ASTM designation: D 698, Method A, except that a 1/20-cubic-foot compaction mold is used and the rammer is dropped from a height of 18 inches, resulting in the same energy of compaction per unit volume.

c. Compacting cohesionless materials--

(1) Compacting cohesionless free-draining materials--Where compaction of cohesionless free-draining materials, such as sands and

gravels, is required, the materials shall be deposited in horizontal layers and compacted to the relative density specified below. The excavating and placing operations shall be such that the materials, when compacted, will be blended sufficiently to secure the highest practicable unit weight and best stability. Water shall be added to the materials as may be required to obtain the specified density by method of compaction being used.

The thickness of the horizontal layers after compaction shall not be more than 6 inches if compaction is performed by tampers or rollers; not more than 12 inches if compaction is performed by treads of crawler-type tractors, surface vibrators, or similar equipment; and not more than the penetrating depth of the vibrators if compaction is performed by internal vibrators.

The relative density of the compacted materials shall be not less than 70 percent as determined by the standard Bureau of Reclamation relative density tests for cohesionless free-draining soils.

(a) Relative density test--The relative density tests will be made by the Government. The relative density of a cohesionless free-draining soil, expressed as a percentage, is defined as its state of compactness with respect to the loosest and most compact states at which it can be placed by laboratory procedures. The relative density will be based on the following formula, wherein the maximum density is the highest unit weight of the soil, minimum density is the lowest unit weight of the soil, and in-place density is the unit weight of the soil in place. Tests for moisture content are made on the materials and unit weights are expressed in terms of ovendry weights.

$$\text{Rel. Den. } (\%) = \frac{\text{max.den. x (in-place den. - min.den.)}}{\text{in-place den. x (max.den. - min.den.)}} \times 100$$

(2) Compacting cohesionless materials containing some clay and silt--Cohesionless materials containing clay and silt may not be free-draining. When compaction of cohesionless materials containing sufficient clay and silt as to impede free drainage is required, the material shall be placed and compacted in accordance with the provisions of c(1) above. These materials shall be compacted to a dry density in accordance with either of the following control tests whichever shows the higher dry unit weight.

(a) Ninety-five percent of the laboratory standard maximum soil density (dry) as determined by the Bureau of Reclamation Proctor Compaction Test as prescribed in b(1) above, or,

(b) The dry density of the material at 70 percent relative density as determined by the relative density test as prescribed in c(1) above.

d. Costs--The costs of compacting earth materials as described in this paragraph shall be included in the prices bid in the schedule for other items of work.

2.1.8 Disposal of Excavated Materials

All suitable material from required excavations, or as much thereof as may be needed, as determined by the contracting officer, shall be used for backfill about structures, in pipe trench backfill, or for other required earthwork, as directed by the contracting officer. Material removed in excavation and not suitable for backfill or other required earthwork shall be wasted on right-of-way owned by the Government at such points as may be approved by the contracting officer. Unless otherwise directed, no material shall be wasted in drainage channels. Waste banks shall be left with reasonably even and regular surfaces as approved by the contracting officer. The cost of all work described in this paragraph shall be included in the respective unit prices bid in the schedule for excavation for pipe trench, and excavation for structures.

DIVISION 3 -- PIPE

Section 3.1 -- PIPE

3.1.1 Pipe

a. General--The contractor shall furnish pipe and construct the pipeline as shown on the drawings and as specified in these specifications. The types of pipe permitted under these specifications are designated in Subparagraph b hereof and shown on the drawings.

During manufacturing, transporting, storing, and laying pipe and pipe fittings, the pipe and pipe fittings shall not be dropped or subjected to any unnecessary impact or other treatment that could damage the pipe.

Pipe shall not be stored in the yard or on the jobsite under conditions which would cause injury. Any length of pipe that, in the opinion of the contracting officer, is damaged beyond repair by the contractor by hauling, handling, unloading, storing, or otherwise, shall be removed from the work-site and replaced by and at the expense of the contractor with another length of pipe or equal or greater strength.

b. Pipe--The contractor shall furnish and install steel pipe as specified in Paragraph 3.1.4 (Steel Pipe and Fittings).

Gaskets furnished with flanged fittings shall be suitable to withstand temperatures of 500°F.

c. Measurement and payment for pipe--Measurement for payment for furnishing and installing the pipeline will be made along the centerline of the pipe between ends of the pipe in place and will be continuous through bends and other fittings with no allowance for lap at joints.

Payment for furnishing and installing the 8-inch Schedule 20 steel pipe will be made at the unit price per linear foot bid therefor in the schedule, which unit price shall include the cost of furnishing all materials, manufacturing, transportation, laying the pipe, and furnishing maintenance warranty of the pipe: Provided, That concrete in pipe anchors, pipe supports, expansion pits, and drain pits will be paid for as provided in Paragraph 4.1 (Concrete) and masonry in expansion pits and drain pits will be paid for as provided in Paragraph 4.2 (Masonry Construction).

88

3.1.2 Testing the Pipeline

a. Pressure test--After the pipeline has been laid, the joints completed, and the trenches partially backfilled, the contractor shall subject the pipe to a hydrostatic pressure of 350 lb/in^2 for a period of not less than one hour. No leakage will be allowed and any and all leaks shall promptly be made watertight.

The contractor shall furnish all pumping equipment, labor, tools, pressure gages, and other equipment, and water required for making the tests.

All exposed piping, fittings, and joints shall be carefully examined during the test. Any cracked or defective piping or fittings discovered during the pressure test shall be removed and replaced by the contractor with sound material and the test repeated as required, all at the expense of the contractor.

All testing shall be done in the presence of a duly authorized representative of the contracting officer.

b. Cost--The entire cost of testing the pipeline and of furnishing all equipment, labor, and materials for making the tests shall be included in the price bid in the schedule for furnishing and installing 8-inch Schedule 20 steel pipe.

3.1.3. Guarantee

The contractor shall furnish a guarantee against leakage of the pipeline for a period of one year from date of acceptance. Any leaks shall be corrected by the contractor, on notice from the contracting officer and at no cost to the Government. Any repairs to the pipeline shall be made in an acceptable manner as approved by the contracting officer.

In lieu of such warranty the contractor may hydrostatically test the pipeline at 150 percent of the specified test pressure of the pipeline at the lowest point in the line. Any visible leaks shall be repaired. The installation will be considered acceptable when the specified test pressure has been maintained without loss for a period of not less than two hours and no leaks

are observed during that period of time or such time as necessary for completing inspection of all joints along the pipeline.

3.1.4 Steel Pipe and Fittings

a. General--The contractor shall furnish and install the steel piping and fittings for the pipeline complete with accessories in accordance with the requirements of these specifications and as shown on the drawings.

b. Materials--Materials shall be in accordance with the following requirements:

(1) 8-inch steel pipe--ASTM A53, Schedule 20, Grade A, seamless, black. Piping 2 inches in size and smaller shall be ASTM A120 galvanized Schedule 40 threaded ends.

(2) Flange gaskets--Flat, asbestos, metallic reinforced.

(3) Bolts and nuts--Bolts - FF-B-575C, Grade II, Type II, or stud bolts; Nuts - FF-N-836D, Type II (Hexagon),Style 4, VNC coarse thread series.

(4) Steel welding flanges--ASTM Designation A181, slip-on type, Grade I, 300# Class, raised face.

(5) Steel fittings--ASTM Designation A234, Schedule 20, long radius welding type, except where designated on the drawings.

(6) Malleable iron fillings--300# Class galvanized.

(7) Flexible ball joints--Flexible ball joints shall be equal to BARCO, Type N, Style 7WEN-8WEN, 8-inch-diameter, schedule 20, weld end, carbon steel, with asbestos gaskets (Code 11N) as furnished by Aeroquip Corporation/BARCO Division, Barrington, Illinois 60010. Ball joints shall be certified as having passed environmental shock testing in accordance with test Specifications MIL-S-4456 or MIL-S-901C.

(8) Drain valve--The 2-inch gate valve required under these specifications shall be 300-pound Bronze Gate Valve, wedge disc, nonrising stem, threaded for standard 2-inch steel pipe, equal to No. 624E, as furnished by the Crane Company, 836 South Michigan Avenue, Chicago, Illinois.

(9) Air valve--The 1-inch air relief gate valves shall conform to Federal Specification No. WW-V-54D, Type 1, Class C, Style 2.

(10) Isolation valve--The 8-inch gate valve shall be CS body, 50% exelloy and 50% stellite trim, OS&Y bolted bonnet, ASA 300 RF FLGD, Crane Model 33, or approved equal.

(11) Insulation--Insulation for the above ground steel pipe, fittings, valves, and appurtenances, shall be equal to Johns-Manville "Metal-ON" aluminum-jacketed, calcium silicate insulation in 2-inch thickness for all 8-inch piping and 1-inch thick for drain and vents, pipings, and fittings, as furnished by Johns-Manville, 22 East 40th Street, New York, New York, 10016, and shall comply with the requirements of Federal Specification HH-I-523c, Type II, Class C. Insulation shall be installed in accordance with the manufacturer's recommendations.

(12) Miscellaneous materials--Where materials are required but are not specified herein, the contractor shall furnish standard commercial quality material suitable for the intended use.

(13) Adjustable pipe rollers--Grinnel No. 177

c. Fabrication--The steel pipe shall be fabricated in accordance with these specifications, the drawings and the requirements of the American Water Works Association Standard C-200. Where provisions of the AWWA Standards conflict with provisions of these specifications and/or drawings, the provisions of these specifications and/or drawings shall govern. The requirements of Sections 5.1 to 5.4, inclusive, of the AWWA Standard C-200 are not a part of these specifications.

d. Installation--The steel pipe and fittings shall be assembled and erected in place as shown on the drawings. The contractor shall furnish and install such temporary supports and bracing as may be required to hold the pipe in place and prevent distortion during placing of backfill; however, the embedment of timber supports or the welding of temporary supports to the pipe shell will not be permitted. Flexible ball joints shall be installed in accordance with the manufacturer's instructions.

91

e. Measurement and payment--Measurement for payment and payment for furnishing and installing 8-inch, Schedule 20, steel pipe, elbows, flanges, and other fittings will be made as provided in Subparagraph 3.1.1.c. (Measurement and payment for pipe).

Payment for furnishing and installing 8-inch flexible ball joints will be made at the respective unit price per each bid therefor in the bidding schedule, which unit price shall include the cost of all labor, transportation, material, and incidental costs associated therewith.

Measurement, for payment, for furnishing and installing the pipe insulation will be made along the centerline of the pipe between ends of the pipe in place and will be continuous through bends and other fittings with no allowance for lap at joints.

Payment for furnishing and installing pipe insulation will be made at the unit price per linear foot bid therefore in the schedule, which unit price shall include the cost of furnishing all materials, transportation, labor, and incidental costs associated therewith.

Payment for furnishing and installing the 2-inch drain valve, 8-inch gate valve, and 1-inch air valves will be made at the respective unit price per each bid in the schedule therefore, which unit price shall include the cost of all labor, material, and incidental costs associated therewith.

Section 3.2 -- MISCELLANEOUS METALWORK

a. General--The contractor shall furnish and install the pipe supports and pipe anchor chairs as shown on the drawings as miscellaneous metalwork.

b. Materials--Materials shall conform to the following requirements:

(1) Structural steel--Structural shapes, plates, and bars shall conform to Federal Specification QQ-S-741D, ASTM Designation: A36.

(2) Steel Pipe--ASTM Designation: A120, seamless black steel.

(3) Bolts and nuts--Bolts shall conform to Federal Specifications FF-B-575C, Type I or II; Nuts - FF-N-836D, Type I or II, Style 1 or 4.

(4) Pipe supports and pipe anchor chairs shall be fabricated as shown on drawings.

(5) Materials for miscellaneous metalwork not specifically covered herein by detailed specifications shall be of good commercial quality approved by the contracting officer.

c. Fabrication--Metalwork shall be fabricated in accordance with the drawings and with the applicable provisions of the "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction.

d. Zinc coating galvanizing--Zinc coating (galvanizing) shall conform to ASTM Designations: A123 and A153.

e. Welding--Welding shall conform with the requirements of the American Welding Society Code AWS D1.0.

f. Installation--The metalwork to be embedded in concrete shall be supported firmly and accurately in position while the concrete is being placed.

g. Payment--Payment for furnishing and installing miscellaneous metalwork will be made at the lump sum price bid therefor in the schedule. The cost of furnishing and installing other metalwork for which specific unit prices are not provided in the schedule shall be included in the unit prices bid in the schedule for the work in which the metalwork is required.

DIVISION 4 -- CONCRETE

Section 4.1 -- CONCRETE

4.1.1 Concrete, General

The contractor shall furnish all materials for use in concrete. The concrete shall be composed of cement, sand, coarse aggregate, air-entraining agent, and water, all mixed well and brought to the proper consistency.

Air-entraining agent and sealing compound will be accepted on manufacturer's certification of compliance with specifications requirements: Provided that the Government reserves the right to require submission of and to perform tests on samples of the agent and/or compound prior to shipment and use in the work.

Cement shall meet the requirements of Federal Specification SS-C-1960/3 for Type V, low alkali, and shall meet the false-set limitation specified therein. The cement shall be free from lumps when used in concrete.

Sand and coarse aggregate shall be furnished from any approved source. The sand particles shall be clean, hard, dense, durable, uncoated rock grag-ments that will pass a screen having 3/16- or 1/4-inch square oppenings and shall be well graded from fine to coarse and shall be free from injurious amounts of dirt, organic matter, or other deleterious substances. Coarse aggregate shall consist of clean, hard, dense, durable, uncoated rock fragments and shall be free of injurious amounts of thin pieces, organic matter, or other deleterious substances, shall be reasonable well graded from 3/16 or 1/4 of an inch to 1 and 1/2 inches, and shall be separated into two sizes by an intermediate screen having 3/4-inch square openings. Screens having openings of other sizes and shapes may be used if equivalent results, as determined by the contracting officer, are obtained.

The Government reserves the right to test the sand and coarse aggregate and if required, the contractor shall submit, for preliminary tests and approval, representative samples of the sand and coarse aggregate pro-posed for use in the concrete work.

The air-entraining agent shall conform to ASTM Designation: C 260, except that the limitation and test in bleeding by concrete containing the agent and time of setting requirement shall not apply. Air-entraining agent shall be used in such amount as will effect the entrainment of 4 to 6 percent of air, by volume, of the concrete as discharged from the mixer

The use of calcium chloride in concrete will not be permitted.

Water used in concrete shall be free from objectionable quantities of silt, organic matter, alkalies, salts, or other impurities.

Reinforcing bars shall conform to Federal Specification QQ-S-632C, Type II, Class B60.

Sealing compound, if used for concrete, shall be white-pigmented compound conforming to Bureau of Reclamation "Specifications for Sealing Compound for Curing Concrete", dated June 1, 1961.

Sand and coarse aggregate shall be mixed in proportions as directed by the contracting officer. One and one-half-inch-maximum-size coarse aggregate shall be used where practicable from the standpoint of satisfactory placing and consolidation of the concrete. Concrete which contains 1 and 1/2-inch-maximum-size aggregate shall have a cement content of not less than 517 pounds per cubic yard, and concrete which contains 3/4-inch-maximum-size aggregate shall have a cement content of not less than 611 pounds per cubic yard. The net water-cement ratio of the concrete (exclusive of water absorbed by the aggregates) shall not exceed 0.47 by weight. The concrete shall develop a minimum compressive strength of 3,000 lb/in^2 at 28 days as determined by standard specimens. The compressive strength of the concrete will be determined by the Government through the medium of tests of 6- by 12-inch cylinders made and tested in accordance with Designations 29 to 33, inclusive, of the Eighth Edition of the Bureau of Reclamation Concrete Manual.

The contractor shall protect all concrete against injury until final acceptance by the Government. The concrete shall be maintained at a temperature not lower than 50°F for at least 72 hours after it is placed and shall be protected against freezing temperatures for 72 hours immediately following the 72 hours of protection at 50°F. Where artificial heat is employed, special care shall be taken to keep the concrete from drying.

The concrete shall be cured by water or membrane curing. If water cured, the concrete shall be kept continuously moist for at least 14 days after being placed by sprinkling or spraying or by other methods approved by the contracting officer. Membrane curing, if used, shall be by application of sealing compound in accordance with the procedures contained in the Eighth Edition of the Bureau of Reclamation Concrete Manual.

4.1.2 Repair of Concrete

Any concrete that is damaged or defective from any cuase; concrete that is honeycombed, fractured, or otherwise defective; and concrete which, because of excessive surface depressions, must be excavated and built up to bring the surfaces to the prescribed lines; shall be removed and replaced; and any imperfections and irregularities on concrete surfaces shall be corrected.

The removal and replacement of damaged or defective concrete, and the correction of surface imperfections and irregularites shall be made with concrete, dry pack, or mortar (portland cement mortar); or, at the option of the contractor, with epocy-bonded concrete, or epoxy-bonded epoxy mortar; where and as applicable for the type of repair involved, in accordance with Bureau of Reclamation "Standard Specifications for Repair of Concrete" dated November 15, 1970. The cost of all materials, labor, and equipment required in the repair of concrete and the correction of surface imperfections and irregularities shall be borne by the contractor.

4.1.3 Reinforcement

Steel reinforcing bars shall be placed in the concrete where shown on the drawings. Before reinforcement is placed, the surfaces shall be cleaned of heavy flaky rust, loose mill scale, dirt, grease, or other foreign substances. Reinforcement shall be accurately placed and secured in position so that it will not be displaced during the placing of the concrete. Welding or tack-welding of Grade 60 reinforcing bars will not be permitted except at locations shown on the drawings.

Unless otherwise shown on the drawings, the reinforcement shall be placed so that there will be a clear distance of at least 1 inch between the reinforcement any any anchor bolts, form ties, or other embedded metalwork.

The Government will not furnish supplemental bar-placing diagrams, bar lists, and bar-bending diagrams. Any such additional diagrams and bar lists of

this type which the contractor may require to facilitate the fabrication and placement of reinforcement shall be provided by the contractor. The cost of preparing such additional diagrams and bar lists, if provided, shall be included in the lump sum price bid in the schedule for furnishing and placing reinforcement. Reinforcement will be inspected for compliance with requirements as to size, shape, length, splicing, position, and amount after it has been placed.

Any bar-placing diagrams, bar lists, and bar-bending diagrams prepared by the contractor shall conform to the requirements shown on Drawing 40-D-6123 unless otherwise shown on the reinforcement design drawings.

4.1.4 Measurement and Payment

Measurement, for payment, of reinforcement will be made only of the weight of the reinforcement placed in the concrete, in accordance with the drawings or as directed. Payment for furnishing and placing reinforcement will be made at the unit price per pound bid therefor in the schedule, which unit price shall include the cost of furnishing and attaching wire ties and metal or other approved supports, if used, and of cutting, bending, cleaning, and securing and maintaining in position all reinforcement as shown on the drawings or as directed.

Cement will be paid for on the basis of the cwt (hundredweight) of cement used in the work covered by these specifications. One bag of cement shall be considered as 0.94 cwt of cement. Measurement, for payment, of cement will be on the basis of the number of bags of cement used at the mixer, except that no payment will be made for cement used in wasted concrete, cement used in damaged or defective concrete, or cement used in concrete required as a result of carefless excavation, or excavation intentionally performed by the contractor to facilitate his operations, as determined by the contracting officer. Payment for furnishing and handling cement will be made at the unit price per cwt bid therefor in the schedule.

Measurement, for payment, of furnishing and placing concrete will be on the basis of cubic yards of concrete having the dimensions shown on the drawings or prescribed by the contracting officer. Payment for furnishing and placing concrete will be made at the unit price per cubic yard bid in the schedule therefor, which unit price shall include the cost of all labor and materials except that payment for furnishing and handling cement, and payment for furnishing and placing reinforcement will be made at the respective unit price bid therefor in the schedule.

97

Section 4.2 -- MASONRY CONSTRUCTION

a. General--Concrete masonry unit walls for the expansion pits and drain pits and other materials as required to complete the concrete masonry unit walls. The concrete masonry walls shall be constructed as shown on the drawings.

The hollow concrete masonry units for the 8-inch thick walls shall be modular-size units having a nominal width, height, and length of 8, 8 and 16 inches. The hollow concrete masonry units for the 6-inch thick walls shall be modular-size units having a nominal width, height, and length of 6, 8 and 16 inches.

The contractor shall furnish all concrete masonry units, materials for mortar and grout, CMP sleeves, and all other related materials required for the masonry construction.

b. Materials --

(1) Concrete masonry units--Except for the requirements hereinafter provided, concrete masonry units shall be in accordance with the following ASTM Designations:

(a) Hollow-load bearing concrete masonry units--Type I, Grade U-I, ASTM Designation: C90

(b) Hollow non-load-bearing concrete masonry units--Type I, ASTM Designation: C129.

Cement for the concrete masonry units shall be Type I or II, low alkali portland cement conforming to SS-C-1960/3. Only units made from sand, gravel, crushed rock, burned clay or shale, volcanic scoria, or approved slag aggregate will be acceptable.

All concrete masonry units shall be autoclave or steam cured, the curing to be followed by air drying. The water absorption and moisture content physical requirements of ASTM Designations: C90 and C129 shall not apply to concrete masonry units to be furnished under these specifications. In lieu of the water-absorption and moisture-content tests of these designations, the relative humidity of the units shall be determined in accordance with ASTM Designation: C427. The average relative humidity of five selected specimens from concrete masonry units proposed for use in the work shall not exceed 50 percent or by more than 5 percent the average

annual relative humidity at the project site as established at the nearest U.S. Weather Bureau Station, whichever is greater. The Government will obtain samples of the concrete masonry units at the time of delivery to the project site, and will test the samples to determine moisture conditions. If the concrete masonry units, when tested, do not meet the relative humidity limitation, they shall not be used in the work until such time as subsequent tests on five newly selected samples show that the relative humidity limitation has been met. On arrival at the project site, the contractor shall take suitable precautions, such as storing the units under adequate cover and on suitable dunnage to prevent exposure to moisture. Any delays in construction caused by failure of the concrete masonry units to meet the specified moisture conditions shall be the responsibility of the contractor.

(2) Water--Water for use in mixing mortar and grout shall be reasonably clean and free from objectionable quantities of silt, organic matter, alkali, salts, and other impurities.

(3) Sand for mortar and grout--Sand for mortar and grout shall be in accordance with ASTM Designation: C144.

(4) Portland cement for mortar and grout--Portland cement for mortar and grout shall be in accordance with Paragraph 4.1 (Concrete).

(5) Masonry cement for mortar--SS-C-1960/1.

(6) Reinforcing bars--Reinforcing bars shall be specified in Paragraph 4.1 (Concrete).

c. Mortar, grout, and joints--

(1) Mortar--All masonry units shall be laid with full mortar bedding. In vertical joints between hollow masonry units having open ends, the mortar shall be applied to the face shells of the units only.

The mortar shall by Type S mortar in accordance with ASTM Designation: C270, except that portland cement, masonry cement, quicklime, and hydrated lime shall conform to the specifications listed above; that mortar shall not be used subsequent to 1 hour after addition of the cement; that mortar shall not be retempered; and that calcium chloride shall not be used in the mortar.

Mixing water may be heated, if necessary, for the purpose of increasing the temperature of the mortar during cold weather: Provided, That mixing water shall not be heated above 160°F.

(2) Grout--Grout for masonry construction shall be cement grout mixing in the following proportions:

Parts, by volume of portland cement	Parts, by volume of sand measured in a damp, loose condition	Parts by volume of coarse aggregate measured in a damp, loose condition
1	2 and 1/2	1 and 1/2

Sufficient water shall be added to produce a consistency for pouring without segregation of the constitutents of the grout. Mixing shall be continued until all aggregate streaks are eliminated and the mass reaches a uniform color.

(3) Joints--The mortar in horizontal and vertical joints for concrete masonry unit construction shall be three-eights of an inch thick. All exposed joints in masonry construction shall be tooled concave joints having uniform appearance and sharp, clean lines. Joints shall be tooled in such a manner as to squeeze the mortar back into the joints. Tooling of joints shall be done before the mortar has taken its initial set.

Any patching of the mortar joints or filling of holes left by nails or line pins should be done with fresh mortar. Particular care shall be taken to prevent smearing mortar onto the surface of the cement masonry units.

d. Laying concrete masonry units--Before starting to lay the concrete masonry units, the concrete foundation upon which the concrete masonry units will be laid shall be clean and rough. Cleaning shall consist of removal of all laitance, loose or defective concrete, sand, and other foreign material.

Before being laid, concrete masonry units shall be dried in accordance with Subparagraph b.(1) and shall not be rewetted.

Concrete masonry units shall be clean before being laid, and shall be laid in running bond courses. All concrete masonry units shall be laid true to the required lines, walls shall be kept plumb, horizontal joints and courses shall be kept level, vertical joints shall be kept plumb, and all joints shall be as uniform as practicable.

Vertical reinforcing bars shall be placed in the cells of the concrete masonry walls where shown or called for on the drawing. The cells in which vertical reinforcing bars are placed shall be filled with grout. In filling the vertical cells, the grout pour shall not exceed 4 feet. The grout shall be rodded or puddled during placement to insure complete filling of the cells. When grouting in any cell will be stopped for more than an hour, the grout pour shall be stopped 1 and 1/2 inches below the top of the cell being filled. Reinforcing bars shall project above the courses sufficiently to permit lapping of reinforcing bars a minimum of 30 bar diameters. The reinforcing bars shall have contact splices.

No concrete masonry units shall be laid during freezing weather unless adequate protection, as approved by the contracting officer, is provided.

Where cutting is necessary, concrete masonry units shall be either cut with a masonry saw or the units to be cut shall be scored on both sides with a brick hammer and chisel. All blocks to be cut shall be cut dry so as not to increase the moisture content of the blocks.

Care shall be taken during construction to keep the wall surfaces clean. Any mortar droppings that stick to the exposed faces of the concrete masonry unit walls shall be allowed to dry and then removed with a trowel. The remaining mortar shall then be removed by rubbing with a piece of a concrete masonry unit. The rubbed spots shall then be brushed with a stiff fiber brush.

101

Payment for masonry construction in the various parts of the work shall be made at the unit price per hundred masonry units which price shall include the cost of all labor and materials required in the construction, including grout; and excepting the payment for furnishing and installing reinforcing steel, will be made at the applicable unit prices bid therefor in the schedule.

DIVISION 5 -- PIPE CULVERT

Section 5.1 -- PIPE CULVERT

5.1.1 Pipe Culvert

a. General--A pipe culvert of corrugated metal pipe shall be constructed where shown on the drawings. All pipe and materials for the culvert shall be furnished by the contractor.

b. Excavation and bedding--The trench in which pipe is to be laid shall be excavated carefully to the established lines and grades to provide a firm and uniform bearing for the entire length of the pipe. Where the character of the material at any point in the bottom of a trench is such as might cause unequal settlement or provide unequal bearing for the pipe, the unsuitable material shall be removed to such depth as may be directed and the additional excavation shall be backfilled with approved material which shall be compacted as provided in Paragraph 2.1.7.

c. Backfilling--As each unit of pipe is laid, sufficient backfill material shall be tamped under and about the pipe to hold it rigidly in place until the joints are completed. After the joints have been completed, the backfilling shall be completed and compacted as provided in Paragraph 2.1.8 (Compacting Earth Materials). The contractor will not be allowed to route construction equipment over a culvert until subgrade material has been placed to a minimum depth of two feet over the top of the pipe.

5.1.2 Corrugated Metal Pipe

a. Furnishing pipe--The contractor shall furnish and lay the corrugated metal pipe culvert at the location shown on the drawings. Galvanized corrugated iron or steel pipe and connecting bands for culverts shall be in accordance with Federal Specification WW-P-405B, Class I, Shape 1. Galvanized sheet for fabricating Class I pipe and coupling bands shall be 16-gauge in accordance with ASTM Designation: A444.

The pipe shall be hauled and handled in such a manner as to avoid damaging the coating. Where field cutting is performed or where the galvanized coating is damaged, the coating shall be repaired by application of two coats of Galvanox as manufactured by Subox, Incorporated, Hackensack, New Jersey, or equal. Any pipe unit that, in the opinion of the contracting officer, is damaged beyond repair by the contractor in hauling, handling, or otherwise, shall be removed from the site of the work and replaced at no cost to the Government.

b. Laying pipe--The pipe shall be laid to the established lines and grades with the separate sections jointed firmly together by means of connecting bands furnished for that purpose and with the outside laps of circumferential joints pointing upgrade, and with the longitudinal joints at the sides.

c. Temporary bulkheads--The contractor shall furnish and install temporary bulkheads at each end of the corrugated metal pipe culvert. Material for bulkheads shall be 1/2-inch minimum plywood of good commercial quality approved by the contracting officer.

No direct payment will be made to the contractor for furnishing and installing the bulkheads and the cost thereof shall be included in the respective unit prices per linear foot bid in the schedule for furnishing and laying corrugated metal pipe.

d. Measurement and payment--Measurement, for payment, for furnishing and laying corrugated metal pipe will be made along the centerline of the pipe, from end to end of the pipe in place, and no allowance will be made for lap at joints. Payment for furnishing and laying corrugated metal pipe will be made at the respective unit prices per linear foot bid therefor in the schedule, which unit prices shall include the cost of excavating and back-filling the trenches, preparing a suitable and even bedding, attaching connecting bands, and for furnishing and installing of temporary bulkheads.

DIVISION 6 -- CARPENTRY

Section 6.1 -- CARPENTRY

a. General--The contractor shall furnish and install the expansion pit and drain pit covers and pipeline marker posts as shown on Drawing Numbers 6821.22B-03, 6821.22B-04, and 6821.22B-06.

b. Materials--Materials shall conform to the following requirements:

(1) All lumber shall be pressure treated Douglass Fir, Wolmanized or equal, or Construction Heart Redwood. Cut faces and bored holes shall be thoroughly brush coated with preservatives.

(2) Rough hardware shall be provided where required consisting of nails, screws, lag screws, and like items for the entire work. The Contractor shall install all bolts, washers, anchors, angles, straps, and like items required in connection with the rough carpentry work. Miscellaneous metal work will be furnished under another section of these specifications. The carpenter shall install such items as are required to support or anchor wood framing and shall provide all blocking and framing necessary for the attachment of all iron work in conformity with detail drawings.

(3) Materials for carpentry not specifically covered herein by detailed specifications shall be of good commercial quality approved by the contracting officer.

c. Fabrication--All rough carpentry work shall be executed as indicated on the drawings or specified and in accordance with the best practice methods. Sizes and spacing of all members shall be as noted on the drawings, accurately cut, closely fitted, set to required lines and level and rigidly secured in place.

All nails used in structural wood framing shall be common wire nails; 16 d or 20d nails for framing 2" thick material, and 8d nails for framing 1" thick material sized as indicated on the drawings. Where nailing has tendency to split the wood, holes of slightly smaller diameter than the nails to be used shall be drilled for nails. All nailing shall conform to the governing codes.

Wood screws of 16 gauge or larger shall have predrilled holes. All screws shall be screwed, not driven, into place. All bolts, lags and wood screws shall be turned up tight at time of installation and tightened again at completion of the work.

d. Payment--Payment for furnishing and installing pit covers and marker posts, shown on the drawings and herein specified will be made at the unit prices bid therefore in the schedule.

DIVISION 7 -- PAINTING AND COATING

SECTION 7.1--PAINTING AND COATING

a. General--The contractor shall furnish all materials, clean surfaces, and apply the paint and protective coatings listed in Paragraph 7.1.2 (Painting Tabulation).

Items or surfaces not required to be painted or coated but which are adjacent to surfaces to be cleaned and painted shall be protected against contamination and damage during the cleaning and painting operations. The cleaning and painting operations shall be so conducted that dust or other contamination from the cleaning process will not fall on wet, newly painted surfaces, and newly painted metalwork shall not be moved until the paint is dry hard. All contractor-applied coatings exposed to view, including any touchup repair painting, shall present a uniform color-matched appearance. Any items or surfaces damaged or contaminated by painting operations shall be returned to their original condition by and at the expense of the contractor. Before topcoating any coated surfaces, the contractor shall reclean any exposed metal and apply paint as necessary to restore to the specified condition all previously applied paint in areas which are defective or damaged. Materials which have been painted shall be handled with care and protected as necessary to preserve the coating in good condition.

Temporary or permanent welding for the convenience of the contractor will not be permitted on areas where the welding will damage paint or other protective coatings unless the areas of coatings which would be damaged thereby are accessible for repairing and inspection. Unless otherwise specified, the contractor will not be required to disassemble machinery, equipment or other metalwork for the purpose of painting the interiors. The contractor shall provide adequate ventilation, lighting and the necessary safety equipment for the protection of the workmen during painting and coating operation.

b. Preparation of surfaces--Surface preparation shall be in accordance with one of the following methods. The method to be used for each item is indicated in the painting tabulation. Weld spatter, slag burrs, or other objectionable surface irregularities shall be removed or repaired before cleaning. Any contaminants to the paint coating, from cleaning operations or other sources, shall be removed before the surface is painted. Cleaning solvent shall be mineral spirits or xylol. Cleaning cloths and solvents shall be discarded before they become contaminated to the extent that a greasy film would remain on the surface after preparation of the surface. In the event that rust forms or the surfaces become otherwise contaminated in the interval between cleaning and painting, or between coats of paint, recleaning will be required. Any coatings not required by and not shown in the painting tabulation shall be removed from the surfaces by suitable and effective means, unless otherwise directed.

Method A All oil, grease, and dirt shall be removed by the use of clean solvent and clean, lint-free wiping material or other effective means. Surfaces with gloss or semigloss paints shall also be sanded lightly.

Method B All oil and grease shall be removed by the use of clean solvent and clean, lint-free wiping materials. Following the solvent cleaning, the surfaces shall be cleaned of all defective or damaged areas of existing paint, and of all loose rust, loose mill scale, and other foreign substances by scraping, chipping, wire brushing, grit-blasting, commercial grade sandblasting, or other effective means.

c. Preparation of other surfaces--All surfaces not covered by the above subparagraphs shall be prepared by methods common to good practice for the particular surface being prepared.

d. Application--Materials shall be thoroughly mixed at the time of application. Surfaces shall be clean and free from moisture at the time of application. Items to be painted that are not thoroughly dry at the time of paint application shall be heated to a sufficient temperature (80°F) to drive off any moisture

present before paint is applied. Effective means shall be provided for removing free oil and moisture from the air supply lines of all spraying equipment. Care shall be exercised during spray application to hold the nozzle sufficiently close to the 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. Nozzle pressure consistent with acceptable finish results shall be employed when spray painting.

Each coat shall be applied in such a manner as to produce an even film of uniform thickness which will completely cover irregularities, fill crevices, and be tightly bonded to the metal or previous coat. Each coat shall be free from runs, pinholes, and sags.

Each coat shall be allowed to dry or to harden before the succeeding coat is applied. Thicknesses shall be measured by an approved dry-film thickness gage and shall be not less than the minimum specified thickness at any point on the coating. Acceptance will be based on the total dry-film thickness gage and shall be not less than the minimum specified thickness at any point on the coating. Acceptance will be based on the total dry-film thickness as measured by an Elcometer, Mikrotest, or other suitable dry-film thickness gage, after the complete paint system has thoroughly dried.

Red lead priming and regular aluminum paint may be thinned if necessary to permit satisfactory application, in which event mineral spirits shall be used and the amount of thinner shall be kept to a minimum but in no event shall it exceed one pint per gallon of paint.

If necessary to improve application properties, cold-applied paints may be heated by means of a hot-water bath to temperatures not to exceed 100°F. Paint shall not be applied when the temperature of the item to be painted or the surrounding air is under 45°F. Painting shall proceed only when the humidity and the temperatures of atmosphere and of surfaces to be painted are such that evaporation rather than condensation will result. Brush coats may be

applied by the conventional brushing procedure, or the paint may be delivered to the surface in a fluid stream by means of spray equipment employing air pressure only on the material and the paint then spread immediately by brushing to an even smooth coating.

Application of specific materials shall be as follows:

(1) Red lead priming paint shall be applied at a maximum coverage of 500-square-feet-per gallon per coat for Type II but the dry film thickness shall be not less than 1.0 mil for the first coat. Zinc-dust-zincoxide paint shall be applied at a maximum coverage of 500-square-feet-per-gallon per coat. Following the first coat of red lead paints, an additional tinted coat shall be applied over all rivets, welds, bolts, seams, sharp corners, and edges before subsequent painting. Alternate coats shall be tinted for color contrast using 1B black. The first coat shall be applied by brush or roller and subsequent coats shall be applied by either brush, roller, or spray, except that Type II red lead priming paint may be applied by spraying when Method B surface preparation is specified and the surface is cleaned by "commercial" grade blast cleaning.

(2) Aluminum paints shall be applied by spraying at a maximum coverage of 500-square-feet-per-gallon per coat for regular aluminum paint. The paints shall be prepared by mixing two pounds of aluminum paste per gallon of mixing varnish and only enough paint for each day's use shall be prepared at one time. The first coat shall be tinted for color contrast using 2A blue. The final coat of aluminum paint shall be "stripe free" with a uniform appearance.

(3) Organic zinc coating shall be applied by brush, conventional spray or airless spray at a maximum coverage of 200-square-feet-per gallon per coat. The dry film thickness shall not be less than 2.0 mils per coat.

e. Materials--All paints and primers shall be purchased in containers not larger than 5 gallons as packaged by the manufacturer. Materials shall be in accordance with the following specifications, or may be in accordance with the subsequent revisions thereto: Provided that the samples or certifications are identified with the proper specifications revision:

Group I

(1) Federal Specifications--
  (a) Red lead priming paint, TT-P-86g, Type II
  (b) Mixing varnish for regular aluminum paint, TT-V-81d, and aluminum paste, TT-P-320c, Type II, Class 2.
  (c) Zinc dust-zinc oxide primer, TT-P-641f, Type II
  (d) Primer coating, zinc dust, chlorinated rubber, TT-P-001046(1), (Galvanizing repair compound)

(2) Miscellaneous Specifications--
  (a) Protective coating, self-curing one-component organic zinc-rich coating, Mil-P-2323G, Type I, Class 3, as manufactured by Koppers Company, Inc., or approved equal.

Group II

(1) Federal Specifications--
  (a) Pigment-in-oil (tinting colors), TT-P-381E(1). Color 2A blue, or equal tinting color in oil.
  (b) Mineral spirits, TT-T-291E, Grade 1.
  (c) Xylol (xylene), TT-X-916b, Grade A or B.

f. Sampling, testing, and certification of materials--The Government will test or require certification of each batch, type, or color of paints or related materials prior to use of application. However, acceptance of the material under the clause of the General Provisions entitled "Inspection and Acceptance" will not be made until the material has been satisfactorily applied and the equipment installed at the jobsite.

The contractor shall furnish copies of all purchse orders for paint or related materialsto the contracting officer. Ccpies of purchase orders shall be furnished far enough in advance of planned use so that the samples if required, will be available to the Government to allow a testingperiod of at least 45 days. The Government will then inform the contractor in writing whether materials covered by each purchase order will be tested or whether the manufacturer's certification will be required. The Government will act on certifications as to paint conformance within 16 days after receipt of the certifications by the Government, and will notify the contractor. Purchase orders and the required certifications or samples shall be furnished by the contractor to the Bureau of Reclamation, Construction Engineer, Yuma Projects Office, P.O. Bin 5569, Yuma, Arizona 85364, shipping costs prepaid, and copies of all correspondence shall be sent to the authorized representative of the contracting officer at the jobsite.

Certifications for each type or batch, or color of Group I materials shall include detailed results of laboratory tests covering all of the applicable specifications requirements and a general statement that the materials comply with the requirements of the specifications. Certifications for quantities of 10 gallons or less of each type, batch, or color of Group I materials may be furnished with only the manufacturer's quality control and composition data, and a general statement that the materials comply with the requirements of the specifications. The certifications shall also contain specific identification data as to material identification, batch number, date of manufacture, quantity being furnished, and the Bureau of Reclamation specifications number. Certifications for Group II materials need not include detailed laboratory testing data but shall comply in other respects with the requirements stated above. The Government reserves the right to test any materials furnished on certification when in the opinion of the Government, such tests are necessary. The contractor shall be responsible for the accuracy of all certifications submitted or data contained therein whether submitted by him, a manufacturer, a supplier, or a subcontractor.

The contractor shall purchase the total quantity of each item of material that is expected to be used in a reasonable length of time to avoid repetitive purchases that would impose additional testing expense on the Government. The costs and delays from additional testing required as a result of either unnecessary small purchases or rejection of the materials submitted shall be the responsibility of the contractor.

g. Costs--The cost of furnishing, preparing, and applying all materials for the cleaning, painting, or coating operations shall be included in the applicable prices bid in the schedule for the items of work requiring painting.

7.1.2 Painting and Coating Tabulation

Contractor furnished items shall receive the cleaning and coating systems shown in the tabulation following. Coatings shall be applied as required under Paragraph 7.1.1 (Painting and Coating).

No.	Item	Surface Preparation Method	Paint or Coating Material	Number of Coats
1	Damaged areas of paint on metalwork and equipment which are furnished complete painted or coated including:	Repair damaged areas to equal and color match undamaged contiguous areas.		
2	Damaged areas of galvanized surfaces that do not require finish painting	B	Zinc dust-zinc-oxide paint	2
3	Exterior exposed metalwork and exposed piping	B	Red lead priming paint, Type II Regular aluminum paint	1 1
4	Buried piping	B (sand blasted)	Organic zinc coating	2
5	Wooden pit covers	A	Red lead priming paint, Type II Regular aluminum paint	1 1

DIVISION 8 -- DRAWINGS

Section 8.1 - DRAWINGS

8.1.1 Drawings, General

a. General.--Some of the drawings included herein show details of fabrication, and other details and specifications not a part of work required under these specifications. Specifications and details shown on these drawings which are not applicable under these specifications shall be disregarded. Reference drawings referred to on specifications drawings, and not included herein, are not considered necessary for bidding purposes but will be furnished to the contractor, where necessary, for construction purposes. Where details shown on Standard Drawings 40-D-and 104-D series differ from those shown on other drawings or the requirements of these specifications, the details shown on other drawings or the requirements of the specifications shall govern. In the event there are minor differences as determined by the contracting officer between details and dimensions shown on the drawings and those of existing features at the site, the details and dimensions ofexisting features at the site shall govern.

The contractor shall check all drawings carefully and advise the contracting officer of any errors or omissions discovered.

b. Additional or revised drawings.--Except as otherwise provided in these specifications for drawings to be furnished by the contractor, the specifications drawings will be supplemented by such additional or revised general and detail drawings as may be necessary or desirable as the work progresses; and the contractor shall do no work without proper drawings and instructions. The contractor will be required to perform the work in accordance with the additional general and detail drawings or revisions furnished by the Government at the applicable prices bid in the schedule for such work.

c. Additional copies of drawings.--The contractor will be furnished such additional copies of the specifications and drawings as may be required for carrying out the work.

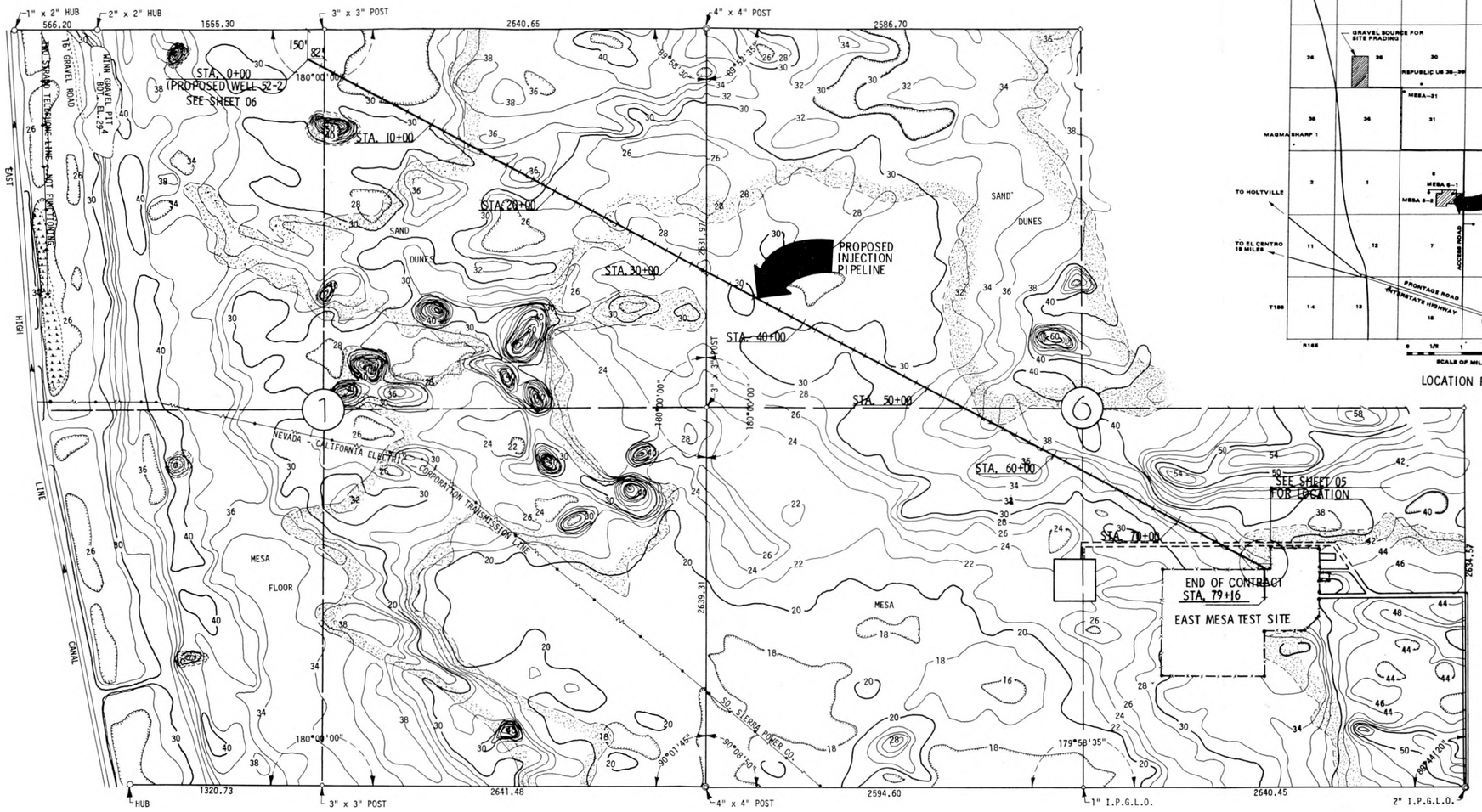
d. Mailing address.--All drawings and data submitted by the contractor for which a specific mailing address is not given in these specifications shall be submitted to the Construction Engineer, Bureau of Reclamation, Yuma Projects Office, 3800 Avenue 3 East, P.O. Bin 5569, Yuma, Arizona 85364.

8.1.2 List of Drawings

The following drawings are made a part of these specifications:

88-4 INJECTION PIPELINE

6821.22B-01	Site Plan
6821.22B-02	Pipeline Plan & Profile, Station No. 0+00 - 30+00
6821.22B-03	Pipeline Plan & Profile, Station No. 30+00 - 60+00
6821.22B-04	Pipeline Plan & Profile, Station No. 60+00 - 73+50
6821.22B-05	Pipeline Plan & Profile, Station No. 73+50 - 79+16
6821.22B-06	Sections and Details

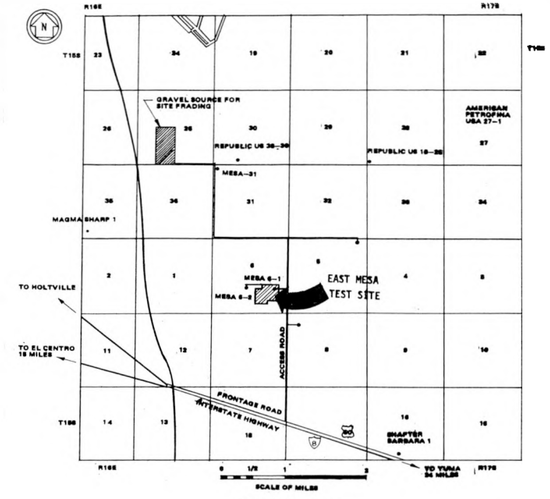


SITE PLAN

SCALE 1" = 400'

400 0 400 800 1200

SCALE OF FEET



LOCATION PLAN

88-4 INJECTION PIPELINE

DRAWING INDEX

DRAWING NO.	DRAWING TITLE
6821.22B-01	SITE PLAN
6821.22B-02	PIPELINE PLAN AND PROFILE STA. 0+00 TO 30+00
6821.22B-03	PIPELINE PLAN AND PROFILE STA. 30+00 TO 60+00
6821.22B-04	PIPELINE PLAN AND PROFILE STA. 60+00 TO 73+50
6821.22B-05	PIPELINE PLAN STA. 73+50 TO 79+16
6821.22B-06	SECTIONS AND DETAILS

LEGEND

- CONTOUR LINE
- DEPRESSION
- SAND DUNE
- SWAMP

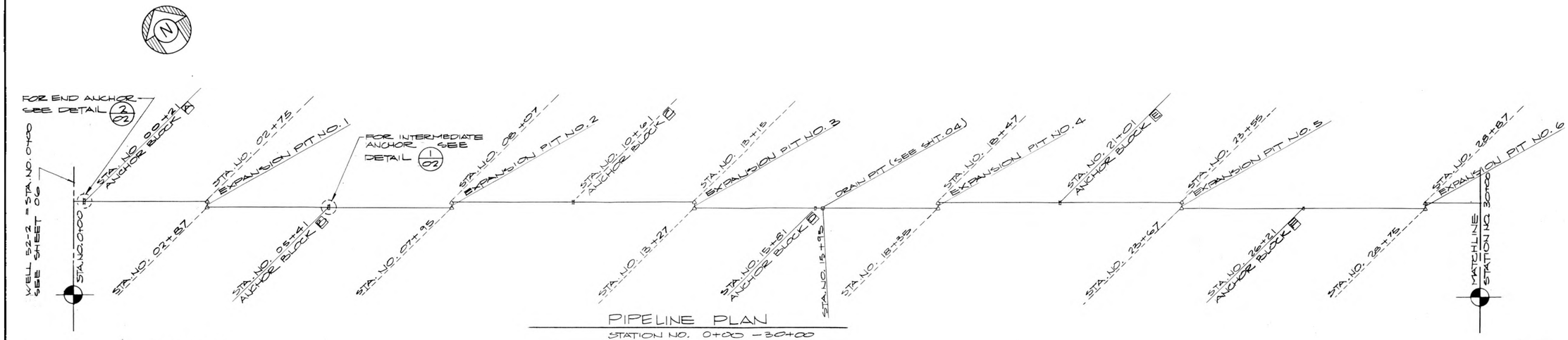
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

52-2 INJECTION PIPELINE
SITE PLAN

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 OCT. 1976
DRAWN D.E.D/R.C.G.
CHKD.
APPRVD.
APPRVD. – PROGRAM OFFICE R.O. Pearson

DWG. NO. 6821.22B-01



PIPELINE PLAN

STATION NO. 0+00 – 30+00
SCALE: 1" = 100'-0"

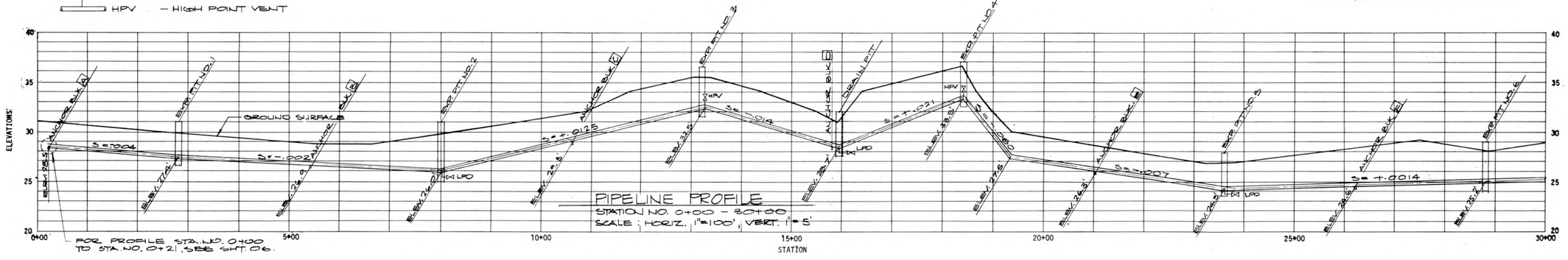
LEGEND

LPD – LOW POINT DRAIN

HPV – HIGH POINT VENT

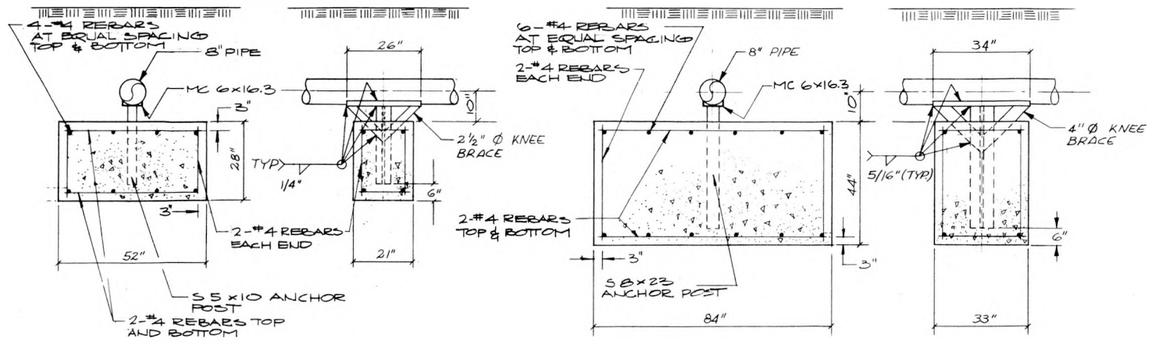
GENERAL NOTE:

1. ALL ELEVATIONS FROM CENTERLINE OF PIPE.



PIPELINE PROFILE

STATION NO. 0+00 – 30+00
SCALE: HORIZ. 1"=100', VERT. 1"=5'



(1/02) INTERMEDIATE ANCHOR – TYPE II
1/2" = 1'-0"

(2/02) END ANCHOR – TYPE I
1/2" = 1'-0"

ANCHOR BLOCK SCHEDULE

ANCHOR LETTER	TYPE OF ANCHOR	ANCHOR CENTER-LINE STATION NO.	PIPE CENTERLINE ELEVATION
A	I	00+21	28.5'
B	II	05+41	26.9'
C	II	10+61	29.3'
D	II	15+81	28.7'
E	II	21+01	26.3'
F	II	26+21	24.6'
G	II	31+41	25.4'
H	II	36+61	28.3'
J	II	41+81	27.3'
K	II	47+01	26.5'
L	II	52+21	32.5'
M	II	57+41	34.6'
N	II	62+61	30.9'
P	II	67+81	31.9'
Q	II	73+01	32.6'
R	I	76+95	31.4'
S	III	79+15	38.8'

NOTE: SEE SHT. 06 FOR ANCHOR TYPE III.

1/2" = 1'-0" 2' 1' 0 2 4 FEET
1" = 5'-0" 5'4' 3' 2' 1' 0 5 10 FEET
1" = 100'-0" 100' 0 100 200 300 FEET

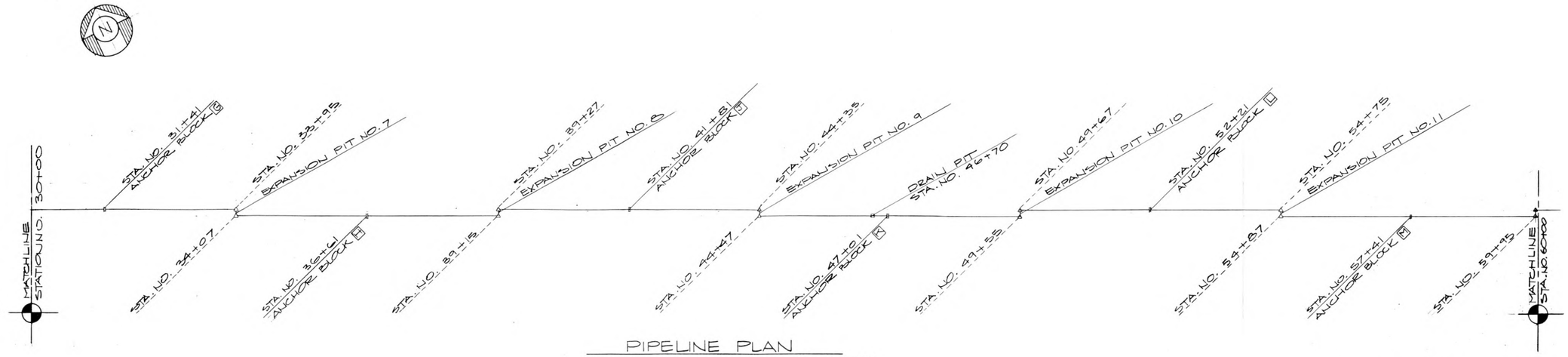
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

52-2 INJECTION PIPELINE
PIPELINE PLAN AND PROFILE
STA. NO. 0+00 – 30+00

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 OCT. 1976
DRAWN RCG, DREVAY
CHKD. [illegible]
APPRVD. [illegible]
APPRVD. – PROGRAM OFFICE RO Pearson

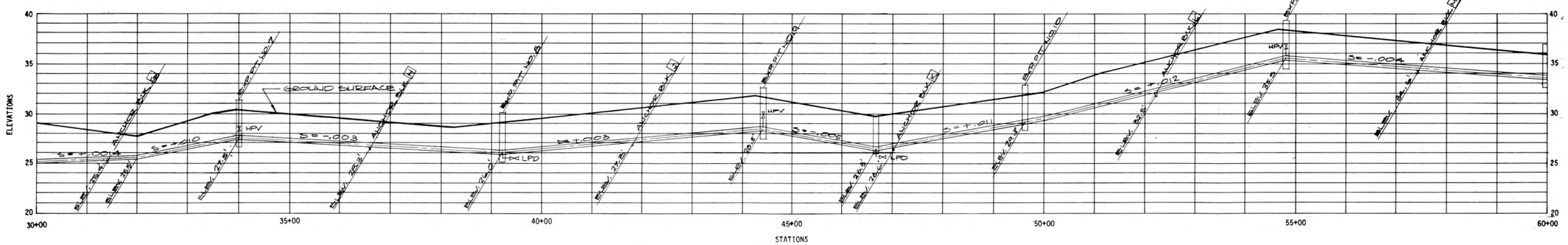
DWG. NO. 6821.22B-02



PIPELINE PLAN

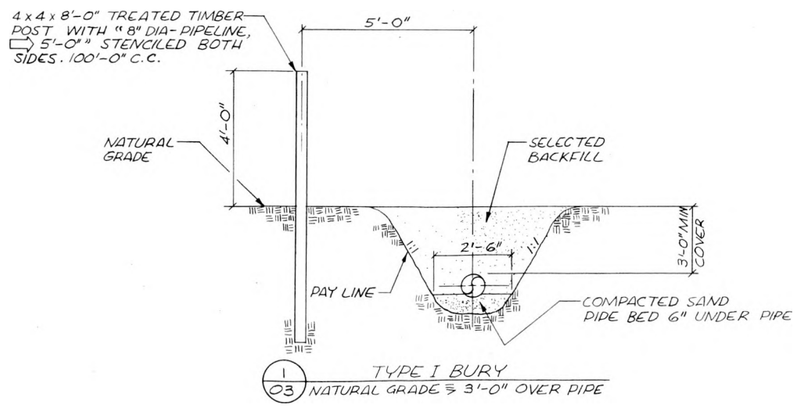
STATION NO. 30+00 – 60+00
SCALE: 1"=100'-0"

GENERAL NOTE:
1. ALL ELEVATIONS FROM CENTERLINE OF PIPE.

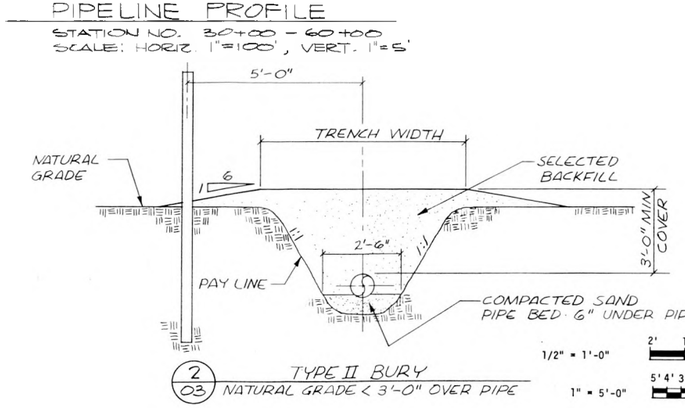


PIPELINE PROFILE

STATION NO. 30+00 – 60+00
SCALE: HORIZ. 1"=100', VERT. 1"=5'



1/03 TYPE I BURY
NATURAL GRADE ≯ 3'-0" OVER PIPE



2/03 TYPE II BURY
NATURAL GRADE < 3'-0" OVER PIPE

1/2" = 1'-0" 2' 1' 0 2 4 FEET
1" = 5'-0" 5' 4' 3' 2' 1' 0 5 10 FEET
1" = 100'-0" 100' 0 100 200 300 FEET

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

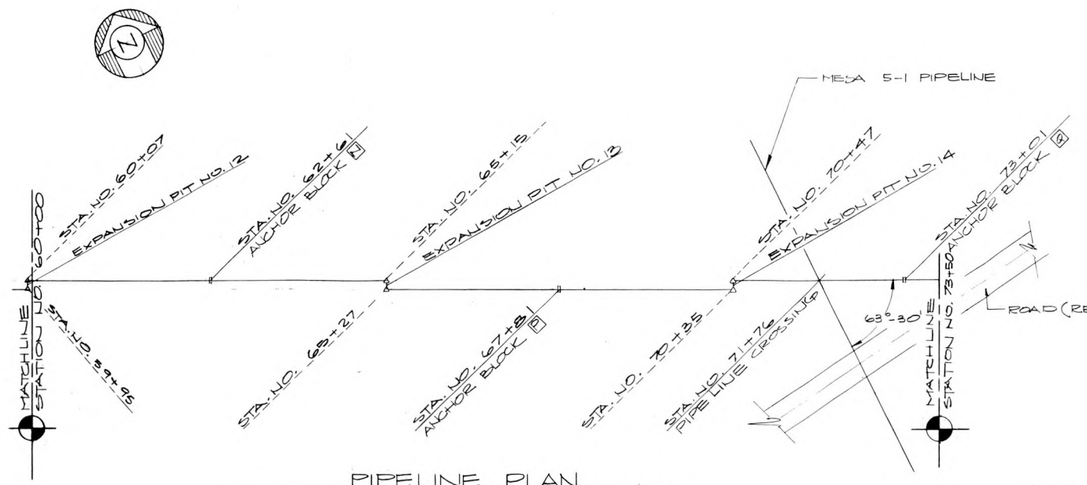
52-2 INJECTION PIPELINE
PIPELINE PLAN AND PROFILE
STA NO. 30+00 – 60+00

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

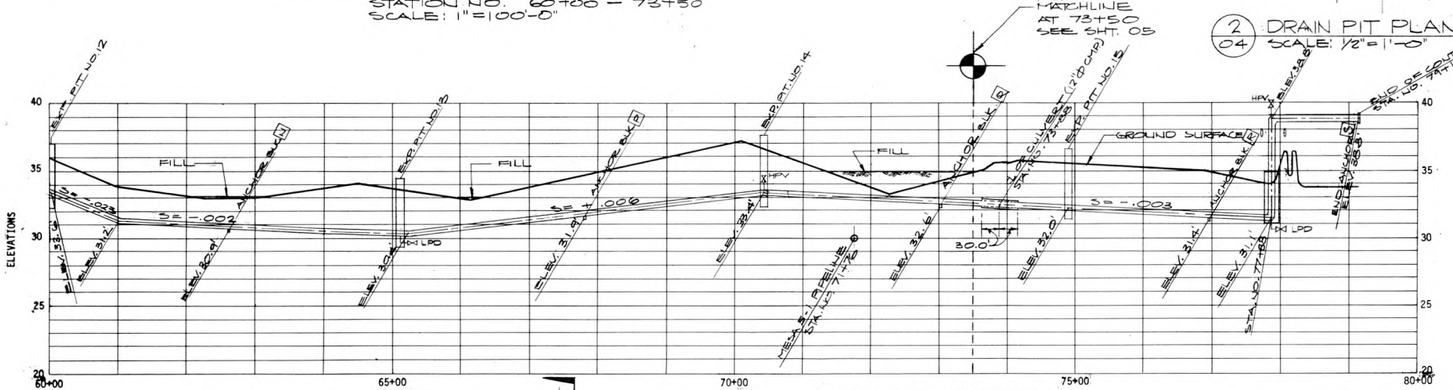
DATE 15 OCT. 1976
DRAWN DREWRY, RCG
CHKD. KAB
APPRVD.

APPRVD. – PROGRAM OFFICE RO Pearson

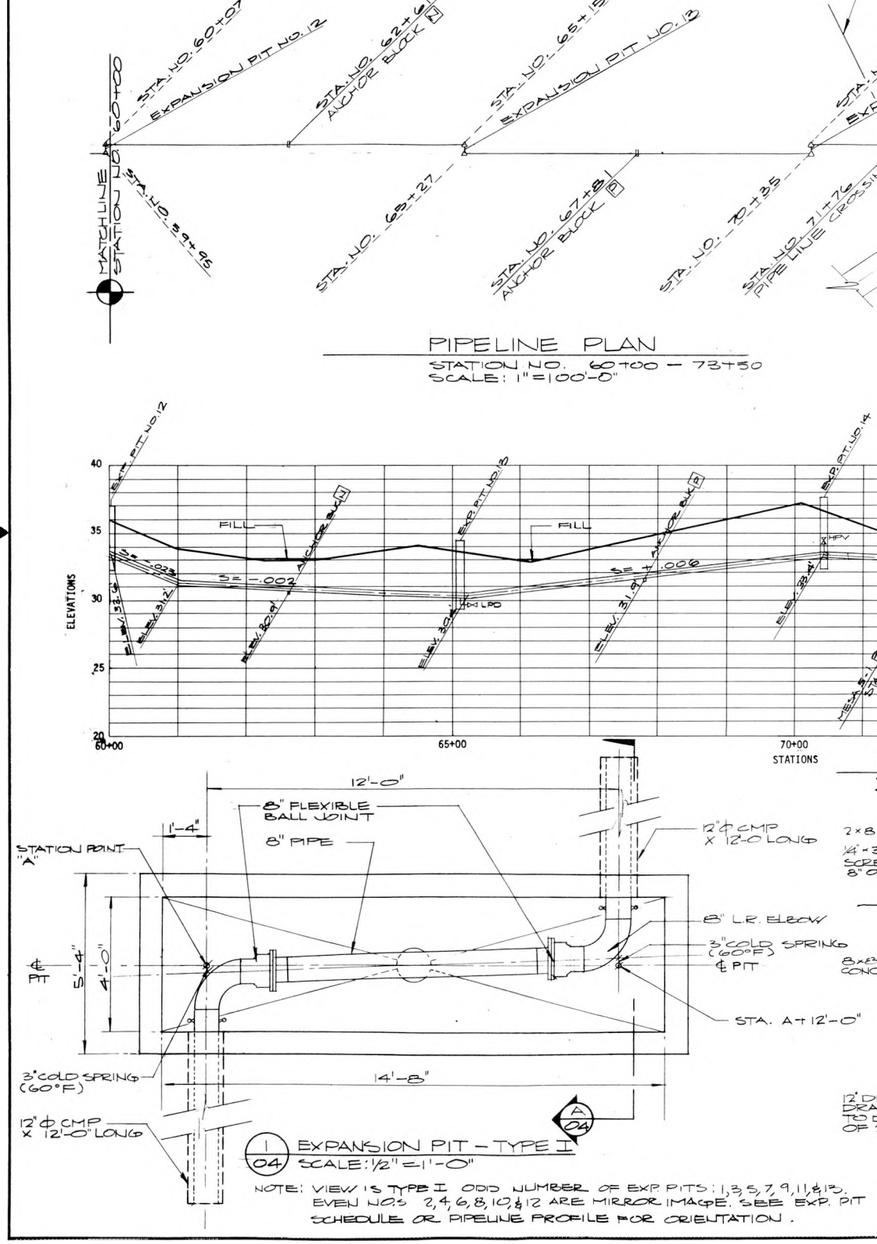
DWG. NO. 6821.22B-03



PIPELINE PLAN
STATION NO. 60+00 – 73+50
SCALE: 1"=100'-0"

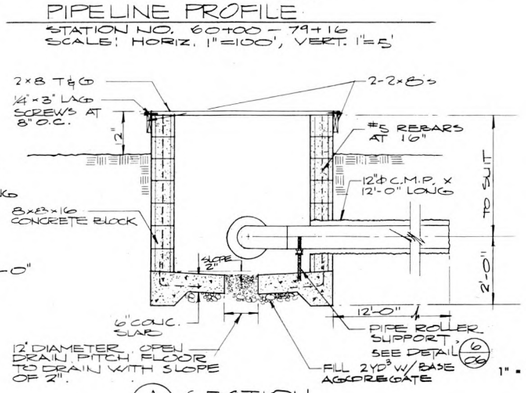


PIPELINE PROFILE
STATION NO. 60+00 – 79+16
SCALE: HORIZ. 1"=100', VERT. 1"=5'



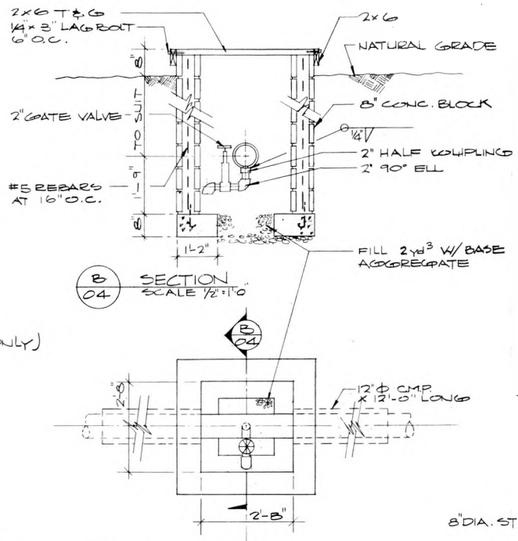
1 / 04 EXPANSION PIT – TYPE I
SCALE: ½"=1'-0"

NOTE: VIEW IS TYPE I ODD NUMBER OF EXP PITS: 1,3,5,7,9,11,&13. EVEN NO.S 2,4,6,8,10,& 12 ARE MIRROR IMAGE. SEE EXP. PIT SCHEDULE OR PIPELINE PROFILE FOR ORIENTATION.



A / 04 SECTION
SCALE: ½"=1'-0"

GENERAL NOTES:
1. ALL ELEVATIONS ARE FROM CENTERLINE OF PIPE.



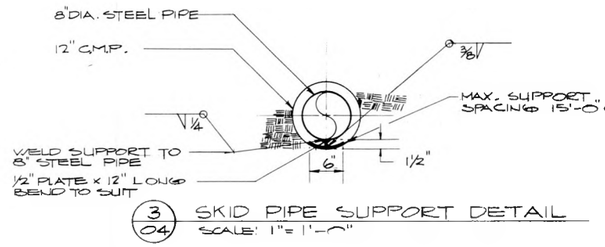
B / 04 SECTION
SCALE ½"=1'-0"

2 / 04 DRAIN PIT PLAN
SCALE: ½"=1'-0"

EXPANSION PIT SCHEDULE

EXP. PIT NO.	TYPE OF EXPANSION PIT	PIPE STATION @ POINT "A"	PIPE & ELEV @ STATION "A"	HIGH POINT VENT	LOW POINT DRAIN
1	I	02+75	27.4'		
2	II	07+95	26.0'		✓
3	II	13+15	32.5'	✓	
4	II	18+35	33.5'	✓	
5	II	23+55	24.3'		✓
6	II	28+75	25.2'		
7	II	33+95	27.5'	✓	
8	II	39+15	26.0'		✓
9	II	44+35	28.5'	✓	
10	II	49+55	29.3'		
11	II	54+75	35.5'	✓	
12	II	59+95	33.6'		
13	II	65+15	30.4'		✓
14	II	70+35	33.4'	✓	
15	I	74+90	32.0'		
16	II	77+88	33.1'	✓	✓

NOTES:
SEE THIS SHEET FOR DETAILS OF EXP. PIT TYPE I.
SEE SHEET 06 FOR DETAILS OF EXP. PIT TYPE II.



3 / 04 SKID PIPE SUPPORT DETAIL
SCALE: 1"=1'-0"

1/2" = 1'-0" — 2' 1' 0 2 4 FEET
1" = 1'-0" — 1' 9" 6" 3" 0 1 2 3 FEET
1" = 5'-0" — 5' 4' 3' 2' 1' 0 5 10 FEET
1" = 100'-0" — 100' 0 100 200 300 FEET

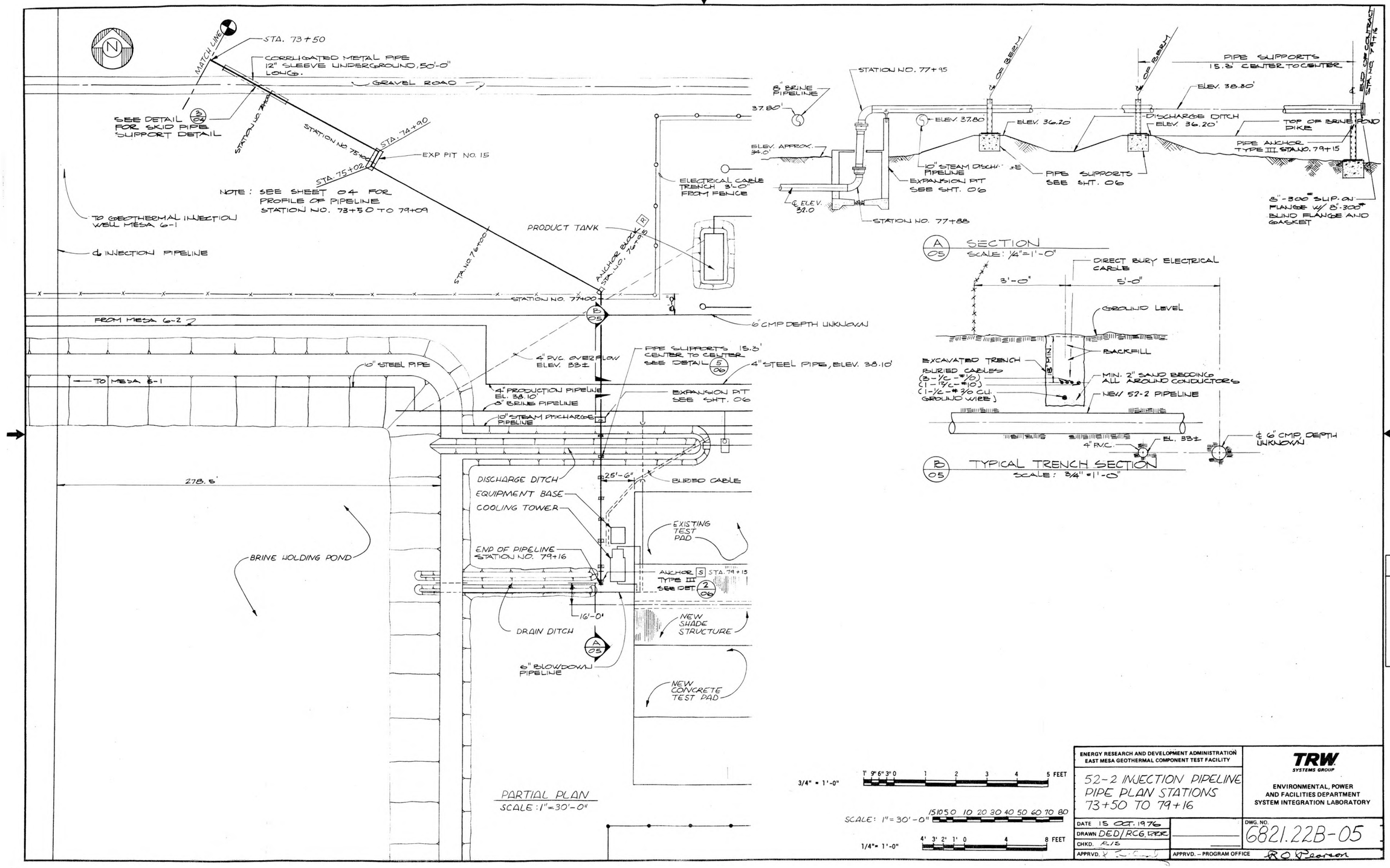
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

52-2 INJECTION PIPELINE
PIPELINE PLAN AND PROFILE
STA. NO. 60+00 – 73+50

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 OCT. 1976
DRAWN D.REVAY
CHKD. Z.C.S
APPRVD. [signature]
APPRVD. – PROGRAM OFFICE R.O.Pearson

DWG. NO. 6821.22B-04

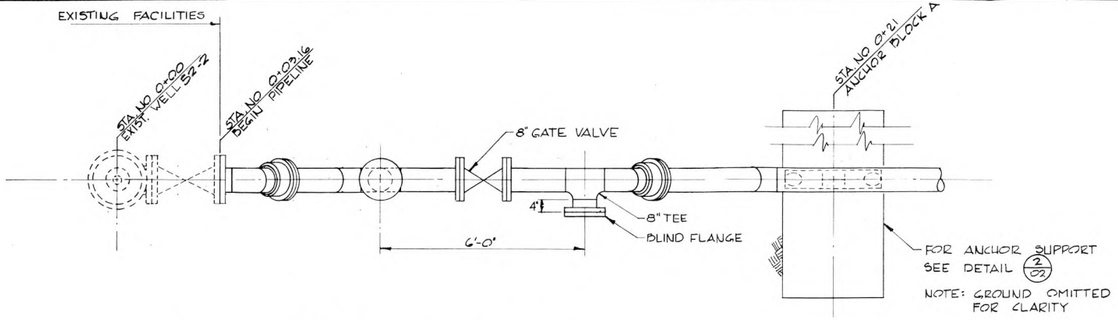


ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

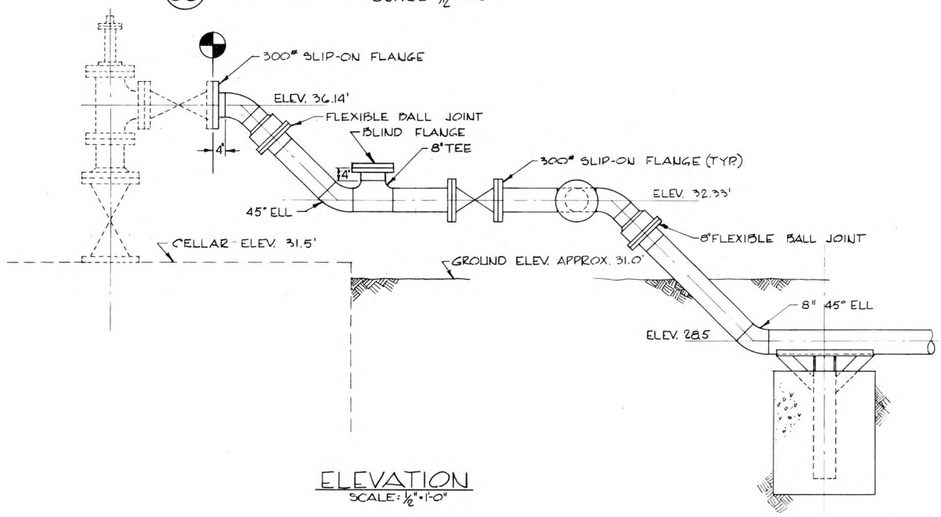
52-2 INJECTION PIPELINE
PIPE PLAN STATIONS
73+50 TO 79+16

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

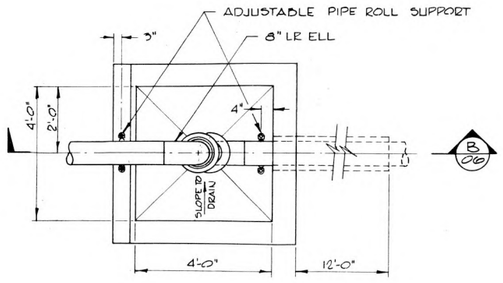
DATE 15 OCT. 1976		DWG. NO. 6821.22B-05
DRAWN DED/RCG, PRR		
CHKD. R.I.S		
APPRVD.	APPRVD. – PROGRAM OFFICE	R.O. Pearson



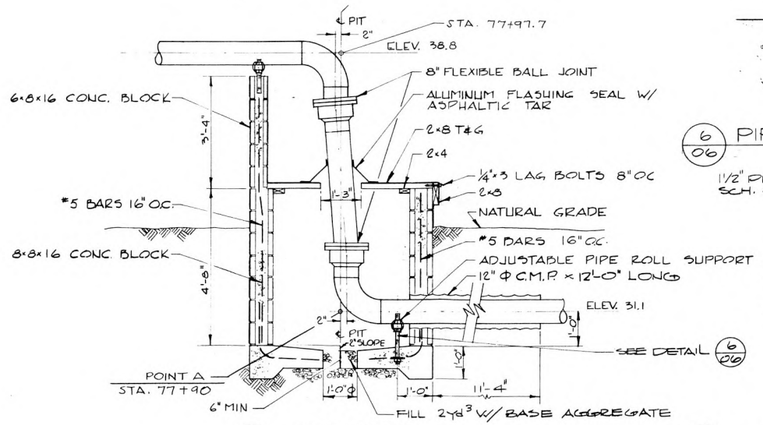
A/06 INJECTION WELLHEAD PLAN
SCALE: 1/2"=1'-0"



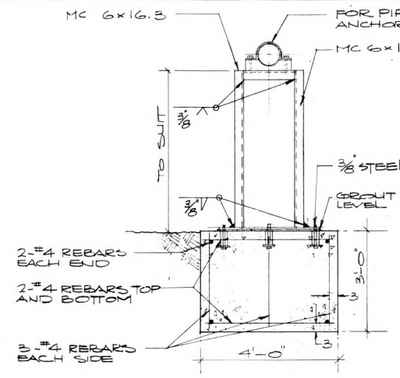
ELEVATION
SCALE: 1/2"=1'-0"

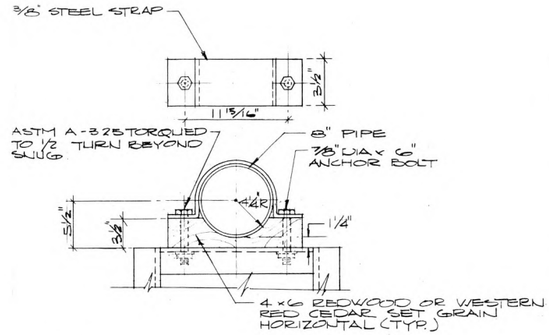


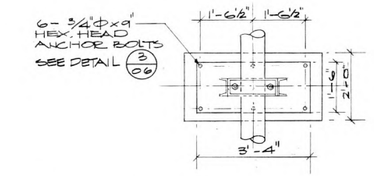
1/06 EXPANSION PIT TYPE II
SCALE: 1/2"=1'-0"



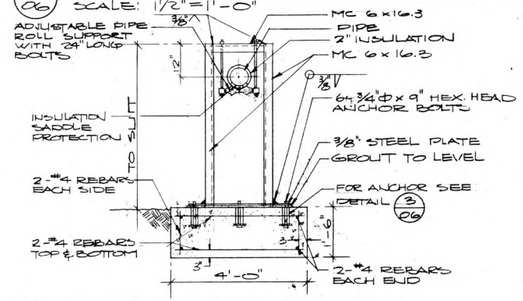
B/06 SECTION
SCALE: 1/2"=1'-0"



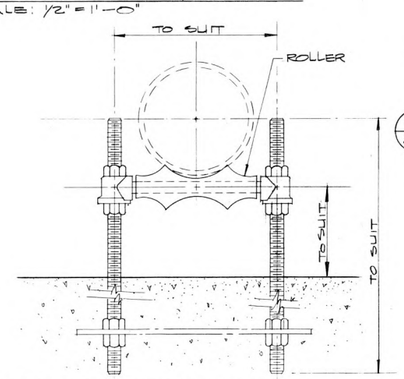




4/06 PIPE SUPPORT-ANCHOR TYPE III DETAIL
SCALE: 1 1/2"=1'-0"

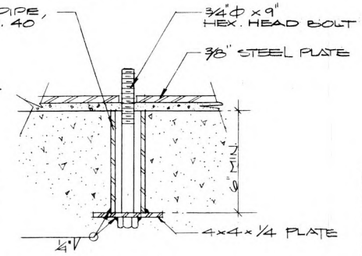


2/06 PIPE ANCHOR - TYPE III
SCALE: 1/2"=1'-0"



5/06 PIPE SUPPORT
SCALE: 1/2"=1'-0"

6/06 PIPE ROLLER SUPPORT
NO SCALE



3/06 ANCHOR DETAIL
NO SCALE

1/2" = 1'-0" 2' 1' 0 2 4 FEET

1-1/2" = 1'-0" 1' 9" 6" 3" 0 1 2 FEET

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
52-2 INJECTION PIPELINE SECTIONS AND DETAILS	
DATE 15 OCT. 1976	DWG. NO. 6821.22B-06
DRAWN B.L., DRR.	
CHKD. R.T.S.	
APPRVD.	APPRVD. – PROGRAM OFFICE R.O. Pearson

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Contract No. E(04-3) - 1140

TASK 4.1.3

CONTROL AND INSTRUMENTATION SPOOLS

SPECIFICATION 6821.22C-S

Prepared by:

Environmental, Power and Facilities Department

TRW
SYSTEMS GROUP

FOREWORD

The work is situated approximately 10 miles east of Holtville, California, in Imperial County. Work to be performed includes fabrication of pipe spools, pipe spool supports, and instrumentation.

Pipe spools to perform the following junction:

Spool	FUNCTIONS
SP-1	Supply and return (reinjection) 200psig & 350°F Brine
SP-2	to and from Customers Test Apparatus at automatically controlled flow rates between 150 to 400 gpm. Flow, temperatures and pressures can be read locally.
SP-3	Provide Customer & Brine Blowdown Connection for flow rates between 150 and 400 gpm. With manual valve control. Pressure and temperature can be read locally.
SP-4	Same functions as SP-1&2 except at flow
SP-5	rates between 0 to 150 gpm.
SP-6	Same functions as SP-3 except at flow rates between 0-150 gpm.
SP-7	Same functions as SP-1&2 except at flow rates
SP-8	between 400 to 1000 gpm.
SP-9	Supply and return of Cooling Water to Customers
SP-10	Test Apparatus at automatically controlled flow rates of between 200 and 800 gpm or temperatures between 90 to 140°F. Flow, temperatures and pressures can be read locally.
SP-11	Same functions as SP-9&10 except flow
SP-12	rates between 0 to 200 gpm

If the contractor discovers a conflict between specifications and drawings, the differences shall be referred in writing to the contracting officer within five days of such discovery for clarification. Until authorized in writing, any work performed after such discovery shall be at the contractor's own risk.

DESCRIPTION OF THE WORK

The principal components of the work to be performed under these specifications include the following:

a. Fabricating control and instrumentation pipe spools, including cleaning and painting.
b. Fabricating pipe spool supports.
c. Supplying and installing mechanical and pneumatic piping in accordance with drawings and specifications.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
	Fabricating and furnishing Pipe Spools			
1	Type No. SP-1	1 each		
2	Type No. SP-2	1 each		
3	Type No. SP-3	1 each		
4	Type No. SP-4	1 each		
5	Type No. SP-5	1 each		
6	Type No. SP-6	1 each		
7	Type No. SP-7	1 each		
8	Type No. SP-8	1 each		
9	Type No. SP-9	1 each		
10	Type No. SP-10	1 each		
11	Type No. SP-11	1 each		
12	Type No. SP-12	1 each		

CONTROL AND INSTRUMENTATION SPOOLS
GENERAL OUTLINE

DIVISION 2--PIPE SPOOLS

Section 2.1--PIPE SPOOLS

- 2.1.1 General
- 2.1.2 Pipe
- 2.1.3 Measurement and Payment for Pipe
- 2.1.4 Testing and Pipeline
- 2.1.5 Guarantee
- 2.1.6 Steel Pipe and Fittings
- 2.1.7 Cleaning

DIVISION 3--PIPE SPOOL SUPPORTS

Section 3.1--PIPE SPOOL SUPPORTS

- 3.1.1 General
- 3.1.2 Materials
- 3.1.3 Workmanship and Defective Materials
- 3.1.4 Fabrication
- 3.1.5 Payment

DIVISION 4--INSTRUMENTATION

Section 4.1--INSTRUMENTATION

- 4.1.1 General
- 4.1.2 Testing
- 4.1.3 Cleaning
- 4.1.4 Materials
- 4.1.5 Instruments
- 4.1.6 Instrument and Control Calibration and Adjustment
- 4.1.7 Nameplates
- 4.1.8 Payment

DIVISION 5--PAINTING

Section 5.1--PAINTING

- 5.1.1 Painting
- 5.1.2 Painting Tabulation
- 5.1.3 Color Schedule for Painting

DIVISION 6--DRAWINGS

Section 6.1--DRAWINGS

6.1.1 Drawings, General
6.1.2 List of Drawings

DIVISION 2 -- PIPE SPOOLS

SECTION 2.1--PIPE SPOOLS

2.1.1 General

The contractor shall furnish pipe, fittings, insulation and all appurtenances and construct the pipe spools as shown on the drawings and as herein specified. Not withstanding any omissions from these specifications or drawings.

During manufacturing, transporting and storing the pipe spools, the pipe spools shall not be dropped or subjected to any unnecessary impact or other treatment that could damage the spools.

Spools shall not be stored in the yard or on the jobsite under conditions which would cause damage. Any spool, in the opinion of the contracting officer, that is damaged beyond repair by the contractor by hauling, handling, unloading, storing, or otherwise, shall be removed from the worksite and replaced by and at the expense of the contractor with another spool.

2.1.2 Pipe

The contractor shall furnish and install steel pipe fittings as specified in Paragraph 2.1.6 (Steel Pipe Fittings).

Gaskets furnished with flanged fittings shall be suitable to withstand temperatures of 500°F.

2.1.3 Measurement and Payment for Pipe

Payment for furnishing and fabricating the 2-, 3-, 4-, 6-, and 8-inch Schedule 40 steel pipe spools will be made at a lumb sum price bid for each spool in the schedule, by which price shall include the cost of furnishing all materials, instrumentation, insulation, manufacturing, transportation to the site, pipe supports, painting, and furnishing maintenance guarantee.

2.1.4 Testing and Pipeline

a. Pressure Test--After the pipe spools have been fabricated and the joints completed, the contractor shall subject the pipe spools to a hydrostatic pressure of 200 lb/in^2 for a period of not less than one hour. No leakage will be allowed and any and all leaks shall promptly be made watertight.

The contractor shall furnish all pumping equipment, labor, tools, pressure gages, and other equipment, and water required for making the tests.

All piping, fittings, and joints shall be carefully examined during the test. Any cracked or defective piping or fittings discovered during the pressure test shall be removed and replaced by the contractor with sound material and the test repeated as required, all at the expense of the contractor.

All testing shall be done in the presence of a duly authorized representative of the contracting officer. The Contractor shall notify the Contracting officer of the time and place ot Test 48 hrs. in advance of test.

b. Cost--The entire cost of testing the pipe spools and of furnishing all equipment, labor, and materials for making the tests shall be included in the respective unit price bid for furnishing and fabricating 2-inch, 3-inch, 4-inch, 6-inch Schedule 40 steel pipe.

2.1.5 Guarantee

The contractor shall furnish a guarantee against leakage of the pipe spools for a period of one year from date of acceptance. Any leaks shall be corrected by the contractor, on notice from the contracting officer and at no cost to the Government. Any repairs to the pipe spools shall be made in an acceptable manner as approved by the contracting officer.

In lieu of such guarantee the contractor may hydrostatically test the pipe spools at 150 percent of the specified test pressure. Any visible leaks shall be repaired. The installation will be considered acceptable when the specific test pressure has been maintained without loss for a period of not less than two hours or no leaks are observed during the period of time or such time as necessary for completing inspection of all joints along the pipe spools. The Contractor shall notify the Contracting Officer of the time and place of test 48 hrs. in advance of test.

2.1.6 Steel Pipe and Fittings

a. General--The contractor shall furnish, install, and insulate the steel piping and fittings for the pipe spools complete with accessories in accordance with the requirements of these specifications and as shown on the drawings.

b. Materials--Materials shall be in accordance with the following requirements:

(1) 2-inch, 3-inch, 4-inch, 6-inch and 8-inch steel pipe--ASTM, Type E or S, Class ASTM, Type E or S, Class A53A (Schedule 40), plain end.

(2) Flange gaskets -- 300 lb. spiral wound 304 SS asbestos filled flexitallic with centering ring.

(3) Bolts and nuts -- Bolts - FF-B-575C, Grade II, Type II, or stud bolts; Nuts - FF-H-336D, Type II (Hexagon), Style 4; VNC coarse thread series.

(4) Steel welding flanges -- ASTM Designation A181, Grade I 300# Class, raised face for all spools.

(5) Steel fittings -- ASTM Designation A234, Schedule 40, long radius welding type.

(6) Insulation -- Insulation for the steel pipe, fittings, valves, and appurtenances, with the exception of instrumentation, dials, gages, etc., shall be equal to Johns-Manville "Metal-ON" aluminum-jacketed, calcium silicate insulation in nominal thickness as shown on the drawings as furnished by Johns-Manville, 22 East 40th Street, New York, New York 10016, and shall comply with the requirements of Federal Specification HH-I-523c, Type II, Class C. Insulation shall be installed in accordance with the manufacturer's recommendations.

(7) Gate valves -- 3-inch and 6-inch gate valves shall be CS body, 50% exelloy and 50% stellite trim, OS&Y bolted bonnet, ASA 300 RF FLGD, Crane Model 33 X UF or approved equal.

(8) Globe valves -- 2-inch and 4-inch shall be CS body, 50% exelloy and stellite trim, ASA 300 RF FLGD, Crane 151 X U or approved equal.

(9) Check valves -- 3-inch and 6-inch for cooling water service shall be swing check, CS body, 50% exelloy and 50% stellite trim, ASA 300 RF FLGD, crane model 159 X U or approved equal.

Brine service check valves shall be poppet valve insert type, ASA 300, 316SS body and spring, teflon seats, 3-inch and 4-inch model FIV 30 SST 1 1/2, 6-inch and 8-inch model FIV 30 SST 1/2, Check-All valve Mfg. Co., or approved equal.

(10) Ball valves -- 2-inch through 8-inch ball valves shall be McCannaseal Model S301-CS-R-S6 Ball Valves, ANSI Class 300/ Flanged Ends/CS body stainless steel trim, reinforced teflon seats, top entry or approved equal.

(11) All FCV's for brine and cooling water service, shall be CAMFLEX Model 35-35200 control valve with penumatic actuator and handwheel Model 7600 positioner and No. 77-4 Airset or approved equal. Air to open, flow to close with carbon steel body, flangeless connection, integral bonnet, 440C hardened stainless steel bearings, 316 stainless steel shaft, No. 6 Stellite plug and ring.

(12) Miscellaneous materials -- Where materials are required but are not specified herein, the contractor shall furnish standard commercial quality material suitable for the intended use.

(13) Bellows type stainless steel expansion joints--Expansion joints shall have a traverse of the amount indicated at each location. Expansion joints shall be of the multi-ply laminated, corrugated bellows construction; constructed of type 347 stainless steel. Each expansion joint shall be provided with ends consisting of rigid flanges with elongated bolt holes. Self-equalizing stainless steel contour rings shall be provided in each corrugation. Each expansion joint shall be so constructed as to require not more than one hundred pounds to compress through its full rated traverse. Expansion joints shall be designed for 300 pounds working pressure and provided with self-guiding internal liners or guides. Expansion joints when installed shall be protected against both end loading and torsional stresses. Expansion joints shall be type 308-1230 supplied by Keflex, Inc., General Offices-San Francisco, California 94111, or approved equal. Contractor shall submit all such materials to contracting officer for approval.

c. Fabrication--The steel pipe shall be fabricated in accordance with these specifications, the drawings and the requirements of the American Water Works Association Standard C201. Where provisions of the AWWA Standards conflict with provisions of these specifications and/or drawings, the provisions of these specifications and/or drawings shall govern. The requirements of Section 5.1 to 5.4, inclusive, of the AWWA Standard C201 are not a part of these specifications. The shell thickness of the pipe shall not be less than 0.250 inches.

d. Installation--The steel pipe and fittings shall be assembled and erected as shown on the drawings.

2.1.7 Cleaning

Finished spools shall be thoroughly cleaned and flushed with water or blown with steam or air to clear the spool of dirt, mill scale, filings and other debris. Cleaning or flushing shall continue until no trash is evident in the exhaust or a clean stream of water is obtained at the outlet.

DIVISION 3 -- PIPE SPOOL SUPPORTS

SECTION 3.1--PIPE SPOOL SUPPORTS

3.1.1 General

The contractor shall furnish, fabricate, and erect the pipe spool supports as shown on the drawings and hereinafter specified.

For the purpose of these specifications, the term "steel" includes all materials defined as structural steel in the AISC "Code of Standard Practice for Steel Buildings and Bridges" as given in pages 5-172 and 5-173 of the Seventh Edition of the Manual of Steel Construction of the American Institute of Steel Construction, Inc.

The contractor shall furnish all materials, including steel, and other related accessory materials, required for the complete erection of steel for the supports notwithstanding any omissions from these specifications or drawings.

3.1.2 Materials

(1) Structural Steel--All structural steel shall conform to: QQ-S-741D, ASTM Designation: A7, A36, or ASTM Designation: A374, except that Government inspection at the mill will be waived.

(2) Arc-welding electrodes--All arc-welding electrodes shall be of the E60 classification in accordance with the latest edition of the American Welding Society Specifications for Iron and Steel Arc-Welding Electrodes and shall be suitable for the base materials, positions, and other conditions of intended use.

(3) Miscellaneous materials--Miscellaneous materials not specifically covered herein by detailed specifications shall be of the top standard commercial quality.

3.1.3 Workmanship and Defective Materials

All work shall be equal to the best modern practice in the manufacture and fabrication of materials of the types covered by these specifications, notwithstanding any omissions from these specifications or drawings. The contractor shall be responsible for the correct fitting of all parts. The contractor shall replace, free of cost to the Government, any defective materials discovered during fabrication, and shall pay all cost of the correction in the field of any errors not previously discovered.

3.1.4 Fabrication

(1) General--All work shall be equal to the best modern practice in the manufacture and fabrication of materials of the types covered by these specifications or drawings. Details of design or fabrication not covered by the drawings or by these specifications shall conform to the applicable provisions of the latest "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," including all supplementary provisions of the American Institute of Steel Construction, and "Specifications for Architecturally Exposed Structural Steel."

(2) Inspection and tests--All materials furnished and all work performed shall be subject to rigid inspection. Inspection and tests of materials by the Government at the mill will be waived. Inspection of materials at the contractor's plant may be made in accordance with the provisions of these specifications. As soon as practicable after receipt by the contractor of notice to proceed, the contractor shall submit to the Government certified mill test reports of the chemical analysis and physical tests of all structural steel.

(3) Straightening material--Before being laid out or worked in any way, structural material shall be straight and free from sharp kinks and bends. If straightening is necessary, it shall be done by methods that will not damage the metal.

(4) Shearing and cutting--Shearing and cutting by torch or electric arc shall be performed carefully, and all portions of the work which will be exposed to view after completion shall be finished neatly. Reentract cuts and copes shall be filleted before cutting.

(5) Welding--All welding and work related thereto shall comply with the latest edition of the American Welding Society "Code for Welding in Building Construction." All welding terms shall be interpreted in accordance with the American Welding Society definition of welding terms. Welding symbols shown on the drawings comply with American Welding Society symbols, unless otherwise noted.

All welds shall be of the types specified on the drawings, shall be continuous unless otherwise noted, and shall be made in such a manner that residual shrinkage stresses will be reduced to a minimum. No stress-relieving treatment will be required unless otherwise noted on the drawings.

(6) Qualifications of welding process and operators--If not previously qualified, the welding process and all welding operators employed in performing the work covered by these specifications shall be qualified in accordance with the American Welding Society Standard Qualification Procedure. A copy of all qualifications shall be submitted to contracting officer.

All structural steel and other related accessory materials for the supports shall be painted in accordance with the provisions of Section 5.1--Painting.

3.1.5 Payment

Payment for appropriate pipe spool supports shall be as provided for in par. 2.1.3.

DIVISION 4 -- INSTRUMENTATION

SECTION 4.1--INSTRUMENTATION

4.1.1 General

The contractor shall furnish all plant, labor, equipment, appliances and materials and perform all operations in connection with the construction of mechanical and pneumatic instrumentation in accordance with this section and applicable drawings. Notwithstanding any moissions from these specifications or drawings.

All materials furnished shall be as specified herein. No departures shall be made without written approval. All workmanship shall be of the highest quality. In general, all lines shall be square with the structure and with sufficient clearance to permit easy installation, removal and maintenance. Lines shall be pitched in the direction of flow for drainage.

All installation shall be performed in accordance with information in this specification, Instrument Society of America Recommended Practices, or as indicated on the drawings. Flow transmitters shall be properly installed in such a manner that the pipe design eliminates dead pockets and is self-draining. Care shall be taken to keep tubing and conduit runs away from hot pipes and under no circumstances shall they be less than six inches from any such pipe. Brine service transmitters shall have chemical seals installed on tubing from flow orifices to protect transmitter.

Tubing shall not touch each other or pipes or fixtures except as support joints. Tubing shall be supported within one foot of each joint. The distance between supports shall not exceed three feet. Supports shall be made of aluminum or a patented commercial type. All indicators and controllers shall be rigidly mounted and shall be readable at normal standing level.

Clamps, brackets, supports, etc., shall not be welded to process piping, electrical conduit, vessels or equipment. "U" bolts or other types of approved clamps shall be used.

4.1.2 Testing

Nitrogen test entire system at 1-1/2 times the working pressure or 100 psi, whichever is greater. Disconnect all instruments and cap tubing before applying test pressures. Liquid soap shall be applied to each connection and checked for leaks. All leaks detected shall be eliminated.

143

4.1.3 Cleaning

Tubing, valves and fittings shall be cleaned in accordance with Section 2.1.7 of these specifications.

4.1.4 Materials

a. Tubing--Shall be 1/4 inch and 1/2 inch O.D., 0.03 inches or 0.032 inches wall seamless copper tubing ASTM B68 or B75, light or soft Anneal Temper covered with PCV sheath.

b. Fittings--Shall be Imperial Eastman "Hi-Seal" brass or equal. Elbows and tees shall be brass forgings - SAE CA 377. Connectors, unions, sleeves and nuts shall be stress relieved brass bar stock-SAE CA360. Outside joints shall be covered with PVC tape.

c. Needle Valves--Needle valves shall be provided at air supply tubing connections to instruments and shall be same size as tubing and be similar to Imperial "Hi-Seal" series 700 with cadmium plated steel bar stock body and "O" ring seal.

4.1.5 Instruments

a. Temperature indicators--

T - 1 Brine Service
Bi-metal 5" dial adjustable thermometer, 304 ss case and stem - 2-1/2" long, 0-500°F RN, 1/2" NPT male conn., with 1/2" x 3/4" NPT x 1/2" thermowell. Rochester R-1849 or approved equal.

T - 2 Cooling Water Service
Same as T-1 except Range of 0-200°F.

b. Pressure Indicators--

P - 1 Brine Service
316 ss Bourdon tube and case, 4-1/2" Dial, 0-400 psi range, 1/4" NPT bottom conn. Marsh Model E 5460 type 100-3SS-MS or approved equal.

P - 2 Cooling Water Service
Same as P-1 except 0-200 psi range and Model No. E5454.

c. Flow Orifices--Orifice flange union, welding neck, raised face, carbon steel complete with 1/2" NPT pressure taps, bolts, nuts and tab type 1/8" AISI type 304 stainless steel orifice plate as supplied by the Foxboro Co. or approved equal.

Brine Service shall be ANSI Class 300, 350°F and 200 psig, S.G. of 0.89 and viscosity of 0.15 cp.

Cooling water service shall be ANSI Class 150, 90°F and 70 psig flow condition, S.G. of 1 and viscosity of 0.75 cp.

Manufacturer to determine orifice plate bore size, with a minimum pressure drop.

FO-1 Brine supply, 6" pipe size, 150 to 400 gpm.
FO-2 Brine supply, 2" pipe size, 0 to 150 gpm.
FO-3 Brine supply, 8" pipe size, 400 to 1000 gpm.
FO-4 Cooling Water supply, 6" pipe size, 200 to 800 gpm.
FO-5 Cooling Water supply, 3" pipe size, 0-200 gpm.

d. Flow transmitter--Transmitter, d/p cell, 20 to 250 in. H_2O span adjustability, Cadmium-plated carbon steel, tapped for 1/2" NPT process connections, 3 to 16 psi output signal and 20 psig supply pressure, calibrated range to be as listed for FO-1 through FO-5, bracket for 2-inch pipe mounting, Model 13A1 Foxboro, or equal.

e. Square Root Extractor--Square root extractor to linearize dp 3-15 psi signals from FO-1 through FO-5 transmitters. To operate with 20 psig air supply, 0.5 percent of span accuracy, in weather-proof and corrosion resistant case. Foxboro Model 557 or approved equal.

f. Flow Indicating Gauge--Receiver gage to receive 3-15 psi signal from transmitter. 270 degree concentric 6 inch dial, the same calibrated range as listed for FO-1 through FO-5, $\pm$ 1 percent of full scale accuracy, 1/4 inch NPT male lower back connection, Foxboro Model P-105-TB or approved equal.

g. Flow Indicating Controller--Pneumatic indicating flow controller, proportional plus reset, 3 to 15 psi signal, 20 psig air supply, function to manually or automatically control pneumatically actuated flow control valve with a signal received from square root extractor, increasing measurement increases air output, measurement range 3-15 psi, scale range to be in GPM of FO, brass receiver element, glass fiber reinforced case, 2" pipe field mounting, Foxboro Model 43AP or approved equal. To control FCV-1,2,3,4 &5.

h. Temperature Indicating Controller -- Pneumatic, indicating temperature controller, proportional plus reset, 20 psig air supply, 1A thermal system 75-150°F range, ss/ss 3/4" bushing mount with 2 inch insert, function to manually or automatically control pneumatically actuated control valve with temperature signal from filled capillary tube element in cooling water return line, glass fiber reinforced polyester case, 2" pipe field mounting complete with two position air switch marked "TEMP." and "FLOW", Forboro Model 43AP-A4 or approved equal to control FCV 4 and 5.

4.1.6 Instrument and Control Calibration and Adjustment

(1) All instruments shall be checked for accuracy of calibration to manufacturer's nameplate data. Adjustments and recalibration shall be made to the satisfaction of the Contracting Officer, whether installed by the Contractor or others.

(2) All control instruments, switches, remote manual controls, and signal-producing devices shall be adjusted for correct control action and connection to provide completely workable operation. Restrictions and speed regulating accessories shall be installed to provide proper operation.

(3) All control valves, cylinders, drives, and connecting linkages shall be stroked and adjusted to the satisfaction of the Contracting Officer.

(4) The Contractor shall make such personnel available during the final testing of equipment as is considered necessary by the Contracting Officer to make immediate adjustments or repairs. Contracting officer shall be notified of place and time of test 18 hrs. in advance of test.

4.1.7 Nameplates

(1) The Contractor shall supply and install permanent nameplates on all locally mounted instruments, and control valves.

(2) Nameplace data shall be as listed in the equipment schedule shown on drawing no. 6821.22C-01

Each piping spool shall have a nameplate firmly affixed to the spool near the test article interface flange. Material to be laminated phenol resin sheet 1/16" thick, semi-matte black surfaces, white center. Sheets to be cut through black surface to white center lamination. Each nameplate to be 2-1/4" long and 3/4" wide with 3/16" lettering.

Exact wording as follows:

SP-1 Brine Supply
SP-4 Brine Supply
SP-7 Brine Supply
SP-2 Brine Reinjection
SP-5 Brine Reinjection
SP-8 Brine Reinjection
SP-3 Brine Blowdown
SP-6 Brine Blowdown
SP-9 CW Supply
SP-11 CW Supply
SP-10 CW Return
SP-12 CW Return

All instruments and valves shall be tagged with corresponding numbers as indicated in the Instrument Section and the Spool Equipment Schedule.

4.1.8 Payment

Payment for appropriate instrumentation shall be as provided for in par. 2.1.3.

147

DIVISION 5 -- PAINTING

SECTION 5.1--PAINTING

5.1.1 Painting

a. General--The contractor shall furnish all materials, clean surfaces and apply the paint and protective coatings listed in Paragraph 5.1.2 (Painting Tabulation) and in accordance with Paragraph 5.1.3 (Color Schedule for Painting.)

Items or surfaces not required to be painted or coated but which are adjacent to surfaces to be cleaned and painted shall be protected against contamination and damage during the cleaning and painting operations. The cleaning and painting operations shall be so conducted that dust or other contamination from the cleaning process will not fall on wet, newly painted surfaces, and newly painted metalwork shall not be moved until the paint is dry hard. All contractor-applied coatings exposed to view, including any touchup repair painting, shall present a uniform color-matched appearance. Any items or surfaces damaged or contaminated by painting operations shall be returned to their original condition by and at the expense of the contractor. Before top-coating any coated surfaces, the contractor shall reclean any exposed metal and apply paint as necessary to restore to the specified condition all previously applied paint in areas which are defective or damaged. Materials which have been painted shall be handled with care and protected as necessary to preserve the coating in good condition.

Temporary or permanent welding for the convenience of the contractor will not be permitted on areas where the welding will damage paint or other protective coatings unless the areas of coatings which would be damaged thereby are accessible for repairing and inspection. Unless otherwise specified, the contractor will not be required to disassemble equipment or other metalwork for the purpose of painting the interiors. The contractor shall provide adequate ventilation, lighting and the necessary safety equipment for the protection of the workmen during painting and coating operation.

b. Preparation of surfaces--Surface preparation shall be in accordance with one of the following methods. The method to be used for each item is indicated in the painting tabulation. Weld spatter, slag burrs, or other objectionable surface irregularities shall be removed or repaired before cleaning. Any contaminants to the paint coating, from cleaning operations or other sources, shall be removed before the surfaces are painted. Cleaning solvent shall be mineral spirits or xylol. Cleaning cloths and solvents shall be discarded before they become contaminated to the extent that a greasy film would remain on the surface after preparation of the surface. In the event that rust forms or the surfaces become otherwise contaminated in the interval between cleaning and painting, or between coats of paint, recleaning will be required. Any coating not required by and not shown in the painting tabulation shall be removed from the surfaces by suitable and effective means, unless otherwise directed.

Method A All oil, grease, and dirt shall be removed by the use of clean solvent and clean, lint-free wiping material or other effective means. Surfaces with gloss or semigloss paints shall also be sanded lightly.

Method B All oil and grease shall be removed by the use of clean solvent and clean, lint-free wiping materials. Following the solvent cleaning, the surfaces shall be cleaned of all defective or damaged areas of existing paint, and of all loose rust, loose mill scale, and other foreign substances by scraping, chipping, wire brushing, grit-blasting, commercial grade sandblasting, or other effective means.

c. Preparation of other surfaces--All surfaces not covered by the above sub-paragraphs shall be prepared by methods common to good practice for the particular surface being prepared.

d. Application--Materials shall be thoroughly mixed at the time of application. Surfaces shall be clean and free from moisture at the time of application. Items to be painted that are not thoroughly dry at the time of paint application shall be heated to a sufficient temperature (80°F) to drive off any moisture present before paint is applied. Effective means shall be provided for removing free oil and moisture from the air-supply lines of all spraying equipment. Care

shall be exercised during spray application to hold the nozzle sufficiently close to the 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 gates, and pressure regulators. Nozzle pressure consistent with acceptable finish results shall be employed when spray painting.

Each coat shall be applied in such a manner as to produce an even film of uniform thickness which will completely cover irregularities, fill crevices, and be tightly bonded to the metal or previous coat. Each coat shall be free from runs, pinholes, and sags.

Each coat shall be allowed to dry or to harden before the succeeding coat is applied. Thicknesses shall be measured by an approved dry-film thickness gage and shall be not less than the minimum specified thickness at any point on the coating. Acceptance will be based on the total dry-film thickness as measured by an Elcometer, Mikrotest, or other suitable dry-film thickness gage, after the complete paint system has thoroughly dried.

Red lead priming paint, regular aluminum paint, and enamels, and oil base paints may be thinned if necessary to permit satisfactory application, in which event mineral spirits shall be used and the amount of thinner shall be kept to a minimum but in no event shall it exceed one pint per gallon of paint.

If necessary to improve application properties, cold-applied paints may be heated by means of a hot-water bath to temperatures not to exceed 100°F. Paint shall not be applied when the temperature of the item to be painted or of the surrounding air is under 45°F, except that vinyl resin paints shall not be applied when metal or air temperatures are above 110° or below 40°F. Painting shall proceed only when the humidity and the temperatures of atmosphere and of surfaces to be painted are such that evaporation rather than condensation will result. Brush coats may be applied by the conventional brushing procedure, or the paint may be delivered to the surface in a fluid stream by means of spray

equipment employing air pressure only on the material and the paint then spread immediately by brushing to an even smooth coating.

Tinting, where required for color contrast, shall be accomplished by using not more than three ounces of tinting color per gallon of paint.

Application of specific materials shall be as follows:

(1) Red lead priming paint shall be applied at a maximum coverage of 500-square-feet-per-gallon per coat but the dry film thickness shall be not less than 1.0 mil for the first coat. Zinc-dust-zincoxide paint shall be applied at a maximum coverage of 500-square-feet-per-gallon per coat. Following the first coat of red lead paints, an additional tinted coat shall be applied over all rivets, welds, bolts, seams, sharp corners, and edges before subsequent coats shall be applied by either brush, roller, or spray, except that Type II red lead priming paint may be applied by spraying when Method B surface preparation is specified and the surface is cleaned by "commercial" grade blast cleaning.

(2) Aluminum paints shall be applied by spraying at a maximum coverage of 500-square-feet-per-gallon per coat for regular aluminum paint. The paints shall be prepared by mixing two pounds of aluminum paste per gallon of mixing varnish and only enough paint for each day's use shall be prepared at one time. The first coat shall be tinted for color contrast using 2A blue. The final coat of aluminum paint shall be "stripe free" with a uniform appearance.

(3) Enamels and oil base paints shall be applied by brush, roller, or spray at a maximum coverage of 500-square-feet-per-gallon per coat.

e. Materials--All pigmented paints and primers shall be purchased in containers not larger than five gallons as packaged by the manufacturer. Colors of finish paints shall be as directed in accordance with Federal Standard No. 595a. All colors shall be factory mixed and ground. Tinting with universal tinting colors will not be permitted, and tinting with colors-in-oil is permitted only where specified for slight contrast between coats. Materials shall be in accordance

with the following specifications, or may be in accordance with the subsequent revisions thereto: Provided, that the samples or certifications are identified with the proper specifications revision:

Group I

(1) Federal Specifications--
  (a) Red lead priming paint, TT-P-86g, Type II.
  (b) Mixing varnish for regular aluminum paint, TT-V-81d, and aluminum paste, TT-P-320c, Type II, Class 2.
  (c) Zinc dust-zinc oxide primer, TT-P-641f, Type II.
  (d) Primer coating, zinc dust, chlorinated rubber, TT-P-001046(1), (Galvanizing repair compound).
  (e) Enamel, gloss, TT-E-489f(1), Class A

(2) Miscellaneous Specifications--
  (a) Paint and coating materials required to be used on work covered by these specifications and which are not covered by this paragraph will be classified as Group I materials, unless otherwise indicated.

Group II

(1) Federal Specifications--
  (a) Pigment-in-oil (tinting colors), TT-P-381E(1). Colors 1B black and 2A blue, or equal tinting color in oil.
  (b) Mineral spirits, TT-T-291E, Grade 1.
  (c) Xylol (xylene), TT-X-916b, Grade A or B.

f. Sampling, testing, and certification of materials--The Government will test or require certification of each batch, type, or color of paints or related materials prior to use of application. However, acceptance of the material under the clause of the General Provisions entitled "Inspection and Acceptance" will not be made until the material has been satisfactorily applied and the equipment installed at the jobsite.

The contractor shall furnish copies of all purchase orders for paint or related materials to the contracting officer. Copies of purchase orders shall be furnished far enough in advance of planned use so that the samples, if required, will be available to the Government to allow a testing period of at

least 45 days. The Government will then inform the contractor in writing whether materials covered by each purchase order will be tested or whether the manufacturer's certification will be required. The Government will act on certifications as to paint conformance within 16 days after receipt of the certifications by the Government, and will notify the contractor. Purchase orders and the required certifications or samples shall be furnished by the contractor to the Bureau of Reclamation, Construction Engineer, Yuma Projects Office, P.O. Bin 5569, Yuma, Arizona, 85364, shippnng costs prepaid, and copies of all correspondence shall be sent to the authorized representative of the contracting officer at the jobsite.

Certifications for each type, batch, or color of Group I materials shall include detailed results of laboratory tests covering all of the applicable specifications requirements and a general statement that the materials comply with the requirements of the specifications. Certifications for quantities of 10 gallons or less of each type, batch, or color of Group I materials may be furnished with only the manufacturer's quality control and composition data, and a general statement that the materials comply with the requirements of the specifications. The certifications shall also contain specific identification data as to material identification, batch number, date of manufacture, quantity being furnished, and the Bureau of Reclamation specifications number. Certifications for Group II materials need not include detailed laboratory testing data but shall comply in other respects with the requirements stated above. The Government reserves the right to test any materials furnished on certification when in the opinion of the Government, such tests are necessary. The contractor shall be responsible for the accuracy of all certifications submitted or data contained therein whether submitted by him, a manufacturer, a supplier, or a subcontractor.

The contractor shall purchase the total quantity of each item of material that is expected to be used in a reasonable length of time to avoid repetitive purchases that would impose additional testing expense on the Government. The costs and delays from additional testing required as a result of either unnecessary small purchases or rejection of the materials submitted shall be the responsibility of the contractor.

153

g. Costs--The cost of furnishing, preparing, and applying all materials for the cleaning, painting, or coating operations shall be included in the applicable prices bid in the schedule for the items of work requiring painting.

5.1.2 Painting Tabulation

Contractor furnished items shall receive the cleaning and coating systems shown in the tabulation following. Coatings shall be applied as required under Paragraph 5.1.1 (Painting).

No.	Item	Surface Preparation Method	Paint or Coating Material	Number of Coats
1	Damaged areas of paint on metalwork and equipment which are furnished complete painted or coated including panelboards, enclosures and instruments	Repair damaged areas to equal and color match undamaged contiguous areas.		
2	Damaged areas of galvanized surfaces that do not require finish painting	B	Zinc dust-zinc-oxide paint	2
3	Exterior exposed metalwork and exposed piping. Structural steel spool piping support	B	Red lead priming paint, Type II, Regular aluminum paint	1 2

5.1.3 Color Schedule for Painting

The colors and gloss of finish coats of paints will be as selected by the contracting officer except as provided in Paragraph 5.1.2 (Painting Tabulation). If items are furnished with a manufacturer's finish painting, the color and gloss of which are acceptable to the contracting officer and which meet the cleaning and painting requirements of Paragraph 5.1.1 (Painting), such items will not require field painting except for repair of damaged painted surfaces.

Color schedules for painting will be provided by the contracting officer.

DIVISION 6 -- DRAWINGS

SECTION 6.1--DRAWINGS

6.1.1 Drawings, General

a. General--In the event there are minor differences as determined by the contracting officer between details and dimensions shown on the drawings and those of existing features at the site, the details and dimensions of existing features at the site shall govern.

The contractor shall check all drawings carefully and advise the contracting officer of any errors or omissions discovered.

b. Additional or revised drawings--Except as otherwise provided in these specifications for drawings to be furnished by the contractor, the specifications drawings will be supplemented by such additional or revised general and detail drawings as may be necessary or desirable as the work progresses; and the contractor shall do no work without proper drawings and instructions. The contractor will be required to perform the work in accordance with the additional general and detail drawings or revisions furnished by the Government at the applicable prices bid in the schedule for such work.

c. Additional copies of drawings--The contractor will be furnished such additional copies of the specifications and drawings as may be required for carrying out the work.

d. Mailing address--All drawings and data submitted by the contractor for which a specific mailing address is not given in these specifications shall be submitted to the Construction Engineer, Bureau of Reclamation, Yuma Projects Office, 3800 Avenue 3 East, P.O. Bin 5569, Yuma, Arizona 85364.

6.1.2 List of Drawings

The following drawings are made a part of these specifications:

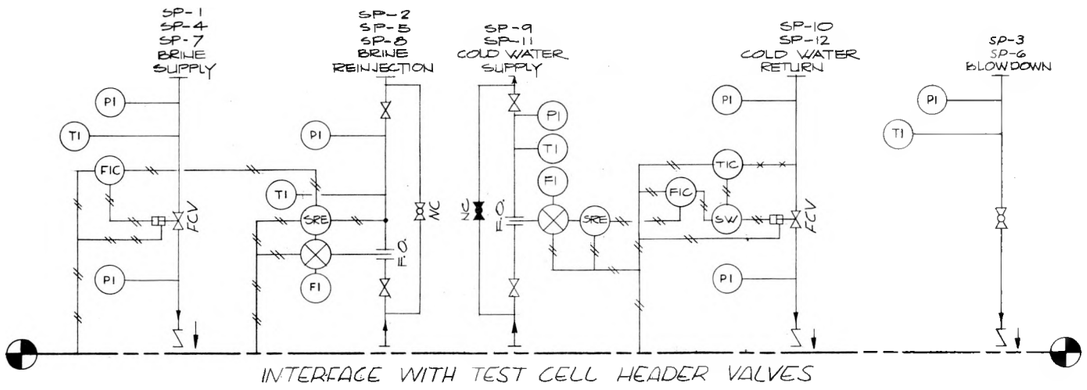
CONTROL AND INSTRUMENTATION SPOOLS
EAST MESA TEST SITE

Construction Design Drawings

6821.22C-01	Piping Diagrams and Schedules
6821.22C-02	Manifold Spools No. 1, 2, 3, 9, 10
6821.22C-03	Manifold Spools No. 4, 5, 6, 11, 12
6821.22C-04	Manifold Spools No. 7, 8

SPOOL EQUIPMENT SCHEDULE

SPOOL NO	SERVICE	INTER FACE SIZE IN.	NOMINAL SPOOL SIZE/ CLASS	OPERATING TEMP °F	OPERATING FLOW GPM	FLOW CONTROL VALVE ITEM NO.	FLOW CONTROL VALVE SIZE IN.	FLOW CONTROL VALVE NO. REQ'D	MANUAL VALVES ITEM NO.	MANUAL VALVES TYPE	MANUAL VALVES SIZE IN.	MANUAL VALVES NO. REQ'D	CHECK VALVES ITEM NO.	CHECK VALVES TYPE	CHECK VALVES SIZE IN.	CHECK VALVES NO. REQ'D	GAUGES TEMP ITEM NO.	GAUGES TEMP NO. REQ'D	GAUGES PRESS ITEM NO.	GAUGES PRESS NO. REQ'D	FLOW ORIFICES ITEM NO.	FLOW ORIFICES SIZE IN.	FLOW ORIFICES MAX ΔP PSIG	FLOW ORIFICES NO. REQ'D	SPOOL CAN BE USED @ ANY TEST CELL IN NORTH PAD	SPOOL CAN BE USED @ ANY TEST CELL IN SOUTH PAD	SPOOL SUPPORT TYPE	INSULATION WITH ALUMINUM JACKET
SP-1	BRINE SUPPLY	4/300	4	350	150-400				V-1 V-2	BALL BALL	4 3	2 1					T1-1	1	P1-1	1	FO-1	4	5	1	X	X	II	2"
SP-2	BRINE REINJECTION	6/300	6	350	150-400	FCV-1	6	1					CV-1	POPPET	6	1	T1-1	1	P1-1	2					X	X	II	2"
SP-3	BRINE BLOWDOWN	4/300	4	350	150-400				V-3	BALL	4	1	CV-2	POPPET	4	1	T1-1	1	P1-1	1					X	X	II	2"
SP-4	BRINE SUPPLY	4/300	2	350	0-150				V-4	BALL	2	3					T1-1	1	P1-1	1	FO-2	2	5	1	X	X	I	2"
SP-5	BRINE REINJECTION	6/300	3	350	0-150	FCV-2	3	1					CV-3	POPPET	6	1	T1-1	1	P1-1	2					X	X	I	1-1/2"
SP-6	BRINE BLOWDOWN	4/300	2	350	0-150				V-5	BALL	2	1	CV-4	POPPET	4	1	T1-1	1	P1-1	1					X	X	I	1-1/2"
SP-7	BRINE SUPPLY	8/300	8	350	400-1000				V-6 V-7	BALL BALL	8 6	2 1					T1-1	1	P1-1	1	FO-3	8	5	1		X	II	2"
SP-8	BRINE REINJECTION	8/300	8	350	400-1000	FCV-3	8	1					CV-5	POPPET	8	1	T1-1	1	P1-1	2						X	II	2"
SP-9	CW SUPPLY	6/300	6	90	200-800				V-8 V-9	GATE GLOBE	6 4	2 1					T1-2	1	P1-2	1	FO-4	6	5	1	X	X	II	NONE
SP-10	CW RETURN	6/300	6	90	200-800	FCV-4	6	1					CV-6	SWING	6	1			P1-2	2					X	X	II	NONE
SP-11	CW SUPPLY	6/300	3	90	0-200				V-10 V-11	GATE GLOBE	3 2	2 1					T1-2	1	P1-2	1	FO-5	3	5	1	X	X	I	NONE
SP-12	CW RETURN	6/300	3	90	0-200	FCV-5	3	1					CV-7	SWING	3	1			P1-2	2					X	X	I	NONE



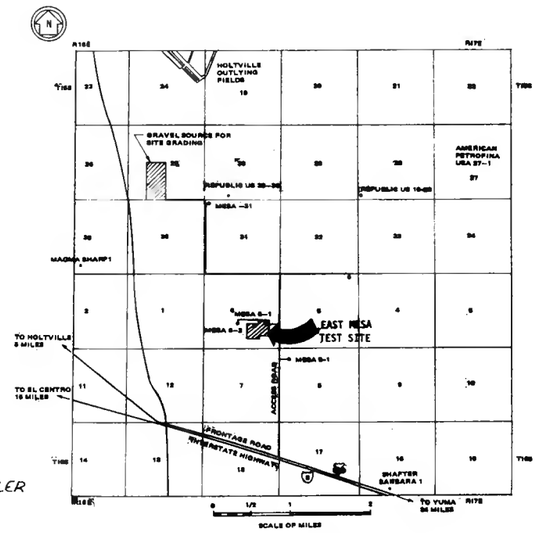
TYPICAL TEST CELL P&ID
NORTH OR SOUTH PAD

LEGEND

- (TI) TEMPERATURE INDICATOR
- (PI) PRESSURE INDICATOR
- (SRE) SQ. ROOT EXTRACTOR
- (FI) FLOW INDICATOR
- (FIC) FLOW INDICATING CONTROLLER
- (TIC) TEMPERATURE INDICATING CONTROLLER
- TRANSMITTER
- BALL VALVE
- GATE VALVE
- GLOBE VALVE
- FLOW CONTROL VALVE PNEUMATIC PISTON OPERATED
- CHECK VALVE
- F.O. FLOW ORIFICE
- INSTRUMENT AIR LINE
- INSTRUMENT CAPILLARY TUBING
- NC NORMALLY CLOSED
- (SW) TWO WAY AIR SWITCH

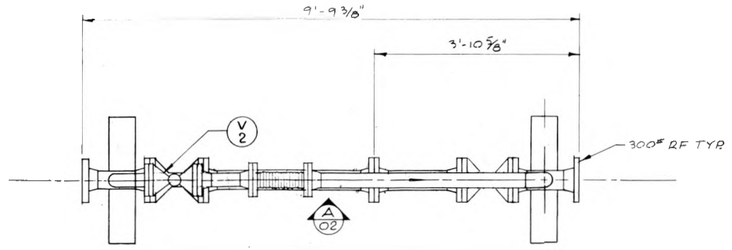
CONTROL AND INSTRUMENTATION SPOOLS

6821.22C-01	PIPING DIAGRAMS AND SCHEDULES
6821.22C-02	MANIFOLD SPOOLS NO. 1, 2, 3, 9, 10
6821.22C-03	MANIFOLD SPOOLS NO. 4, 5, 6, 11, 12
6821.22C-04	MANIFOLD SPOOLS NO. 7, 8

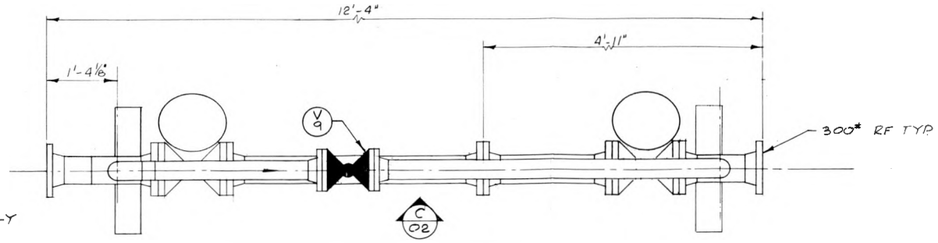


LOCATION PLAN

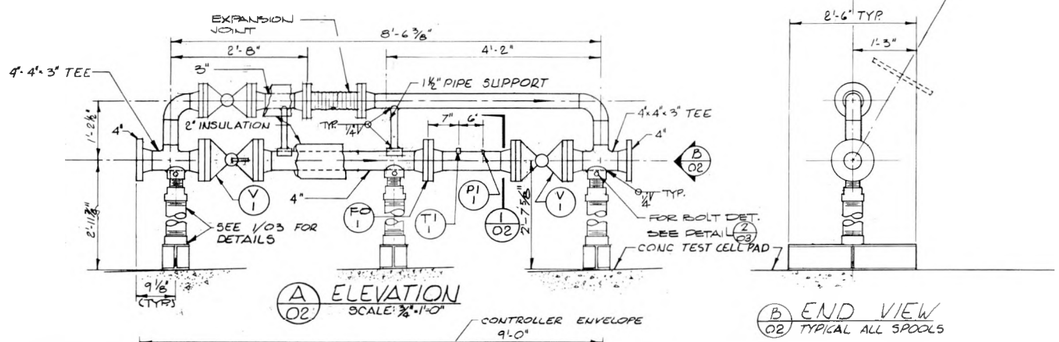
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP
CONTROL & INST. SPOOLS PIPING DIAGRAMS & SCHEDULES	ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
DATE 15 OCT 1976	DWG NO. 6821.22C-01
DRAWN RCG	
CHKD B.E.	
APPRVD.	APPRVD. – PROGRAM OFFICE RO Pearson



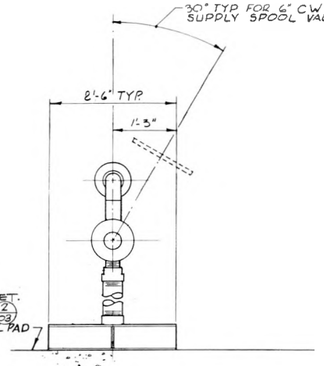
SP-1 BRINE SUPPLY SPOOL PLAN
SCALE: 3/4"=1'-0"



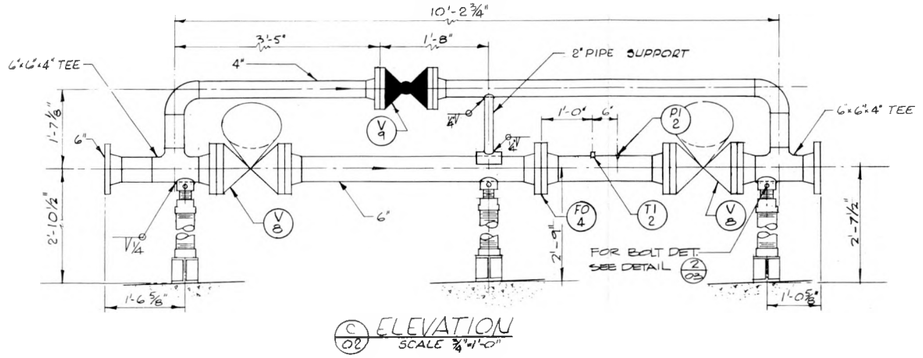
SP-9 CW SUPPLY SPOOL
SCALE 3/4"=1'-0"



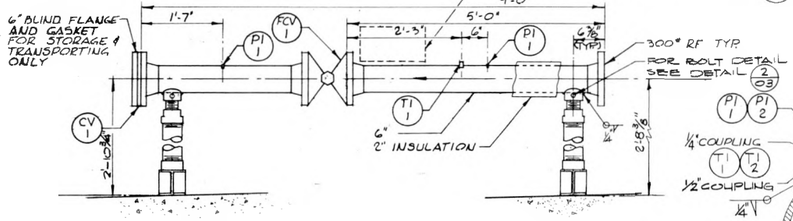
A 02 ELEVATION
SCALE: 3/4"=1'-0"



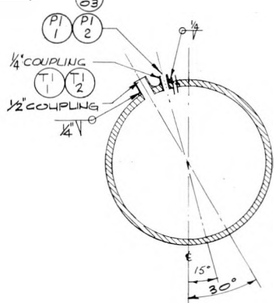
B 02 END VIEW
TYPICAL ALL SPOOLS

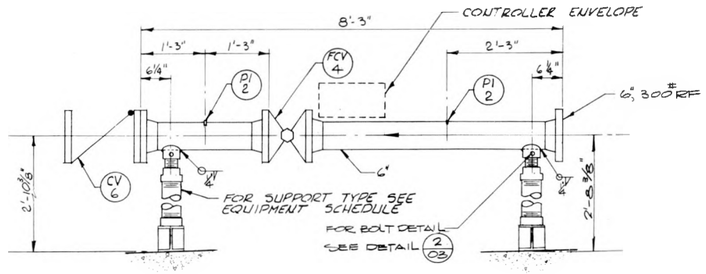


C 02 ELEVATION
SCALE 3/4"=1'-0"

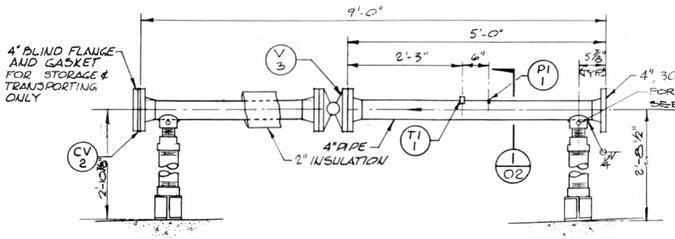


SP-2 BRINE REINJECTION SPOOL ELEVATION
SCALE: 3/8"=1'-0"





SP-10 CW RETURN SPOOL ELEVATION
SCALE: 3/4"=1'-0"



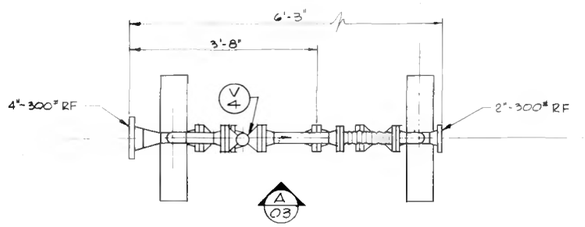
SP-3 BRINE BLOWDOWN SPOOL ELEVATION
SCALE: 3/8"=1'-0"

1/2 PIPE SECTION - TYPICAL
NO SCALE

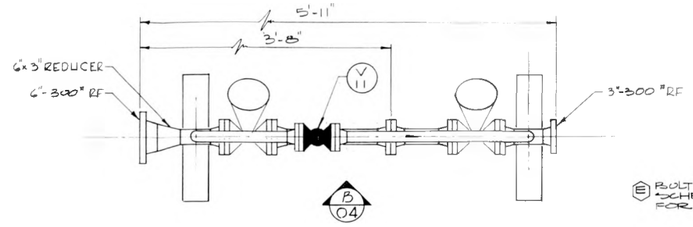
3/4" = 1'-0"

1' 9" 6" 3" 0 1 2 3 4 5 FEET

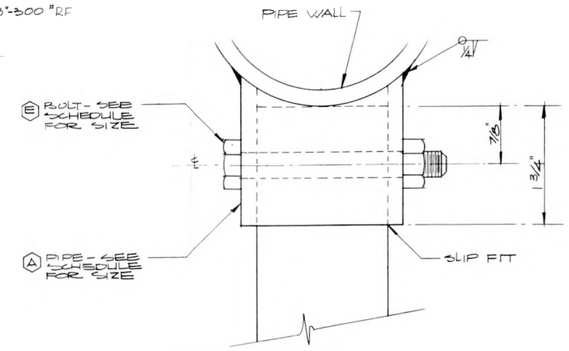
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
CONTROL & INSTR. SPOOLS MANIFOLD SPOOLS NO 1, 2, 3, 9, 10	
DATE 15 OCT 1976	DWG. NO. 6821.22C-02
DRAWN DRR/RJC	
CHKD. B.E.	
APPRVD.	APPRVD – PROGRAM OFFICE R O Pearson



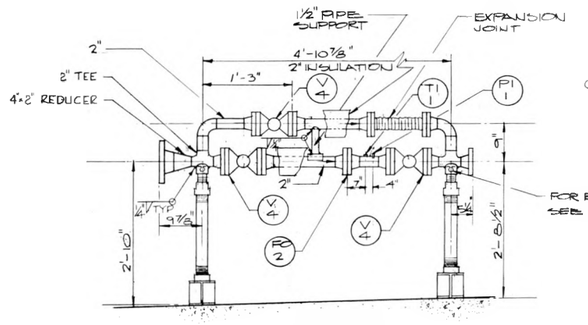
SP-4 BRINE SUPPLY SPOOL PLAN
SCALE: 3/4"=1'-0"



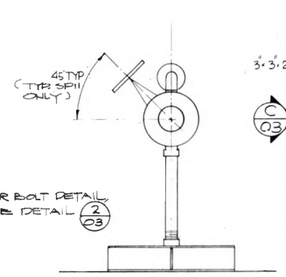
SP-11 C.W. SUPPLY SPOOL PLAN
SCALE: 3/4"=1'-0"



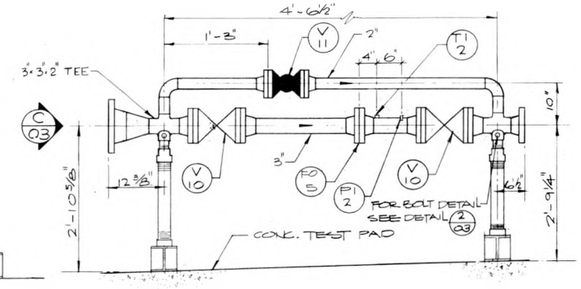
BOLT DETAIL
SCALE: FULL SIZE



A 03 ELEVATION
SCALE: 3/4"=1'-0"

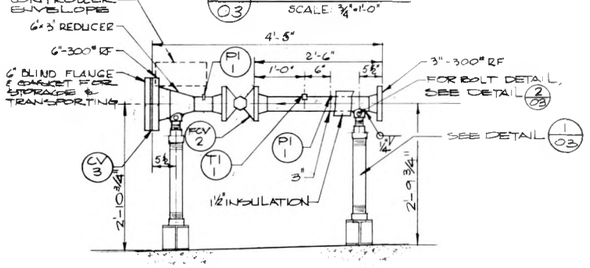


C 03 END VIEW

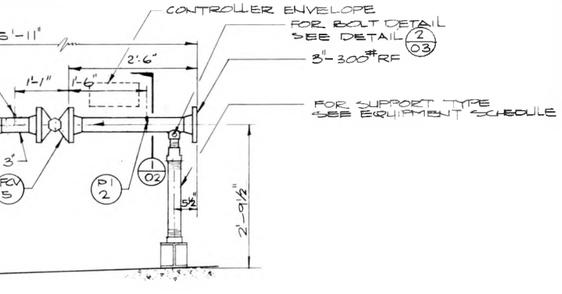


B 03 ELEVATION
SCALE: 3/4"=1'-0"

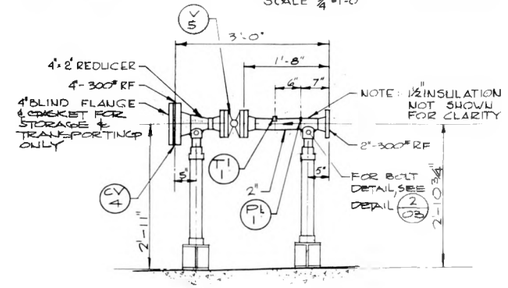
NOTES:
1. ALL SUPPORT HEIGHTS ARE CALCULATED WITH ADJUSTABLE PIPE AT MID HEIGHT
2. ADJUSTABLE PIPE SUPPORT (B) TO BE EQUAL TO GRINNELL Fig. 264 LESS YOKE
3. SEE SPOOL EQUIPMENT SCHEDULE FOR PIPE SUPPORT TYPE.



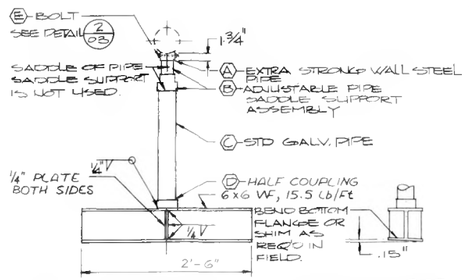
SP-5 BRINE REINJECTION SPOOL ELEVATION
SCALE 3/4"=1'-0"



SP-12 CW RETURN SPOOL ELEVATION
SCALE 3/4"=1'-0"



SP-6 BLOW DOWN SPOOL ELEVATION
SCALE 3/4"=1'-0"



1 03 ADJUSTABLE PIPE SUPPORT DETAIL
SCALE: 1"=1'-0"

PIPE SUPPORT SCHEDULE

SUPPORT TYPE	COMPONENT				
	A	B	C	D	E
I	2" SCH. 80 PIPE	2½" ASSEMBLY	2½" SCH. 40 PIPE	2½" SCH. 40 PIPE	3/8"x3"
II	3" SCH 80 PIPE	4" ASSEMBLY	3" SCH. 40 PIPE	3" SCH 40 PIPE	½"x4"

3/4" = 1'-0" 1' 9" 6" 3" 0 1 2 3 4 5 FEET
1" = 1'-0" 1' 9" 6" 3" 0 1 2 3 FEET

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

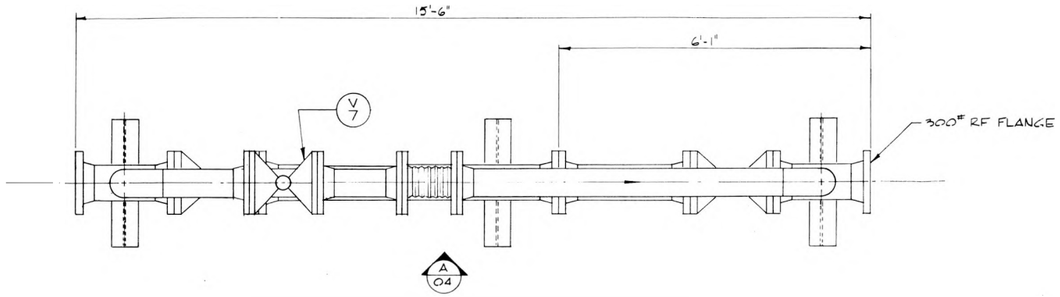
CONTROL & INSTR. SPOOLS
MANIFOLD SPOOLS
NO. 4, 5, 6, 11, 12

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

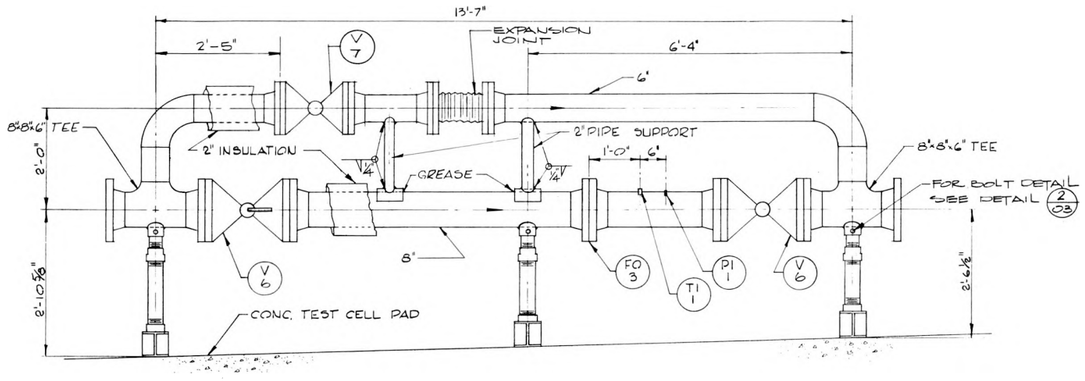
DATE 15 OCT 1976
DRAWN KJC, DRR
CHKD. BE
APPRVD. —

APPRVD. – PROGRAM OFFICE RO Pearson

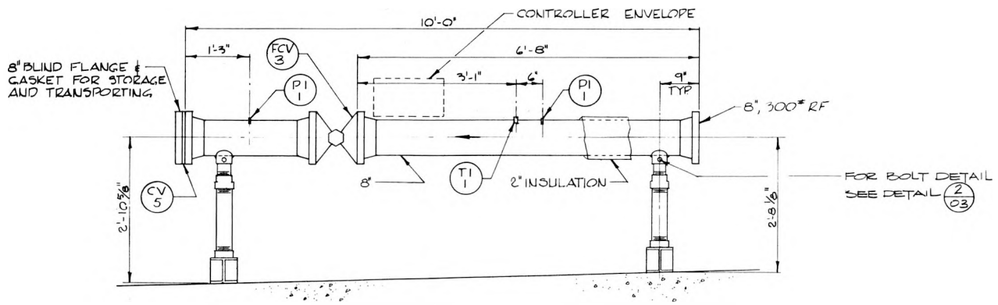
DWG NO. 6821.22C-03



SP-7 BRINE SUPPLY SPOOL PLAN
SCALE: 3/4"=1'-0"



A/04 ELEVATION
SCALE: 3/4"=1'-0"



SP-8 BRINE REINJECTION SPOOL ELEVATION
SCALE: 3/4"=1'-0"

3/4" = 1'-0"

1" 9" 6" 3" 0 1 2 3 4 5 FEET

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
CONTROL & INSTR. SPOOLS MANIFOLD SPOOLS NO. 7,8	
DATE 15 OCT 1976 DRAWN K.J.C. CHKD. B.E.	DWG. NO. 6821.22C-04
APPRVD.	APPRVD. – PROGRAM OFFICE R.O. Pearson

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Contract No. E(04-3) - 1140

TASK 4.1.4
CALIBRATION TEST BENCH
SPECIFICATION 6821.22D-S

Prepared by:

Environmental, Power and Facilities Department

TRW
SYSTEMS GROUP

FOREWORD

Work under these specifications consists of furnishing and installing equipment for the calibration of thermometers.

DESCRIPTION OF THE WORK

Furnish and install complete temperature comparison calibration system to calibrate all types of thermometers up to and including 16 inches in length with an overall system accuracy of $\pm$ 0.47°F on an RSS basis over a range of + 40°F to 940°F.

BIDDING SCHEDULE FOR
SPECIFICATION NO. 6821.22D-S

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
1	Temperature Instrument Calibration System	For the lump sum of		

CALIBRATION TEST BENCH

GENERAL OUTLINE

DIVISION 2--TEMPERATURE INSTRUMENT CALIBRATION SYSTEM

SECTION 2.1--TEMPERATURE INSTRUMENT CALIBRATION SYSTEM

- 2.1.1 General
- 2.1.2 Payment
- 2.1.3 System Equipment

DIVISION 3--DRAWINGS

SECTION 3.1--DRAWINGS

- 3.1.1 Drawings, General
- 3.1.2 List of Drawings

DIVISION 2 -- TEMPERATURE INSTRUMENT CALIBRATION SYSTEM

SECTION 2.1--TEMPERATURE INSTRUMENT CALIBRATION SYSTEM

2.1.1 General

The contractor shall furnish and install a complete temperature calibration system to calibrate all types of thermometers up to and including 16 inches in length with an overall system accuracy of ± 0.47°F on an RSS basis over a range of + 40°F to 940°F.

The equipment installation will be made within an existing building at the East Mesa Test Site. The exact location shall be determined during construction by the contracting officer; refer to drawings for installation location.

Installation by the contractor shall further include provision and installation of electrical power to the calibration unit. This shall be by a separate circuit made of #10 AWG wire and incorporating a 30 ampere breaker. Exact location of electrical power outlet will be determined by contracting officer at time of installation.

2.1.2 Payment

Payment for furnishing and installing Temperature Instrument Calibration System will be made at a lump sum price bid in the Bidding Schedule.

2.1.3 System Equipment

System equipment shall be as manufactured by Rosemount, Inc., Post Office Box 35129, Minneapolis, Minnesota 55435, or approved equal, as follows:

Quantity	Part No.	Item
1 ea	914C3	Console, bath and storage - with 37" high x 26" wide x 25" deep basic module, a 2 shelf with door storage module and a 78" x 27-1/2" plastic clad writing desk top. Finish to be blue enamel and anodized aluminum trim.

Quantity	Part No.	Item
1 ea	910AC2	Bath, assembly, mechanically refrigerated, top agitated, 2-1/2" diameter x 13" long 1.7 gallon calibration zone. Maximum power consumption 16 amperes at 115 volts. A variable temperature calibration system consisting of an agitation assembly with a heating coil, stirrer and flow chute; a platinum resistance control sensor and control module; a stainless steel dewar and a mechanical refrigeration unit.
1 ea	78-65-41	Temperature sensor, 12" long, single element, 316 stainless steel, -100 to 400°C with teflon insulated, nickel plated, 22 gage stranded copper lead wires.
1 ea	414L	Signal bridge, 1 mv/°F linear output.
1 ea	420S	Chassis for signal bridge including line cord, enclosed 115V power connection for bench mounting of bridge and terminal strip for connecting sensor and signal leadwires.
2 gal	10485-3	Silicone oil, No. 200, vis = 5 CSTK @ 25°C, 135°C flash point.
2 gal	8701	Silicone oil, No. 710, visc = 500 CSTK @ 25°C, 300°C flash point.
2 gal	9979	Diffusion pump oil, No. 704, visc = 39 CSTK @ 25°C, 221°C flash point.
Newport Laboratories, Inc., or approved equal:		
1 ea	203-03	Voltmeter, millivolt ac range digital, 1 millivolt resolution, DIN cutout, 92 x 45 mm, 1/2" LED display, plastic case, 115 volts.

DIVISION 3 -- DRAWINGS

SECTION 3.1--DRAWINGS

3.1.1 Drawings, General

a. General--In the event there are minor differences as determined by the contracting officer between details and dimensions shown on the drawings and those of existing features at the site, the details and dimensions of existing features at the site shall govern.

The contractor shall check all drawings carefully and advise the contracting officer of any errors or omissions discovered.

b. Additional or revised drawings--Except as otherwise provided in these specifications for drawings to be furnished by the contractor, the specifications drawings will be supplemented by such additional or revised general and detail drawings as may be necessary or desirable as the work progresses; and the contractor shall do no work without proper drawings and instructions. The contractor will be required to perform the work in accordance with the additional general and detail drawings or revisions furnished by the Government at the applicable prices bid in the schedule for such work.

c. Additional copies of drawings--The contractor will be furnished such additional copies of the specifications and drawings as may be required for carrying out the work.

d. Mailing address--All drawings and data submitted by the contractor for which a specific mailing address is not given in these specifications shall be submitted to the Construction Engineer, Bureau of Reclamation, Yuma Projects Office, 3800 Avenue 3 East, P.O. Bin 5569, Yuma, Arizona 85364.

3.1.2 List of Drawings

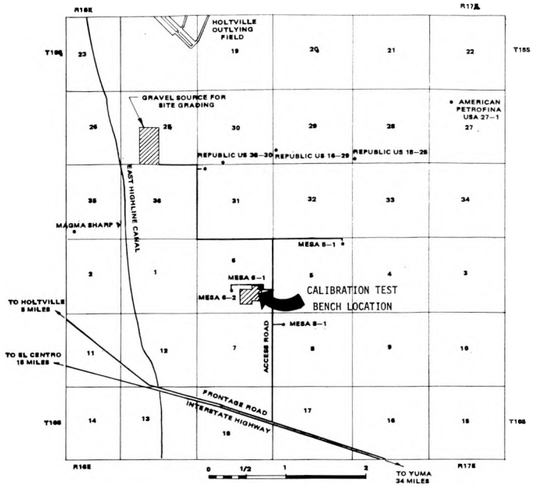
The following drawings are made a part of these specifications:

TEMPERATURE INSTRUMENT CALIBRATION SYSTEM
EAST MESA TEST SITE

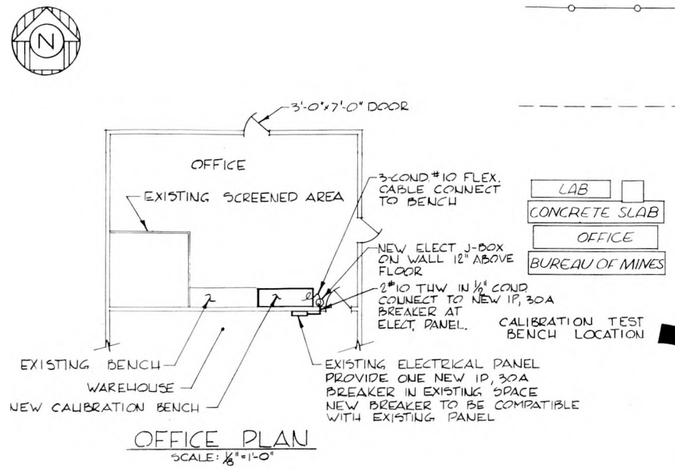
Installation Drawings

6821.22D-01 Bench Installation

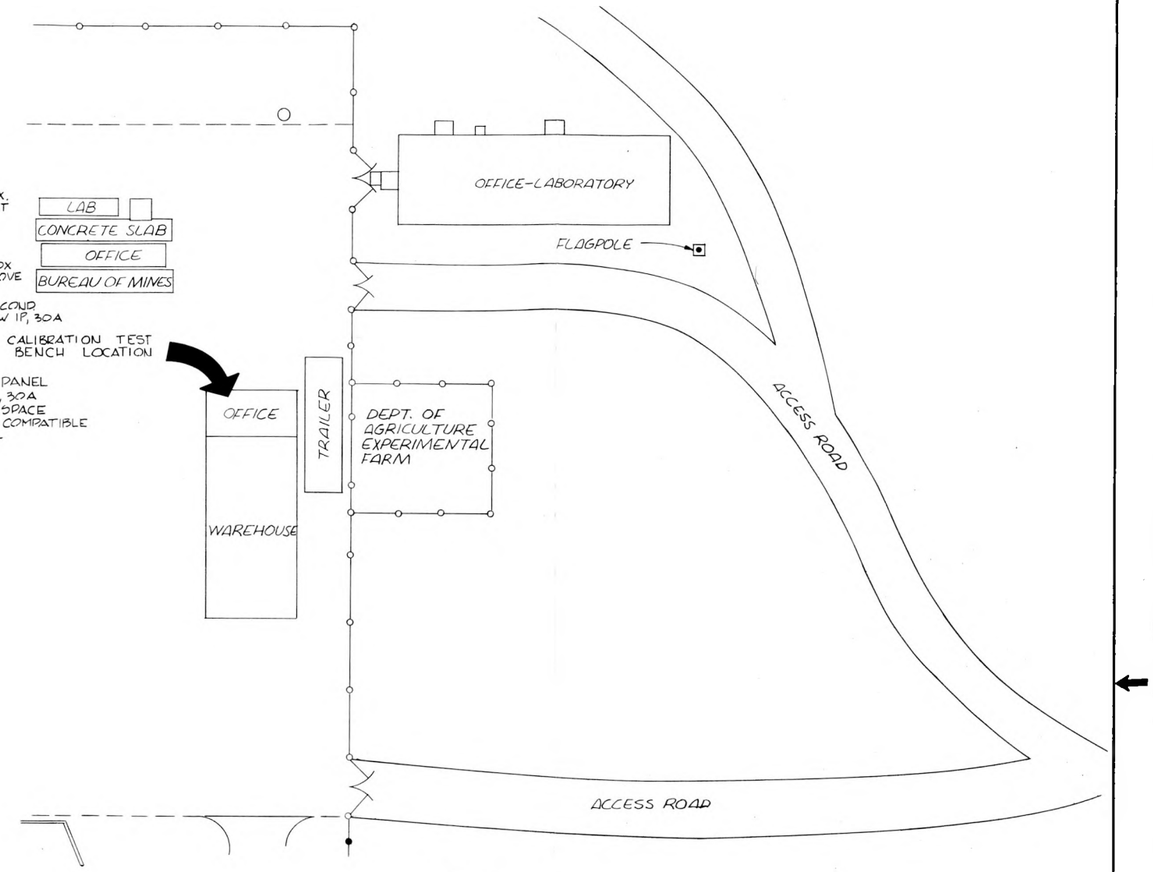
174



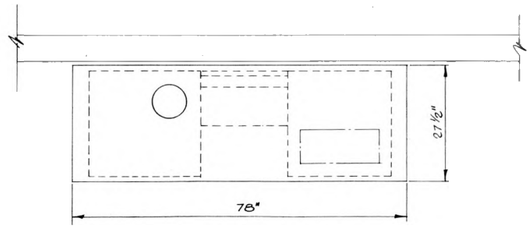
LOCATION PLAN



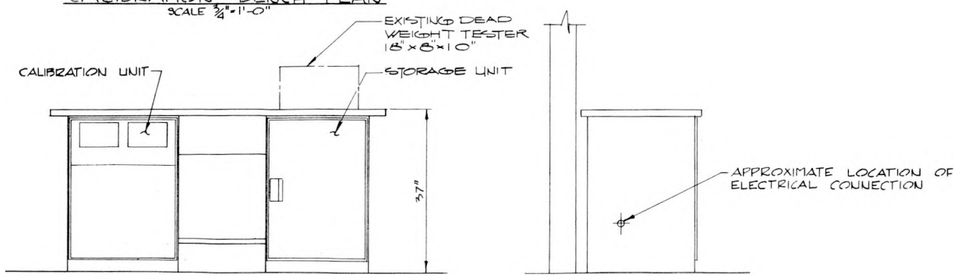
OFFICE PLAN
SCALE: ⅛"=1'-0"



SITE PLAN
SCALE: 1"=30'-0"



CALIBRATION BENCH PLAN
SCALE ¾"=1'-0"



FRONT ELEVATION
SCALE: ¾"=1'-0"

LEFT SIDE VIEW
SCALE: ¾"=1'-0"

1"=30'-0" 10 5 0 10 20 30 40 50 60 70 80

1/8"= 1'-0" 8' 6' 4' 2' 0 8 16 FEET

3/4" = 1'-0" 1' 9" 6" 3" 0 1 2 3 4 5 FEET

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
CALIBRATION TEST BENCH BENCH INSTALLATION	
DATE 15 OCT 1976 DRAWN RJC CHKD. R. COREY APPRVD.	DWG. NO. 6821.22D-01 APPRVD. – PROGRAM OFFICE R O Pearson

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Contract No. E(04-3) - 1140

TASK 4.1.5

TEST PAD MODIFICATIONS

SPECIFICATION 6821.22E-S

July 28, 1976

Prepared by:

Environmental, Power and Facilities Department

TRW
SYSTEMS GROUP

FOREWORD

The work is situated approximately 10 miles east of Holtville, California, in Imperial County. Work to be performed includes construction of additions to and modifications of ERDA Test Facilities at the test site.

The principal feastures of the work to be performed include:

1. Furnishing and erecting a 60'x160' metal shade structure.
2. Furnishing and placing an 80'x175' reinforced concrete test base, including shade structure footings.
3. Modifying the existing test base to accept footings for the shade structure.
4. Removal of 4 existing lamp standards and relocation of lamps on shade structure.
5. Relocation of existing test base grounding system.
6. Furnishing and placing 2-18" corrugated metal pipe culverts for future piping.
7. Furnishing and placing 1-15" corrugated metal pipe culvert and concrete end structures, and relocating existing insulated 8" steel pipe (from well 8-1) through culvert.
8. Furnishing and placing 1-18" corrugated metal drainage pipe with concrete headwall.
9. Furnishing and placing A.C. paved parking area and access road for new test pad.
10. Removal and relocation of fencing, including furnishing and erecting sufficient new fencing and posts to complete.
11. Electrical and grounding systems for outdoor lighting.
12. All earthwork, including trenches, required for completion of this work package.

Description of the Work

The principal components of the work to be performed under these specifications include the following:

a. Furnishing and erecting a 60 foot by 160 foot metal shade structure complete, including all components, fastenings, and finishes.

b. Furnishing and placing an 80 foot by 175 foot reinforced concrete test base, and shade structure footings, including expansion joints, and placing all conduit, anchor bolts, and miscellaneous metal required to be embedded in the concrete test base and shade structure footings.

c. Perform modifications to the existing concrete test base to permit the installation of footings for the metal shade structure.

d. Removal and salvage of four existing lamp standards and lamps, and reinstallation of lamps on the shade structure.

e. Relocation of grounding grid for existing test base to avoid conflict with new construction.

f. Furnishing and placing 2-18" corrugated metal pipe culverts for future piping under the new a.c. paved access road. The ends of these culverts are to be closed with removable covers.

g. Furnishing and placing 1-15" corrugated metal pipe culvert with concrete entrance wells at each end and relocating existing 8" insulated steel pipe (from well 8-1) through culvert.

Description of work (cont.)

h. Furnishing and placing 1-18" corrugated metal pipe drainage culvert and concrete headwall.

i. Furnishing and placing a.c. paved parking area adjoining new test pad and a.c. paved access road.

j. Removal of indicated barbed wire fencing and removal and relocation of existing chain link fencing and posts, including furnishing and erecting of new fencing and posts as required.

k. Provide and install electrical and grounding systems for outdoor lighting.

l. All earthwork including trenches, required for completion of this work package.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
1	Furnishing and erecting a 60'x160' metal shade structure	For the lump sum of		
2	Furnishing and applying finish color paint to shade structure	Per coat		
3	Furnishing and installing electrical and grounding systems, including relocating 4 existing lamps on shade structure	For the lump sum of		
4	Removal and salvage of 4 lamp standards and removal of footings	For the lump sum of		
5	Relocate existing grounding grid	For the lump sum of		
6	Excavation from borrow (fill for slab)	1514 C.Y.		
7	Excavation for structures	93 C.Y.		
8	Backfill about structures	88 C.Y.		
9	Compacting the backfill about structures	88 C.Y.		
10	Furnishing and placing gravel fills under concrete and for french drain	225 C.Y.		
11	Furnishing and placing concrete for test base and miscellaneous structures	317 C.Y.		
12	Furnishing and handling cement	1937 cwt.		
13	Furnishing and placing reinforcement	23,932 lbs.		

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
14	Furnishing and laying 18" corrugated metal pipe and flared end section	43 L.F.		
15	Furnishing and laying 15" corrugated metal pipe	120 L.F.		
16	Excavation for subgrade of access road and parking pad and drainage ditch	45 C.Y.		
17	Borrow materials for sub-grade of access road and parking pad	1561 C.Y.		
18	Compacting of access road and parking pad subgrade materials	1561 C.Y.		
19	Aggregate base for access road and parking pad	102 ton		
20	Liquid asphalt Grade MC-250 (prime)	2.43 ton		
21	Cationic emulsified asphalt Grade CMS-2h (seal coat)	2.02 ton		
22	Asphalt cement, Grade 60-70 (AR-8000) for plant mix	16.6 ton		
23	Plant mix bituminous surfacing	207.5 ton		
24	Aggregate for seal coat	22.71 ton		
25	Tack Coat	0.04 ton		
26	Removal and relocation of existing fencing and posts and provision and erection of new fencing and posts	For the lump sum of		
27	Furnish and install 8" diameter schedule 40 steel pipe (salvage and reuse existing 40' section)	3.5 L.F.		

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
28	Furnish and install miscellaneous steel pipe fittings including but not limited to: tapers, tees, elbows, flanges and caps	200 Lbs.		
29	Furnish and install pipe insulation 8" pipe 2" thick	46.7 L.F.		
30	Furnish and install pipe supports and protection saddles	120 Lbs.		

TEST PAD MODIFICATION

GENERAL OUTLINE

DIVISION 2--DEMOLITION

Section 2.1--DEMOLITION

- 2.1.1 Preparatory Operations
- 2.1.2 Lamp Standards and Lamps
- 2.1.3 Chain-Link Fence
- 2.1.4 Piping
- 2.1.5 Modifications to Existing Concrete Slab
- 2.1.6 Miscellaneous Demolition
- 2.1.7 Payment

DIVISION 3--EARTHWORK

Section 3.1--EARTHWORK

- 3.1.1 Classification of Excavation
- 3.1.2 Site Grading
- 3.1.3 Excavation for Structures
- 3.1.4 Backfill About Structures
- 3.1.5 Compacting Backfill About Structures
- 3.1.6 Excavation and Backfill for Trenches
- 3.1.7 Excavation From Borrow
- 3.1.8 Disposal of Excavated Materials
- 3.1.9 Gravel Fills
- 3.1.10 Compacting Earth Materials
- 3.1.11 Cutting and Repairing Asphalt Surfacing

DIVISION 4--CONCRETE

Section 4.1--CONCRETE

- 4.1.1 Concrete, General
- 4.1.2 Materials
- 4.1.3 Composition
- 4.1.4 Batching and Mixing
- 4.1.5 Forms, Preparation for Placing, and Placing
- 4.1.6 Protection and Curing
- 4.1.7 Repair of Concrete
- 4.1.8 Reinforcement
- 4.1.9 Measurement and Payment

Section 4.2--SPECIAL CONCRETE REQUIREMENTS

- 4.2.1 Joints in Concrete
- 4.2.2 Tooled Edges and Tooled Grooves
- 4.2.3 Concrete Floor Hardener
- 4.2.4 Grouting Mortar for Metalwork
- 4.2.5 Dowels

DIVISION 5--ACCESS ROAD AND PARKING AREA

Section 5.1--EARTHWORK FOR ACCESS ROAD AND PARKING AREA

- 5.1.1 General
- 5.1.2 Excavation for Roadway and Parking Area
- 5.1.3 Preparation of Surfaces Under Roadway and Parking Area Embankments
- 5.1.4 Construction of Roadway and Parking Area Embankments
- 5.1.5 Moistening and Compacting Roadway and Parking Area Embankments
- 5.1.6 Subgrade
- 5.1.7 Excavation for Drainage Channels

Section 5.2--BITUMINOUS SURFACING

- 5.2.1 General
- 5.2.2 Sampling, Certification, and Testing of Bituminous Materials
- 5.2.3 Weights of Roadway Materials
- 5.2.4 Aggregates for Bituminous Surfacing
- 5.2.5 Aggregate Base
- 5.2.6 Fine Grading of Base Course
- 5.2.7 Distributor for Applying Liquid Asphalt
- 5.2.8 Liquid Asphalt Prime Coat
- 5.2.9 Plant-Mix Bituminous Surfacing
- 5.2.10 Aggregate Seal Coat
- 5.2.11 Tack Coat

DIVISION 6--PIPE CULVERTS

Section 6.1--CULVERTS

- 6.1.1 Pipe Culverts
- 6.1.2 Furnishing and Laying Corrguated Metal Pipe

DIVISION 7--PIPING ALTERATIONS

Section 7.1--PIPELINES

- 7.1.1 Pipelines
- 7.1.2 Testing the Pipeline
- 7.1.3 Guarantee
- 7.1.4 Steel Pipe and Fittings
- 7.1.5 Pipe Supports and Saddles

DIVISION 8--CONSTRUCTION OF SHADE STRUCTURE BUILDING

Section 8.1--PREFABRICATED METAL BUILDING

8.1.1 General and Payment
8.1.2 Prefabricated Metal Building
8.1.3 Drawings and Data to be Furnished by Contractor
8.1.4 Dimensions
8.1.5 Materials for Structural Framing
8.1.6 Design Stresses and Loads
8.1.7 Fabrication
8.1.8 Erection
8.1.9 Protective Coating for Building Metalwork
8.1.10 Roofing and Siding
8.1.11 Monitors

Section 8.2--MISCELLANEOUS METALWORK

8.2.1 Miscellaneous Metalwork

Section 8.3--PAINTING

8.3.1 Painting
8.3.2 Painting Tabulation
8.3.3 Color Schedule for Painting

DIVISION 9--ELECTRICAL

Section 9.1--ELECTRICAL AND GROUNDING SYSTEMS

9.1.1 General
9.1.2 Acceptance of Electrical and Grounding Systems
9.1.3 Drawings and Data to be Furnished by the Contractor
9.1.4 Grounding System
9.1.5 Electrical Conduit System
9.1.6 Insulated Electrical Wires and Cables
9.1.7 Circuit Breaker
9.1.8 Lighting Fixtures
9.1.9 Payment

DIVISION 10--FENCING

Section 10.1--CHAIN LINK FENCE

10.1.1 General

DIVISION 11--DRAWINGS

Section 11.1--DRAWINGS

11.1.1 Drawings, General
11.1.2 List of Drawings

DIVISION 2 -- DEMOLITION

SECTION 2.1--DEMOLITION

2.1.1 Preparatory Operations

a. All electric, gas, water, steam and other service lines shall be shut off, capped, or otherwise controlled, outside the work area before demolition work is started. In each case, any utility company which is involved shall be notified in advance.

b. If it is necessary to maintain any power, water or utilities during demolition, such lines shall be temporarily relocated, as necessary, and protected.

c. It shall be determined if any type of hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances have been used in any affected receptacle on the property. When the presence of any such substances is apparent or suspected, testing and purging shall be performed and the hazard eliminated before demolition is started.

2.1.2 Lamp Standards and Lamps

a. Four existing lamp standards and lamps, as defined and located in the drawings shall be removed by the contractor. Concrete lamp standard footings shall be removed and wasted.

b. Lamp standards shall be preserved intact and delivered to such location for storage as determined by the Contracting Officer.

c. Lamps shall be removed from the standards intact and relocated on the shade structure as shown on the drawings.

2.1.3 Chain-Link Fence

a. The existing chain link fence, posts and post footings shall be removed by the contractor in accordance with Specification Division 10-Fencing.

2.1.4 Piping

a. Piping from Well Mesa 8-1 shall be relocated by the contractor through the new culvert under the new access road as shown on the drawings and in accordance with Specification Division 7--Piping Alterations.

2.1.5 Modifications to Existing Concrete Slab

a. Openings shall be saw-cut in the existing concrete slab as shown in the drawings, in preparation for later excavation and installation of footings. Concrete slab sections cut out shall be removed and wasted by the contractor, and the resulting opening filled with clean gravel to a level flush with the top of the concrete slab.

2.1.6 Miscellaneous Demolition

a. Any other items of demolition as indicated in the drawings shall be performed by the contractor. These items include, but shall not be limited to, removal of barbed wire fencing and posts, relocation of grounding counterpoise, and electrical or grounding conductor modification.

2.1.7 Payment

a. Payment for performing the demolition will be made at the lump sum price bid therefor in the schedule, which lump sum price shall include furnishing all labor, equipment and material required to perform the demolition as described in these paragraphs including wasting and storing of materials.

DIVISION 3--EARTHWORK

SECTION 3.1--EARTHWORK

3.1.1 Classification of Excavation

a. General--Materials excavated will not be classified for payment. Except as otherwise provided in these specifications, material excavated will not be measured and the cost of excavation of all materials required to be excavated shall be included in the prices bid in the schedule for various items of work. No additional allowance will be made on account of any of the material being wet. Bidders and the contractor must assume all responsibility for deductions and conclusions as to the nature of the materials to be excavated and the difficulties of making and maintaining the required excavations.

b. Clearing--Any brush, plant growth, or other unsuitable material shall be removed and disposed of as provided in Paragraph 1.6.5 (Cleanup and Disposal of Waste Materials). The cost of all clearing shall be included in the prices bid in the schedule for various items of work.

3.1.2 Site Grading

a. General--The contractor shall perform all excavation for site grading to the subgrade for final elevations as shown on the drawings or established by the contracting officer. The contractor shall use materials removed in excavation for constructing fills. Fills shall be constructed and compacted in accordance with provisions of Subparagraph b., hereof. Any extra or unsuitable excavated material from site grading shall be disposed of in waste areas as directed by the contracting officer.

b. Constructing fills--The area on which fills are to be placed shall be scarified to a depth of three inches, moistened and compacted to meet the requirements of Paragraph 3.1.12 (Compacting Earth Materials). Fills shall be constructed to the established lines and grades shown on the drawings and as required for the construction of the test slab structures. Fills

shall be placed in continuous approximately horizontal layers not more than 6 inches in thickness after compaction. The layers shall be carried across the entire width of the fill as it is being constructed. The fills shall be compacted in accordance with Paragraph 3.1.12 (Compacting Earth Materials). Where required excavations do not provide sufficient suitable materials for construction of required fills, the contractor shall procure additional earth materials for construction of required fills from borrow pits approved by the contracting officer.

c. Costs--The cost of site grading shall be included in the prices bid in the schedule for various items of work, which prices shall include the cost of all labor, equipment, and incidentals required to perform the site grading as herein specified.

3.1.3 Excavation for Structures

a. Measurement for payment--Excavation for structures will be measured for payment to excavation pay lines shown on the drawings, or if not shown on the drawings to pay lines in accordance with the provisions of this paragraph. Regardless of quantities removed, measurement for payment will be made to the prescribed pay lines: Except, That for purposes of safety or other practicable reasons in connection with individual structures the Government reserves the right to require the contractor to excavate to the prescribed pay lines. No payment will be made for excavation or removal of material which is outside of the prescribed pay lines.

Measurement of excavation will be in accordance with the following:

(1) Shade structure building column footings, pipe supports, and pipe pits--Measurement of excavation for structureswill include all required excavation for the structure below the original ground surface and between vertical planes at the ends of the structure or combination of adjoining structures. Such measurement will also include any excavation for the structure outside of these vertical planes which may be required below the original ground surface and outside of the pay lines for excavation for the concrete footings, pipe supports and pipe pits. Measurement of excavation will be made to dimensions 1 foot outside of the foundations of the structure and to slopes of 1:1 to ground surface.

(2) Pipe portions of the structures listed in (1) above--Excavation of the pipe trench will not be measured, and payment therefor will be made as provided in Division 6--Pipe Culverts.

b. Foundations for structures--Excavation for the foundation of structures shall be to the elevations shown on the drawings or established by the contracting officer. The contractor shall prepare the foundations at structure sites by methods which will provide firm foundations for the structures. The bottom and side slopes of common excavation, upon or against which the structure is to be placed, shall be finished to the prescribed dimensions, and the surfaces so prepared shall be moistened and tamped with suitable tools to form firm foundations upon or against which to place the structure.

Where rock or other unsuitable material is encountered in the foundation for a structure, the contracting officer will direct additional excavation to remove the unsuitable material. This additional excavation shall be made to provide a minimum clearance between the undisturbed foundation and the underside of the structure and the additional excavation shall be refilled with compacted backfill to provide a firm foundation for the structure. Measurement and payment for excavation, backfill, and compacting backfill will be made to depths and dimensions prescribed by the contracting officer.

If at any point in excavation the foundation material is excavated beyond the lines required to receive the structure, the overexcavation shall be filled with suitable materials and compacted in accordance with Paragraph 3.1.12 (Compacting Earth Materials). If at any point in excavation, the natural foundation material is disturbed or loosened during the excavation process or otherwise, it shall be compacted in place or, where directed, it shall be removed and replaced with suitable material and compacted in accordance with Paragraph 3.1.12 (Compacting Earth Materials). Any and all excess excavation or overexcavation performed by the contractor for any purposes or reason except for additional excavation as may be prescribed by the contracting officer and whether or not due to the fault of the contractor, shall be at the expense of the contractor. Fill and compacting of fill for such excess excavation or over excavation shall be at the expense of the contractor.

c. Payment--Insofar as practicable, the material moved in excavation for structures shall be used for backfill and embankments, otherwise it shall be wasted as directed by the contracting officer. Payment for excavation for

structures will be made at the unit price per cubic yard bid therefor in the schedule. The unit price bid in the schedule for excavation for structures shall include the cost of all labor and materials, of all other work necessary to maintain the excavations in good order during construction, and shall include the cost of disposal of the excavated material.

3.1.4 Backfill About Structures

a. General--Backfill about structures shall be placed to the lines shown on the drawings, as prescribed in this paragraph, or as directed. The type of material used for backfill, the amount thereof, and the manner of depositing the material shall be subject to approval. Insofar as practicable, backfill material shall be obtained from material moved in excavating for structures, but when sufficient suitable material is not available from this source or additional material shall be obtained from approved borrow pits. Except as otherwise provided in Paragraph 3.1.5 (Compacting Backfill About Structures), special compaction of the backfill will not be required.

b. Structures on fill--Where the original ground surface is below the base of a structure or below the bottom of a structure, all fill required for the structure foundation and all fill up to the bottom of a structure shall be placed as embankment. All fill about the structures above the original ground surface and outside of the above described backfill shall be placed as embankment.

c. Measurement and payment--Excavation refill required to be placed about structures that is within the payline limits for excavation for the structures will be measured in place for payment as backfill about structures. Fill about the structures above the orignal ground surface and within the slopes of excavation pay lines for such structures as extended to intersect the finished surfaces of adjacent earthwork will be measured for payment as backfill about structures: Except, That above the original ground surface the excavation pay lines will be extended to intersect the finished surfaces at slopes of one to one. Where the original ground surface is below the base of a structure, measurement, for payment, of backfill will be made above the structure base and within the lines prescribed in Subparagraph b. for backfill and embankment.

Measurement, for payment, of backfill about structures will be made only for the quantities actually placed within the limits of the established pay lines.

Payment for backfill about structures will be made at the unit price per cubic yard bid therefor in the schedule, which unit price shall include the cost of all work connected therewith, including the excavation and haul of the necessary material: Provided, That material from required excavation used for backfill about structures will be paid for both as excavation when removed from original position and as backfill when placed. Where additional material is obtained from approved borrow pits and used for backfill about structures, payment will not be made for backfill about structures but payment for such materials will be made as provided in Paragraph 3.1.9 (Excavation from Borrow).

Refill of excavation performed outside of the established pay lines for excavation for structures shall be placed in the same manner as specified for the adjacent backfill, and such refill shall be placed at the expense of the contractor.

3.1.5 Compacting Backfill About Structures

a. General--Unless otherwise shown on the drawings, backfill about structures shall be compacted as prescribed in this paragraph or as directed.

To provide adequate protection for compacted backfill about a structure, the Government reserves the right to direct the contractor to place a sufficient amount of backfill or embankment material over the compacted backfill within 72 hours after compacting of the backfill has been completed.

The 1:1 slopes specified below shall extend from the top of the concrete walls to their intersection with the surfaces of the excavation or embankment as the case may be.

b. Location of compacted backfill--

(1) Shade structure building column footings, pipe supports and backfill about the concrete test pad shall be compacted to

slopes of 1:1 from the concrete bases to the ground surface: Provided, That where the structure is located in compacted embankment, the backfill shall be compacted to the elevation prescribed for the adjacent compacted embankment.

c. Material and compacting--The material used for backfill to be compacted shall be selected material, containing no stones larger than 3 inches in diameter, approved by the contracting officer, and obtained from required excavation or approved borrow pits. To prevent unequal loadings and displacement of structures, the backfill shall be placed and compacted in layers having essentially the same top elevation on each side of the structure. All materials in backfill to be compacted shall be placed, moistened, and compacted as provided in Paragraph 3.1.12 (Compacting Earth Materials).

d. Measurement and payment--Measurement for payment for compacting backfill about structures will be made in place to the lines shown on the drawings, as prescribed in this paragraph, or as directed by the contracting officer and will be made only for the quantities actually compacted within the limits of the established pay lines for backfill about structures, and the compacting of refill outside of excavation pay lines shall be performed at the expense of the contractor. Payment for compacting backfill about structures will be made at the unit price per cubic yard bid therefor in the schedule and will be in addition to the payment made for backfill about structures. The unit price bid in the schedule for compacting backfill about structures shall include the costs of furnishing water and moistening the materials.

3.1.6 Excavation and Backfill for Trenches

a. General--Excavation, backfill, and compacting backfill for trenches include all excavation, backfill, and compacting backfill required for trenches for electrical cable, conduits, and grounding cables.

b. Excavation--All excavation for trenches shall be made to the lines, depths, and grades shown on the drawings or directed by the contracting officer. The bottom of the trench shall be finished accurately to the lines and grades shown on the drawings or established by the contracting officer and in a manner suitable

and as provided for the facility to be placed in the trench. The bottom of the trenches shall be prepared so as to provide a firm, even, and unyielding foundation. Trenches for small diameter pipe, conduit, or cable may be excavated by trencher but the backfill shall be compacted as provided for in this paragraph.

If at any point in excavation the material is excavated beyond the lines required, the overexcavation shall be filled with suitable materials and compacted in accordance with Paragraph 3.1.12 (Compacting Earth Materials). If at any point in excavation the natural foundation material is disturbed or loosened during the excavation process or otherwise, it shall be compacted in place, or where directed, it shall be removed and replaced with suitable material and compacted in accordance with Paragraph 3.1.12 (Compacting Earth Materials). Any and all excess excavation or overexcavation performed by the contractor for any purposes or reason, except for such additional excavation as may be prescribed by the contracting officer and, whether or not due to the fault of the contractor, shall be at the expense of the contractor. Fill and compaction of fill for such excess excavation or overexcavation shall be at the expense of the contractor.

c. Backfill--All backfill shall be placed carefully to give the conduit or cable a continuous even bearing on the bottom and sides. Backfill shall not be dropped directly on the conduit or cable. Rocks and clods, larger than 3 inches in maximum dimensions, shall not be placed within 6 inches of the conduit or cable.

d. Compacting backfill--All backfill in trenches under paving, structures, and where otherwise directed by the contracting officer, shall be compacted. All backfill shall be placed, moistened, and compacted in accordance with the applicable provisions of Paragraph 3.1.12 (Compacting Earth Materials). The backfill shall be compacted in layers having the same elevation on both sides of the pipe or cable to prevent unequal loading and displacement.

e. Costs--The cost of excavation for trenches, backfill for trenches, and compacting backfill for trenches shall be included in the prices bid in the schedule for other items of work, which prices shall include the cost of all labor and equipment required to perform the excavation, backfill and compacting backfill for the various trenches.

3.1.7 Excavation from Borrow

a. General--Where the required excavation at any section does not furnish sufficient suitable material for embankments, and for refill of excavation, suitable material shall be obtained from the borrow area shown on the drawings or approved by the contracting officer. The surface of borrow pits shall be left in a reasonably smooth and even condition approved by the contracting officer. Where necessary, as determined by the contracting officer, to prevent the accumulation of standing water, borrow pits shall be drained by means of open ditches. Borrow pits shall be left in a safe condition with side slopes not steeper than 1-1/2 to 1.

b. Measurement and payment--Measurement, for payment, of material taken from borrow pits will be made in excavation, except that, where determined to be necessary by the contracting officer, the quantity of excavated material may be computed by application of a factor to the quantity of borrowed material as measured in fill or embankment in place. Measurement, for payment, of excavation from borrow will be made of only such quantities as are required for embankments, or such as by direction of the contracting officer are excavated and wasted or laid aside. Payment for excavation of material from borrow required for embankments will be made at the unit price bid in the schedule for excavation from borrow, which unit price shall include the cost of excavating loading, hauling, and placing of the borrow material.

3.1.8 Disposal of Excavated Materials

All suitable material from required excavations, or as much thereof as may be needed, as determined by the contracting officer, shall be used for backfill, construction of fills, and for other required earthwork, as directed by the contracting officer. Material removed in excavation and not suitable for backfill or other required earthwork shall be wasted on right-of-way owned by the Government at such points as may be approved by the contracting officer. Unless otherwise

directed, no material shall be wasted in drainage channels. Waste banks shall be left with reasonably even and regular surfaces as approved by the contracting officer. The cost of all work described in this paragraph for the disposal of excavated materials shall be included in the prices bid in the schedule for other items of work. Waste asphalt, concrete, or other than natural earth materials shall be wasted at special nearby disposal areas, as designated by the contracting officer, where such materials will not be exposed to public view or present an unsightly appearance from public roadways or regular places of travel.

3.1.9 Gravel Fills

a. General--The contractor shall be responsible for furnishing all materials and performing all work for placing gravel fills under the concrete floor of the test pad. Gravel fills under the concrete test pad shall be covered with sheet polyethylene. The contractor shall furnish all gravel for gravel fills and the sheet polyethylene.

b. Materials--

(1) Gravel--The material for gravel fills shall be composed of hard, dense, durable rock particles, obtained from any approved source and shall range from 3/16 to 3/4 of an inch in size.

(2) Sheet polyethylene--The sheet polyethylene material shall be equal to 0.006 inch thick "Visqueen," as manufactured by the Visking Company, 6733 West 65th Street, Chicago, Illinois 60638.

c. Placing gravel fills--Before gravel is placed, the subgrades shall be leveled to a uniform cross section, free from depressions and soft spots. All gravel shall be placed to the lines and grades shown on the drawings or as directed.

Gravel fills under the concrete test pad shall be deposited and compacted as specified in Paragraph 3.1.12 (Compacting Earth Materials) and shall be covered with sheet polyethylene. Before the sheet polyethylene is placed, the surfaces of the gravel fills shall be prepared by any suitable means satis-

factory to the contracting officer which will prevent protrusions that may cause damage to the sheet polyethylene. The sheet polyethylene shall be lapped 6 inches at all ends and edges with the top lap in the direction of the spreading of the concrete. The contractor shall exercise care in placing materials and in his operations so as not to damage the sheet polyethylene covering.

d. Payment--Payment for furnishing and placing gravel fills under concrete will be made at the unit price bid therefor in the schedule, which unit price shall include the cost of furnishing and placing gravel and sheet polyethylene, of all work required for loading, hauling, placing, spreading, and compacting the gravel; and the cost of preparing, shaping, and compacting the subgrade surface as necessary for a satisfactory base for the gravel fill.

3.1.10 Compacting Earth Materials

a. General--Where compacting of earth materials is required, the materials shall be deposited in horizontal layers and compacted as specified in this paragraph. The excavation, placing, moistening, and compacting operations shall be such that the material will be uniformly compacted throughout the required section and will be homogeneous, free from lenses, pockets, streaks, laminations, or other imperfections.

b. Compacting clayey and silty materials--Where compaction of earth materials containing appreciable amounts of clay or silt is required, the materials shall be deposited in horizontal layers. The thickness of each horizontal layer after compaction shall be not more than 6 inches. The excavation and placing operations shall be such that the materials when compacted will be blended sufficiently to secure the highest practicable unit weight and best impermeability and stability.

Prior to and during compaction operations, the materials shall have a moisture content of not greater than 2 percent wet or less than 2 percent dry of optimum moisture, as determined by the contracting officer and the moisture content shall be uniform throughout each layer.

Insofar as practicable, as determined by the contracting officer, moistening of the material shall be performed at the site of excavation but such moistening shall be supplemented by sprinkling at the site of compaction, if necessary. If the moisture content is less than optimum for compaction by more than 2 percentage points or is greater than optimum for compaction by more than 2 percentage points, the compaction operations shall not proceed, except with the specific approval of the contracting officer, until the material has been wetted or allowed to dry out, as may be required, to obtain optimum moisture content within the tolerances permitted above, and no adjustment in price will be made on account of any operations of the contractor in wetting or drying the materials or on account of any delays occasioned thereby.

When the material has been conditioned as hereinbefore specified, it shall be compacted by rollers or by hand or power tampers. Where hand or power tampers are used to compact soils in confined areas such as under pipe, they shall be equipped with suitably shaped heads to obtain the required density.

The density (dry) of the soil fraction in the compacted material shall not be less than 95 percent of the laboratory standard maximum soil density (dry) as determined by the Bureau of Reclamation Proctor Compaction Tests for the materials being compacted.

(1) Compaction test--The compaction tests will be made by the Government. The standard maximum soil density is the dry weight per cubic foot of the soil compacted at optimum moisture content of laboratory procedure. The compaction test is the same as ASTM designation: D 698, Method A, except that a 1/20-cubic-foot compaction mold is used and the rammer is dropped from a height of 18 inches, resulting in the same energy of compaction per unit volume.

199

c. Compacting cohesionless materials--

(1) Compacting cohesionless free-draining materials--Where compaction of cohesionless free-draining materials, such as sands and gravels, is required, the materials shall be deposited in horizontal layers and compacted to the relative density specified below. The excavating and placing operations shall be such that the materials, when compacted, will be blended sufficiently to secure the highest practicable unit weight and best stability. Water shall be added to the materials as may be required to obtain the specified density by method of compaction being used.

The thickness of the horizontal layers after compaction shall not be more than 6 inches if compaction is performed by tampers or rollers; not more than 12 inches if compaction is performed by treads of crawler-type tractors, surface vibrators, or similar equipment; and not more than the penetrating depth of the vibrator if compaction is performed by internal vibrators.

The relative density of the compacted materials shall be not less than 70 percent as determined by the standard Bureau of Reclamation relative density tests for cohesionless free-draining soils.

(a) Relative density test--The relative density tests will be made by the Government. The relative density of a cohesionless free-draining soil, expressed as a percentage, is defined as its state of compactness with respect to the loosest and most compact states at which it can be placed by laboratory procedures. The relative density will be based on the following formula, wherein the maximum density is the highest unit weight of the soil, minimum density is the lowest unit weight of the soil, and in-place density is the unit weight of the soil in place. Tests for moisture content are made on the materials and the unit weights are expressed in terms of ovendry weights.

$$\text{Rel. Den. (\%)} = \frac{\text{max.den. x (in-place den. - min. den.)}}{\text{in-place den. x (max. den. - min. den.)}} \times 100$$

200

(2) Compacting cohesionless materials containing some clay and silt--Cohesionless materials containing clay and silt may not be free-draining. When compaction of cohesionless materials containing sufficient clay and silt as to impede free drainage is required, the material shall be placed and compacted in accordance with the provisions of c.(1) above. These materials shall be compacted to a dry density in accordance with either of the following control tests whichever shows the higher dry unit weight.

(a) Ninety-five percent of the laboratory standard maximum soil density (dry) as determined by the Bureau of Reclamation Proctor Compaction Test as prescribed in b.(1) above, or

(b) The dry density of the material at 70 percent relative density as determined by the relative density test as prescribed in c.(1)(a) above.

d. Costs--The costs of compacting earth materials as described in this paragraph shall be included in the prices bid in the schedule for other items of work.

3.1.11 Cutting and Repairing Asphalt Surfacing

Reference in this paragraph to asphalt surfacing and the requirements of this paragraph shall apply to all cutting and repairs necessary to asphalt surfacing. All operations of the contractor at the East Mesa Test Site shall be subject to the approval of the contracting officer.

Asphalt shall be cut on neat, trim, and straight lines. All surfacing cut or damaged in the course of the construction operations shall be reconstructed with the same kind of material and to the same dimensions and standards as the original surfacing. Minimum compacted thickness of the original bituminous surfacing was 2-1/2 inches. All backfill shall be compacted beneath such surfacing.

No direct payment will be made for cutting and repairing of the asphalt surfacing, or any other work as specified herein in connection with cutting and repairing asphalt surfacing, and the cost thereof shall be included in the prices bid in the schedule for items requiring the cutting of asphalt surfacing, which prices

shall include the cost of compacted backfill, asphaltic materials, and all other labor, materials, and equipment required for cutting and repairing asphalt surfacing as specified herein and disposal of bituminous materials removed.

DIVISION 4-- CONCRETE

SECTION 4.1-- CONCRETE

4.1.1. Concrete, General

The contractor shall construct the reinforced concrete test pad, reinforced concrete column footings, reinforced concrete pipe pits, and reinforced concrete pipe supoorts, as shown on the drawings and herein specified.

All concrete construction shall conform to Paragraphs 4.1.1. (Concrete, General) to 4.1.9 (Measurement and Payment) inclusive, and to the requirements of Section 4.2--SPECIAL CONCRETE REQUIREMENTS. Concrete finishes shall conform to Paragraph 4.1.5. (Forms, Preparation for Placing, and Placing) and shall be as noted on the drawings.

All structures shall be built to the prescribed lines, grades, and dimensions. The location of all construction joints shall be subject to approval. Joints shall be constructed as shown on the drawings. The contractor shall place and attach to the structure all metal, or other accessories necessary for its completion as shown on the drawings. The cost of such work, for which specific prices are not provided in the schedule, shall be included in the respective unit price per cubic yard bid in the schedule for furnishing and placing concrete.

The dimensions of the structures shown on the drawings may be subject to such reasonable changes as may be found necessary by the contracting officer.

4.1.2 Materials

The contractor shall furnish all materials for use in concrete, including cement, water, sand and coarse aggregate, and air-entraining agent, and shall furnish all reinforcing bars and materials for curing concrete. Air-entraining ing agent and curing compound will be accepted on manufacturer's certification of compliance with specification requirements: Provided, That the Government reserves the right to require submission of and to perform tests on samples of the agent and/or compound prior to shipment and use in the work.

Except as hereinafter provided, cement shall be obtained from a commercial (non-Government tested) bin and shipped on manufacturer's certificate of

compliance with specification requirements, the certification to be accompanied by mill test report. If the cement company does not have a commercial bin of cement meeting the specified requirements and which they can certify, Government tested and approved cement may be shipped, if available at the cement plant concerned, in which case certification by the manufacturer will not be necessary. If cement is shipped under the foregoing conditions from a Government-tested bin, the contractor will be charged by deduction from payments due for the cost of testing of all such cement he obtains in excess of the quantity used in work under these specifications, which charge, including Government overhead, will be at the rate of 3.5 cents per cwt (hundredweight).

Permission to ship on manufacturer's certification shall in no way relieve the contractor of the responsibility for furnishing materials meeting specification requirements. The contractor shall be responsible for the accuracy and completeness of certifications and mill test reports furnished.

a. Cement.--Cement shall meet the requirements of Federal Specification SS-C-192G, including Amendment -3 thereto, for Type II low alkali, and shall meet the false-set limitation specified therein. The cement shall be free from lumps and damaged cement when used in concrete.

b. Water.--Water shall be free from objectionable quantities of silt, organic matter, alkalies, salts, or other impurities.

c. Sand and coarse aggregate.--Sand and coarse aggregate shall be furnished from any approved source. The sand particles shall be clean, hard, dense, durable, uncoated rock fragments that will pass a screen having 3/16- or 1/4-inch-square openings. The sand shall be well graded from fine to coarse and shall be free from injurious amounts of dirt, organic matter, and other deleterious substances. The coarse aggregate shall consist of clean, hard, dense, durable, uncoated rock fragments, shall be free from injurious amounts of thin pieces, organic matter, or other deleterious substances, shall be reasonably well graded from 3/16 of an inch to 1 and 1/2 inches, and shall be separated into two sizes by an intermediate screen having 3/4-inch-square openings. Screens having openings of other sizes and shapes may be used, if the Government reserves the right to test the sand and coarse aggregate

and if required, the contractor shall submit, for preliminary tests and approval, representative samples of the sand and coarse aggregate proposed for use in the concrete work.

d. Air-entraining agent.--The air-entraining agent shall conform to ASTM Designation: C 260, except that the limitation and test on bleeding by concrete containing the agent and time of setting requirement shall not apply.

e. Reinforcing bars.--Reinforcing bars shall conform to ASTM Designation: A 615, Grade 60, or ASTM Designation: A 617, Grade 60.

Fabric shall be electrically welded-wire fabric conforming to ASTM Designation: A 815.

f. Wax-base curing compound.--Wax-base curing compound shall be white-pigmented compound confroming to Bureau of Reclamation "Specifications for Wax-Base Curing Compound," dated May 1, 1973.

4.1.3 Composition

Sand and coarse aggregate shall be mixed in proportions as directed by the contracting officer. One and one-half-inch-maximum-size coarse aggregate shall be used where practicable from the standpoint of satisfactory placing and consolidation of the concrete. Concrete which contains 1 and 1/2-inch-maximum-size aggregate shall have a cement content of not less than 517 pounds per cubic yard, and concrete which contains 3/4-inch-maximum-size aggregate shall have a cement content of not less than 611 pounds per cubic yard. The net water-cement ratio of the concrete (exclusive of water absorbed by the aggregates) shall not exceed 0.47 by weight. The concrete shall develop a minimum compressive strength of 3,000 lb/in^2 at 28 days as determined by standard specimens. The compressive strength of the concrete will be determined by the Government through the medium of tests of 6- by 12-inch cylinders made and tested in accordance with Designations 29 to 33, inclusive, of the Seventh Edition of the Bureau of Reclamation Concrete Manual.

The use of calcium chloride in concrete will not be permitted.

Air-entraining agent shall be used in such amount as will effect the entrainment of from 4 to 6 percent of air, by volume, of the concrete as discharged from the mixer.

The slump of the concrete shall not exceed 2 inches for slabs, and 3 inches for all other concrete.

4.1.4 Batching and Mixing

The sand and coarse aggregate shall be weighed and shall be proportioned on the basis of integral bags of cement unless the cement is weighed. Weighing equipment of the beam type may be used. The contractor shall provide equipment and shall maintain and operate the equipment as required to accurately determine and control the amount of each separate ingredient entering the concrete. Batching shall be such that combined inaccuracies in feeding and measuring the materials will not exceed 1 and 1/2 percent for water and weighed cement and 2 percent for sand and each size of coarse aggregate. The concrete shall be uniform in composition and consistency throughout the mixed batch, and from batch to batch, except where changes in composition or consistency are directed. The mixing time shall be at least 1 and 1/2 minutes. Excessive overmixing requiring the addition of water to preserve the required consistency will not be permitted. The temperature of the concrete when it is being placed shall be not more than $90^{o}F$ and not less than $40^{o}F$ in moderate weather or $50^{o}F$ when the mean daily temperature drops below $40^{o}F$. Truck mixers will be permitted only when the mixers and their operation are such that the concrete throughout the mixed batch and from batch to batch is uniform with respect to consistency and grading. Any concrete retained in truck mixers so long as to require additional water to permit satisfactory placing shall be wasted.

4.1.5 Forms, Preparation for Placing, and Placing

Forms shall be sufficiently tight to prevent loss of mortar from the concrete and shall be maintained rigidly in position until the concrete has hardened sufficiently to prevent damage by form removal. All surfaces of foundations upon or against which concrete is to be placed shall be free from standing water, mud, and debris. The surfaces of absorptive foundations against which concrete is to be placed shall be moistened thoroughly so that moisture will not be drawn from the freshly placed concrete. The surfaces of construction joints shall be clean, rough, and surface dry when covered with

fresh concrete. Cleaning shall consist of the removal of all laitance, loose or defective concrete, coatings, sand, curing compound if used, and other foreign material. A mortar layer shall not be used on concrete construction joints. Unless otherwise directed in formed work, structural concrete placements shall be started with an oversanded mix containing 3/4-inch-maximum-size aggregate; a maximum net water-cement ratio of 0.47, by weight; 6 percent air, by volume of concrete; and having a maximum slump of 4 inches; placed several inches deep on the joint at the bottom of the placement.

The methods and equipment used for transporting concrete, and the time that elapses during transportation shall be such as will not cause appreciable segregation of coarse aggregate or slump loss in excess of 1 inch in the concrete as it is delivered into the work. Retempering of concrete will not be permitted. Any concrete which has become so stiff that proper placing cannot be assured shall be wasted. Formed concrete shall be placed in continuous approximately horizontal layers, the depths of which generally shall not exceed 20 inches. Concrete shall be vibrated until it has been consolidated to the maximum practicable density, is free from rock pockets of coarse aggregate, and closes snugly against all surfaces of forms and embedded materials.

Exposed unformed surfaces of concrete shall be brought to uniform surfaces and worked with suitable tools to a reasonably smooth wood-float or steel-trowel finish as directed.

4.1.6. Protection and Curing

The contractor shall protect all concrete against injury until final acceptance by the Government. The concrete shall be cured by water curing or by application of wax-base curing compound. If concrete is cured by water curing, the concrete shall be kept continuously moist for at least 14 days after being placed by sprinkling or spraying or by other methods approved by the contracting officer. If concrete is to be cured by application of curing compounds, the application of the curing compound shall be in accordance with the procedures contained in the Seventh Edition of the Bureau of Reclamation Concrete Manual for curing with sealing compounds.

4.1.7. Repair of Concrete

Any concrete that is damaged or defective from any cause; concrete that is honeycombed, fractured, or otherwise defective; and concrete which, because of excessive surface depressions, must be excavated and built up to bring the surfaces to the prescribed lines; shall be removed and replaced; and any imperfections and irregularities on concrete surfaces shall be corrected.

The removal and replacement of damaged or defective concrete, and the correction of surface imperfections and irregularities shall be made with concrete, dry pack, or mortar (portland cement mortar); or, at the option of the contractor, with epoxy-bonded concrete, or epoxy-bonded epoxy mortar; where and as applicable for the type of repair involved, in accordance with Bureau of Reclamation "Standard Specifications for Repair of Concrete" dated November 15, 1970. The cost of all materials, labor, and equipment required in the repair of concrete and the correction of surface imperfections and irregularities shall be borne by the contractor.

4.1.8. Reinforcement

Steel reinforcing bars shall be placed in the concrete where shown on the drawings. Before reinforcement is placed, the surfaces shall be cleaned of heavy flaky rust, loose mill scale, dirt, grease, or other foreign substances. Reinforcement shall be accurately placed and secured in position so that it will not be displaced during the placing of the concrete. Welding or tack-welding of Grade 60 reinforcing bars will not be permitted except at locations shown on the drawings.

Unless otherwise shown on the drawings, the reinforcement shall be placed so that there will be a clear distance of at least 1 inch between the reinforcement and any anchor bolts, form ties, or other embedded metalwork.

The Government will not furnish supplemental bar-placing diagrams, bar lists, and bar-bending diagrams. Any such additional diagrams and bar lists of this type which the contractor may require to facilitate the fabrication and placement of reinforcement shall be provided by the contractor. The cost of preparing such additional diagrams and bar lists, if provided, shall be included in the lump sum price bid in the schedule for furnishing and placing reinforcement. Reinforcement will be inspected for compliance with requirements as to size, shape, length, splicing, position, and amount after it has been placed.

Any bar-placing diagrams, bar lists, and bar-bending diagrams prepared by the contractor shall conform to the requirements shown on drawing 6821-22E-09 (40-D-6123) unless otherwise shown on the reinforcement design drawings.

4.1.9. Measurement and Payment

Measurement, for payment, of reinforcement will be made only of the weight of the reinforcement placed in the concrete, in accordance with the drawings or as directed. Payment for furnishing and placing reinforcement will be made at the unit price per pound bid therefor in the schedule, which unit price shall include the cost of furnishing and attaching wire ties and metal or other approved supports, if used, and of cutting, bending, cleaning, and securing and maintaining in position all reinforcement as shown on the drawings or as directed.

Cement will be paid for on the basis of the cwt (hundredweight) of cement used in the work covered by these specifications. One bag of cement shall be considered as 0.94 cwt of cement. Measurement, for payment, of cement will be on the basis of the number of bags of cement used at the mixer, except that no payment will be made for cement used in wasted concrete, cement used in damaged or defective concrete, or cement used in concrete required as a result of careless excavation, or excavation intentionally performed by the contractor to facilitate his operations, as determined by the contracting officer. Payment for furnishing and handling cement will be made at the unit price per cwt bid therefor in the schedule.

Measurement, for payment, of furnishing and placing concrete will be on the basis of cubic yards of concrete having the dimensions shown on the drawings or prescribed by the contracting officer. Payment for furnishing and placing concrete will be made at the unit price per cubic yard bid in the schedule therefor, which unit price shall include the cost of all labor and materials except that payment for furnishing and handling cement, and payment for furnishing and placing reinforcement will be made at the respective unit price bid therefor in the schedule.

SECTION 4.2--SPECIAL CONCRETE REQUIREMENTS

4.2.1. Joints in Concrete

a. Construction joints.--Construction joints are joints which are either purposely placed in structures to facilitate construction or which occur in structures as a result of inadvertent delays in concrete placing operations. Construction joints are located to facilitate the contractor's operations, to reduce initial shrinkage stresses and cracks, to allow time for the installation of embedded metalwork, or to allow for the subsequent placing of other concrete, backfill concrete, or second-stage concrete. Bond is required at construction joints regardless of whether or not reinforcement is continuous across the joint.

The location of all construction joints shall be as shown on the drawings or as directed by the contracting officer. Construction joints shall be constructed in accordance with Paragraph 4.1.5. (Forms, Preparation for Placing, and Placing).

b. Expansion joints.--Expansion joints are joints placed in structures or slabs to provide for volumetric shrinkage of a monolithic unit or movement between monolithic units. The joints shall be so constructed that there will be no bond between the concrete surfaces forming the joint. Except as otherwise provided for dowels, reinforcement is never continuous across an expansion joint. Expansion joints shall be located as shown on the drawings or as directed by the contracting officer.

Preformed bituminous joint filler shall be placed in the expansion joints. The joint filler shall cover the entire surface of the concrete at the joint, and shall be laid against the completed side of the joint and held rigidly in place by copper nails or bonding cement while the concrete is placed on the other side of the joint. All joints in the joint filler shall be tight-fitting butt joints.

c. Materials.--

(1) Preformed bituminous joint filler.--HH-F-341f, Type I.

(2) Copper nails.--FF-N-105 for common copper nails.

d. Cost.--Except as hereafter provided in Paragraph 4.2.5. (Dowels), the entire cost of constructing joints in concrete shall be included in the price bid in the schedule for the concrete in which the joints are required, which price shall include the cost of furnishing all labor, materials, tools, and incidentals required to construct joints in concrete as shown on the drawings and herein specified.

4.2.2. Tooled Edges and Tooled Grooves

The top edges of concrete bases, edges at expansion joints, and other edges where shown on the drawings or as directed shall be tooled. The edges shall be tooled neatly with an edging tool. Tooled grooves shall be constructed in the concrete base as directed by the contracting officer. The tooled grooves shall have a width of approximately 1/4 inch and a depth of about 3/8 inch. The top edges of the grooves shall be tooled.

The cost of tooling edges and grooves shall be included in the prices bid in the schedule for various items of work, which prices shall include the cost of all labor, tools, and incidentals required to tool edges and grooves as herein specified.

4.2.3. Concrete Floor Hardener

a. General.--The contractor shall furnish and apply a liquid floor hardener to the surfaces of the concrete test pad.

b. Materials.--Fluosilicate crystals shall be used for floor hardener and shall be magnesium fluosilicate or zinc fluosilicate or a combination of both.

c. Applying liquid floor hardener.--Two coats of liquid floor hardener shall be applied to the concrete test pad in a manner approved by the contracting officer. After the concrete pad has been cured thoroughly and at such time as directed by the contracting officer, the surface shall be cleaned thoroughly of all dirt, grease, laitance, or other foreign matter and shall be allowed to dry, immediately after which the floor hardener shall be applied. The contractor shall prepare the hardener solution by dissolving fluosilicate crystals in the proportion of one-half pound of crystals per gallon of water for the first coat and 2 pounds of crystals per gallon of water for the second coat. The hardener solution shall be applied at a maximum coverage of 100-square-feet-per-gallon per coat. The solution shall

211

be applied liberally by means of floor mops. Each coat shall be spread uniformly, and the presence of pools of the hardener solution shall be avoided. The first coat shall be allowed to dry thoroughly before the second coat is applied. After the second coat has dried, the floors shall be brushed and washed with water to remove any crystals which may have formed on the surface.

The contractor's cost for furnishing and applying liquid floor hardener and any work connected therewith shall be included in prices bid in the schedule for other items of work.

4.2.4. Grouting Mortar for Metalwork

a. General.--Grouting mortar required to be placed under the baseplates of all building columns and metalwork shall be in accordance with this paragraph. The contractor shall furnish all materials.

b. Grouting mortar.--Grouting mortar shall be composed of cement, water and sand. Cement, water and sand shall be in accordance with Paragraph 4.1.2. (Materials), except that sand passing a No. 16 screen shall be used when clearances are such that the specified grading for sand is not suitable. Grouting mortar shall be mixed in the proportion of 1 part of portland cement to 2 and 1/2 parts of sand, by weight, and to the consistency prescribed by the contracting officer.

c. Preparation for placing, and placing.--Before placing grouting mortar, the surfaces of base concrete to which the mortar will be bonded shall be roughened and shall be cleaned of all laitance, loose or defective concrete, coatings, and other foreign material by effective means, followed by thorough washing with water. If any delay occurs between the washing of the concrete and placing of the mortar, the surfaces of the concrete shall be lubricated by washing with water immediately prior to placing of the mortar. Forms shall be used, where required, to confine the grouting mortar. The mortar shall be placed so as to completely fill spaces adjacent to equipment and metalwork as shown on the drawings.

d. Curing.--The exposed surfaces of mortar shall be cured for 72 hours by keeping them covered with moist burlap, damp sand, or by other effective means approved by the contracting officer.

Loads shall not be applied to the mortar sooner than 72 hours after placement and shall be applied only after the mortar has attained a compressive strength of at least 3,000 psi. The time required for the mortars used to attain this strength will be determined by the Government. Care shall be taken when applying loads on the hardened mortar and the contractor shall be responsible for any damage thereto resulting from impact loads when positioning equipment or metalwork.

e. Cost.--The costs of all work in connection with the grouting mortar operations and the cost of the cement, water and sand for mortar shall be included in the prices bid in the schedule for the items of work for which the mortar is required.

4.2.5. Dowels

Dowel bars shall be furnished and placed across expansion joints as shown on the drawings. The dowels shall be smooth round bars conforming to Federal Specifications QQ-S-632c, Type I.

The dowel bars shall be cleaned and painted with red primer on the full length of the bar and the paint shall be thoroughly dry before placement in concrete. The bars shall be spaced as shown on the drawings and placed across the expansion joint so that one-half of the bar will be embedded in the first placement. The dowels shall be positioned parallel to each other and to the surfaces of the floor slab where dowels are used. Special care shall be taken to maintain the dowels accurately in position during concrete placement operations. Immediately before placement of concrete, the half-length of dowel to be initially embedded shall be coated with a film of oil having an SAE viscosity of not less than 250. Before final set of the concrete in the initial placement, the dowels shall be twisted and withdrawn 1 inch to break bond.

Payment for furnishing and placing dowels will be made at the unit price per pound bid in the schedule for furnishing and placing and reinforcement, as specified in Paragraph 4.1.9. (Measurement and Payment).

DIVISION 5 -- ACCESS ROAD AND PARKING AREA

SECTION 5.1 -- EARTHWORK FOR ACCESS ROAD AND PARKING AREA

5.1.1 General

The contractor shall construct the access road as shown on the drawings and as herein prescribed.

Earthwork for the access road and parking area shall be performed in accordance with the requirements of Paragraphs 5.1.2 to 5.1.7 inclusive, except that excavation, backfill, and compacting backfill for road culverts and for furnishing and laying culvert pipe shall be performed in accordance with Division 6--Pipe Culverts.

5.1.2 Excavation for Roadway and Parking Area

a. Roadway sections--The roadway sections are shown on the drawings, but the undetermined character of the materials which will form the embankment, slopes and roadbed, or other factors, may make it necessary or desirable during the progress of the work to vary the width of the roadbed or the slopes, alignment, or grades, and the dimensions dependent thereon. Any increase or decrease of quantitites excavated as a result of such variations will be included in the estimates. However, if the contracting officer determines that the contractor's costs will be increased by reason of such variations an equitable ajustment will be made to cover such increased costs. Otherwise, the work will be paid for at the unit price bid therefor in the schedule regardless of such variations.

The roadway shall be constructed to the full dimensions shown on the drawings or otherwise established, and shall be finished to the prescribed lines and grades. The centerline of the roadbed shall conform strictly to the center stakes. The gradelines shown on the profiles represent finished grade. The term "subgrade" refers to the top of the embankments and the bottom of excavations ready to receive the roadway surfacing.

b. Excavation--In material which is unsuitable for a subgrade the bottom shall in all cases be taken out to 6 inches below subgrade. Payment for such excavation will be made at the unit price per cubic yard bid in the schedule for excavation for roadway. Such additional excavation shall be refilled to subgrade with material obtained from excavation for the roadway and the refilled material shall be compacted equivalent to the compaction required for the roadway embankments. Refill of excavation below subgrade will be considered to be part of embankment construction and measurement for payment for such refilling will be made in excavation.

Side drains shall be constructed as shown on the drawings or as directed and shall be left clear of obstructions and at the lower ends shall diverge sufficiently to prevent erosion of the adjoining embankments. Excavation around trees, poles, or other objects which are to remain within the right-of-way for the roadway shall be performed and completed in such a manner as to avoid injury or damage to such objects.

c. Payment--Measurement, for payment, of excavation for roadway will be made only to the neatlines as shown on the drawings or established by the contracting officer. Payment for excavation for roadway will be made at the unit price per cubic yard bid therefor in the schedule.

5.1.3 Preparation of Surfaces under Roadway and Parking Area Embankments

a. Surface treatment--Where embankments are to be built in sloping ground, the surface of the ground shall be prepared to provide bond with the embankments and prevent slipping thereof. Where embankments are to be placed on smooth firm surfaces and where shallow embankments are to be placed, the original ground surface shall be thoroughly plowed or stepped as directed to insure proper bonding of the new and existing material.

b. Removal of unsuitable material--Where the ground surface under an embankment is not suitable, as determined by the contracting officer, for a foundation for

the embankment, the contractor shall strip the area under the embankment of such unsuitable material to such depth as directed. Measurement, for payment, of stripping unsuitable material under embankments will be made only to the directed lines and depths, and payment therefor will be made at the unit price per cubic yard bid in the schedule for excavation for roadway.

5.1.4 Construction of Roadway and Parking Area Embankments

a. General--Embankments shall be constructed to the established lines and grades which, in general, will be the lines and grades shown on the drawings, increased by such heights and widths as necessary to allow for settlement. The embankments shall be maintained by the contractor to proper heights, dimensions, and slopes until the final completion and acceptance of all of the work under the contract.

b. Materials--No brush, roots, sod, or other perishable or unsuitable materials shall be placed in embankments. Material containing sand in such proportion as to prevent it from compacting properly shall not be used, except with prior approval. Clods or hard lumps of earth having maximum dimensions of more than 8 inches shall be broken up before or after being placed on the embankments. Where there is a choice of materials, the best shall be used on the top of embankments for at least one foot in depth. No material shall be placed in the embankments when either the material or the surface on which it would be placed is frozen.

c. Construction--All material shall be deposited in embankments so that rock, cobbles, and gravel will be well distributed through the other materials and not nested in any position within or under the embankments. The combined excavation and placing operations shall be such that the materials in the embankment will be blended sufficiently to secure the best practicable degree of compaction and stability, and for this purpose the contracting officer may designate the locations in the embankment where the individual loads shall be deposited.

Embankments shall be placed in continuous, approximately horizontal layers not more than 8 inches in loose thickness prior to being compacted. The layers shall be carried across the entire width of the embankments and shall be built to the required slopes and not widened with loose material from the top: Provided, that sidehill fills where the width is too narrow to accommodate hauling equipment may be placed by end dumping until the width of the embankment becomes great enough to permit the use of hauling equipment, after which the remainder of the embankment shall be placed in layers as specified herein. The contractor shall route his hauling equipment over the layers already in place and shall distribute the travel evenly over the entire width of the embankment so as to obtain the most practicable compacting effect of the equipment. The embankment shall be compacted to a degree equivalent to 95 percent laboratory density as provided in Paragraph 5.1.5. The slopes of embankments shall be reasonably true to line and grade.

When the surface of roadway embankment in which a pipe culvert is to be placed has reached an elevation approximately one-fourth the diameter of the pipe above the prescribed elevation of the invert of the pipe, the embankment material shall be excavated carefully to the established lines and grades to provide a firm and uniform bearing for the entire length of the pipe.

d. Cost--The cost of all work described in this paragraph shall be included in the unit price per cubic yard bid in the schedule for excavation for roadway.

5.1.5 Moistening and Compacting Roadway and Parking Area Embankments

a. General--Where the construction of embankments as provided in Paragraph 5.1.4 will not result in compaction of the embankments to a degree equivalent to 95 percent of laboratory density, embankments or portions thereof will require moistening of the embankment materials and/or compacting with special compacting equipment.

The density (dry) of the soil fraction in the compacted material shall not be less than 95 percent of the laboratory standard maximum soil density (dry) as determined by the Bureau of Reclamation Proctor Compaction Test for the materials being compacted.

217

(1) Compaction test--The compaction tests will be made by the Government. The standard maximum soil density is the dry weight per cubic foot of the soil compacted at optimum moisture content by laboratory procedure. The compaction test is the same as ASTM Designation: D 698, Method A, except that a 1/20-cubic foot compaction mold is used and the rammer is dropped from a height of 18 inches.

The amount of moistening and/or compacting in general will depend upon the nature and condition of the materials available for the construction of the embankments.

b. Moistening of embankment materials--Where embankment materials do not contain sufficient moisture to insure satisfactory compaction, additional moisture shall be provided by sprinkling with water as the layers of materials are placed on the embankments. The materials shall be moistened uniformly and, where directed, shall be harrowed or otherwise worked to produce the required uniformity of moisture content. Material containing an excess of moisture shall be permitted to dry to the extent required before being compacted.

Any additional work required in drying embankment material to the required moisture content shall be considered as work required by the provisions of this paragraph and no payment shall be made for the work.

c. Rolling embankments--Where the construction of embankments as provided for in Paragraph 5.1.4 will not result in a satisfactory degree of compaction, the contractor shall roll each layer of materials as it is placed on the embankments. The amount of rolling which will be required will depend upon the nature of the materials to be compacted. Succeeding layers of embankment shall not be placed until the layer being compacted has been compacted to 95 percent laboratory density.

d. Cost--The cost of all work described in this paragraph shall be included in the unit price per cubic yard bid in the schedule for excavation for roadway.

5.1.6 Subgrade

The subgrade for the roadway shall be finished to the lines and grades shown on the drawings or established by the contracting officer and shall be maintained at all times in such condition that it will drain readily and correctly.

5.1.7 Excavation for Drainage Channels

a. General--In connection with the excavation for the roadway, the contractor shall perform excavation as directed for drainage channels including, but not restricted to:

(1) Cross-drainage channels;
(2) Channels leading to or away from culverts and other structures; and
(3) Intercepting surface ditches at the top of the cut or adjacent to the toe of embankments where the ground slopes toward the embankment.

All ditches and drains shall be completed to drain the roadway effectively before any other construction will be permitted on that part of the work affected by such ditches and drains. The locations, grades, side slopes, and bottom widths of drainage channels will be established by the contracting officer to conform to the topographic and hydraulic conditions to be met. All materials excavated in connection with the construction of drainage channels shall be placed in roadway embankments, or deposited in wast banks.

b. Payment--Payment for excavation required for drainage channels will be made at the unit price per cubic yard bid in the schedule for excavation for roadway.

217

SECTION 5.2 - BITUMINOUS SURFACING

5.2.1 General

Following completion of earthwork as herein specified, including 3-inch aggregate base, the surfacing for the access road and parking area will consist of a prime coat of liquid asphalt over the entire width of the aggregate base followed by 2-1/2 inches of plant-mix bituminous surfacing, and an aggregate seal coat applied to the new surfacing, all as shown on the drawings. All materials for the roadway and parking area surfacing shall be furnished by the contractor. Equipment not suitable to produce the quality of work required for the surfacing will not be permitted to operate on the work. The contractor, at his own expense, shall furnish all necessary flagmen, signs, lights, and barricades for the protection of traffic, or protection of freshly applied liquid asphalt during the drying period.

Discharging unused liquid asphalt into roadway, borrow pits, or gutters will not be permitted. Applying liquid asphalt will not be permitted when the surface to be treated is appreciably damp or when weather conditions are unsuitable. Liquid asphalt shall be heated in a retort or by steam coil in such a manner that steam will not be introduced directly into the liquid asphalt during heating.

5.2.2 Sampling, Certification, and Testing of Bituminous Materials

Only materials conforming to these specifications shall be used in the work. The contractor shall furnish a certified laboratory analysis with each shipment of liquid asphalt prior to incorporating the material into the work. The certification shall include: material identification, quantity represented, and certified test results performed by the manufacturer or other laboratory covering all of the test requirements of the specifications. The accuracy of all laboratory analyses shall be guaranteed by the contractor.

The Government reserves the right to test any or all materials acceptable on certification when, in the opinion of the Government such tests are necessary.

5.2.3 Weights of Roadway Materials

Materials for roadway and parking area surfacing which will be paid for by the ton shall be weighed on platform scales furnished at the expense of and by the contractor, unless the materials are shipped by rail or computed by volumetric measurement as specified below: Provided , that weight slips prepared by certified public weighmasters stationed at public scales will be accepted.

Scales furnished by the contractor shall be approved by the contracting officer and shall be tested and sealed, at the expense of the contractor, as often as the contracting officer may deem necessary to insure their accuracy. The contractor shall furnish a certified public weighmaster who shall weigh all materials required to be weighed on contractor-furnished scales as herein provided. If the materials are shipped by rail, the car weights will be accepted: Provided, that actual weights of the materials only will be paid for and not minimum car weights used for assessing freight tariff: Provided further, that car weights will not be acceptable for materials passed through mixing plants.

When the water content of any mineral aggregate for surfacing exceeds 4 percent, by weight, of the ovendry weight of the material, as determined by the contracting officer, the weight of the material to be paid for shall be determined by deducting from the weight of the material delivered to the job the weight of water in the material in excess of 4 percent of the ovendry weight of the material.

Volumetric measurements of liquid asphalt at any temperature will be reduced to the volume the material would occupy at 60°F before converting the volumetric measurements to tons. The following table will be used to convert the volumes from gallons to tons, and the methods specified in "ASTM-IP Petroleum Measurement Tables" (Designation: D 1250) of the American Society for Testing and Materials will be used to convert the volume at any temperature to the volume at 60°F.

Grade of liquid asphalt	Gallons per ton at 60°F
MC-250	249
MC-800	245
Emulsion	240 at 70°F
Asphalt cement penetration	
Grade 60-70 (AR-8000)	235

221

5.2.4 Aggregates for Bituminous Surfacing

All aggregate materials for the bituminous surfacing shall be furnished by the contractor. The contractor may obtain material from any approved source and he shall make all necessary arrangements with the owners and shall pay all costs connected therewith.

The source of supply of each of the materials furnished by the contractor shall be subject to approval before the delivery is started. Only approved materials conforming to the requirements of these specifications shall be used in the work. All materials proposed for use may be inspected or tested at any time during their preparation and use. If, after trial, it is found that sources of supply which have been approved do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the contractor shall furnish approved material from other approved sources. No material which, after approval, has in any way become unfit for use shall be used in the work. Sites from which material has been removed shall be left in a neat and presentable condition upon the completion of the work, and all fences removed for purposes of entry shall be replaced in as good a condition as they were before being removed.

5.2.5 Aggregate Base

a. Materials -- The mineral aggregate for aggregate base shall be furnished by the contractor, shall consist of natural aggregate, quarry waste, broken stone, crushed gravel, or a combination thereof and shall be uniform in quality and grading. The aggregate shall be free from adobe, vegetable matter, loam, and other deleterious substances and shall be of such quality that it will compact thoroughly when watered and rolled to form a firm well-bonded base. When tests indicate the material is deficient in binder, additional soil binder shall be added to the material on the road but only in such amounts as will insure the total material conforming to the following requirements. Soil binder shall be pulverized before mixing with gravel or stone.

(1) Grading -- The aggregate when tested by means of standard screens (Designation 4) shall conform to the following limits of gradation:

100 percent passing a screen with 1-1/2 inch square openings;
30 to 65 percent passing a screen with 3/4 inch square openings;
25 to 55 percent passing a No. 4 mesh screen;
0 to 12 percent passing a No. 200 mesh screen; and
0 to 5 percent clay content.

Locally available aggregate base material having similar gradation may also be accepted if approved by the contracting officer.

(2) Quality -- When subjected to the Los Angeles abrasion test (Designation 21), the aggregate shall have a loss, using grading A, not to exceed 50 percent, by weight, at 500 revolutions. The designations in parenthese refer to methods of test described in the Seventh Edition of the Bureau of Reclamation Concrete Manual. The Government will test the aggregate, and the contractor shall provide such facilities as may be necessary for procuring representative test samples (Designation 1).

(b) Placing -- The subgrade for aggregate base shall conform to Paragraph 5.1.3 (Preparation of Surfaces Under Roadway Embankments). The aggregate base when thoroughly compacted shall conform to the grades and dimensions shown on the drawings or otherwise established. Depositing and spreading the materials shall commence at the point farthest from the point of loading and shall progress continuously without breaks, except as otherwise directed. The material shall be spread from the hauling vehicle by hand, from spreading boxes, or from self-spreading vehicles. Dumping in piles on the subgrade or on a preceding course will not be permitted. The material shall be deposited and spread in a layer of uniform thickness and of such depth that after being compacted the course will be of the required thickness. After the material for base course has been spread, it shall be mixed thoroughly, by a heavy blade grader having a wheel base not less than 15 feet long, until the material shows a uniform mixture of all sizes of particles. Wetting may be necessary to obtain proper mixing.

223

(c) Compacting -- Rolling of the material shall commence immediately after it has been mixed as described above. Rollers shall weigh from 7 to 12 tons and shall be of the smooth-wheel type. Rolling shall commence at the outer edges and shall progress toward the center. Under no circumstances shall the center of a course be rolled first. Sufficient water to obtain compaction shall be applied during the rolling operations. The base shall be rolled until it is compacted thoroughly and is true to grade and cross section.

(d) Measurement -- The quantity of material for aggregate base for which payment will be made will be determined as provided in Paragraph 5.2.3 (Weights of Roadway Materials). The weight of aggregate base for which payment will be made will be the total weight of the mineral aggregate and binder.

(e) Payment -- Payment for aggregate base will be made at the unit price per ton bid therefore in the schedule, which unit price shall Include the cost of: preparing the subgrade; furnishing all materials, including binder and water incorporated with the mineral aggregate; hauling, placing, blading, mixing and compacting the aggregate base; and all incidental work connected therewith.

5.2.6 Fine Grading of Base Course

Before application of the prime coat, the aggregate base course of the parking area and access road shall be fine-graded, if required, to conform to the grades and cross sections shown on drawings or established by the contracting officer. Where directed by the contracting officer, water shall be added to the base course and it shall be compacted by rolling and the finished surface shall be free of all loose or extraneous material.

The cost of fine grading base course shall be included in the prices in the schedule for other items of work.

5.2.7 Distributor for Applying Liquid Asphalt

The distributor used in applying all liquid asphalt shall be of the self-propelled type, of sufficient power and capacity to apply the asphalt under pressure uniformly and at the proper rate with not more than 10 percent variation therefrom. The distributor shall be equipped with tachometer and

charts, pressure gage, thermometer well, and thermometer and shall have adjustable length spray bars. The spray bars shall be adjustable vertically to permit application of the asphalt at the height above the surface approved by the contracting officer and shall be of the full-circulating type with satisfactory cut-off device at each nozzle. The use of trailer-type distributors will not be permitted. There shall be a trough under the sprays, properly arranged to be swung out of the way after the sprays are operating in a uniform manner at the desired pressure or, in lieu thereof, building paper shall be spread over the treated surface for a sufficient length back so that the sprays are operating properly when uncovered surface is reached. The building paper shall then be removed and burned or otherwise disposed of if burning is not allowed. If the cut-off is not sufficiently positive, the similar use of paper may be required at the end of the area being covered. The distributor shall be operated in such a manner that liquid asphalt will not be splashed on adjacent structures. Any asphalt so splashed shall be removed at the expense of and by the contractor.

5.2.8 Liquid Asphalt Prime Coat

a. Description -- The prime coat shall consist of liquid asphalt applied to the compacted base course in advance of placing the bituminous surfacing.

b. Material -- Liquid asphalt, Grade MC-250, shall be furnished in accordance with ASTM Designation: D 2027-72, Federal Specification SS-A-671C, or AASHTO Designation: M 82-73.

c. Applying -- Liquid asphalt shall be applied to the full width of the fine-graded area to be surfaced at a temperature of 165° to 225°F and in the amount ranging between 0.20 to 0.40 gallon per square yard or as determined by the contracting officer. The prime coat shall be allowed to dry prior to placing of bituminous surfacing. The prime coat shall not be applied during rainy weather or when the atmospheric temperature is less than 70°F.

d. Measurement -- The quantity of material for liquid asphalt prime coat for which payment will be made will be determined as provided in Paragraph 5.2.3 (Weights of Roadway Materials).

e. Payment -- Payment for liquid asphalt Grade MC-250 for prime coat will be made at the unit price per ton bid therefor in the schedule, which unit price shall include the cost of furnishing and applying the liquid asphalt.

5.2.9 Plant-Mix Bituminous Surfacing

a. Description -- Plant-mix bituminous surfacing shall consist of penetration grade or viscosity grade asphalt cement and graded mineral aggregate, mixed at a central mixing plant and placed to the lines, grades, and dimensions shown on the drawings or as determined by the contracting officer. Application of the plant-mix material will not be permitted during unsuitable weather conditions or when the atmospheric temperature is below 70°F.

b. Asphalt cement -- Asphalt cement furnished shall be Penetration Grade 60-70, AASHTO Designation: M 20-70 (ASTM Designation: D 946-69a); or Viscosity Grade AC-10, AASHTO Designation: M 226-73; Viscosity Grade AR-8000, Pacific Coast Asphalt Specifications, or Type I, penetration range 60-70 in accordance with Federal Specifications SS-A-706C.

c. Mineral aggregate -- Mineral aggregate shall be crushed from rock or gravel, shall be uniform in quality and grading, and shall be free from highly plastic clays, vegetable matter, and other deleterious substances.

(1) Grading -- The mineral aggregate when tested by means of standard screens (Designation 4) shall conform to the following limits of gradation:

100 percent passing a screen with 3/4 inch square opening;
40 to 65 percent passing a No. 4 mesh screen;
30 to 55 percent passing a No. 10 mesh screen;
15 to 35 percent passing a No. 40 mesh screen, and
5 to 15 percent passing a No. 200 mesh screen.

The plasticity index of material passing the No. 40 mesh screen shall not exceed 5. Standard gradings for mineral aggregates, 3/4 inch maximum size, as specified by the Arizona or California Highway Departments for asphalt-concrete paving, may be accepted if approved by the contracting officer.

226

(2) Quality -- When subjected to the Los Angeles abrasion test (Designation 21), the mineral aggregates shall have a loss, using Grading B, not to exceed 50 percent, by weight, at 500 revolutions. The designations in parentheses refer to methods of test described in the Seventh Edition of the Bureau of Reclamation Concrete Manual. The Government will test the mineral aggregates, and the contractor shall provide such facilities as may be necessary for procuring representative test samples (Designation 1).

d. Mixing -- The mixing plant used by the contractor shall be a pugmill type, designated to properly dry, heat, screen, and mix the materials. The plant shall have screens capable, at normal speeds, of separating all aggregate to the required sizes. At least two storage bins, proportioned so as to insure adequate dry storage of the appropriate sizes of the aggregate, shall be provided. The break in gradation to determine limiting sizes of fine and coarse aggregate will be determined by the contracting officer. The plant shall be equipped with weighing or, where approved by the contracting officer, volumetric equipment of sufficient capacity for accurately proportioning the two sizes of aggregate and asphalt. Where the materials are weighed, scales to be used shall be either dial scales or multiple-beam scales of an approved type having an accuracy within one-half percent for all loads weighed. The plant shall have a dryer, suitably designed to heat and dry the aggregate. Suitable accurate thermometric equipment shall be furnished for ascertaining the temperature of the aggregae discharged from the dryer. Equipment for heating the asphalt shall consist of a retort or steam coils so designed that steam will not be introduced into the asphalt.

The mineral aggregate shall be furnished in two sizes and shall be stored in separate bins. The two sizes shall be combined in proper proportions as directed at the time of mixing. The aggregates shall be heated, before entering the mixer, to a temperature not in excess of that consistent with proper mixing and laying, but in no case shall the temperature of the materials exceed 350°F. All materials shall be proportioned accurately, by weight, or where approved, by volume.

Additional filler, if required, shall be proportioned and blended with the mineral aggregate before screening into the separate bins. Filler may be added to the aggregate at the mixing plant by thoroughly premixing it with the other fine aggregates. Spreading filler over the top of aggregate pits or dumping it indiscriminately into the hopper at crushing plants will not be permitted.

The amount of asphalt cement may vary between 6 and 8 percent, by weight, of the mineral aggregate, and the exact percentage will be fixed by the contracting officer. When a greater amount of asphalt cement is required to produce a satisfactory mixture, due to the porosity of the rock, the quantity will be increased above the limits herein specified. The asphalt cement shall be added to the mixture at a temperature of not less than 250°F and not more than 325°F. The contractor shall furnish, and keep on the work at all times, an accurate thermometer suitable for determining the temperature of the asphalt cement being added. The amount of asphalt cement to be added shall be accurately weighed by means of an approved weighing device or accurately metered by an approved volumetric device.

Mixing of the mineral aggregate and the asphalt cement shall continue for a period of time after all ingredients are in the mixer until a uniform mixture of unchanging appearance is obtained, with all of the particles or aggregate thoroughly coated with liquid asphalt.

e. Transporting -- The mixture shall be transported from the mixing plant to the site of the work in trucks having tight, clean, and smooth beds which have been oiled with a minimum amount of approved thin oil to prevent adhesion of mixture to the beds. Deliveries of material shall be made so that spreading and rolling of all mixtures can be completed during daylight, unless adequate artificial light is provided. The mixture, when delivered to the placement site, shall be at a temperature of not less than 200°F.

f. Spreading and compacting -- The plant-mix surfacing material shall be spread and struck off with an approved self-propelled paving machine. capable of spreading and finishing the mix to line, grade, and cross section without the use of forms or side supports. The finishing machine shall be equipped with a positive controlled mechanical screed capable of striking off the mix to the specified thickness and producing a smooth and uniform texture without tearing, shoving, or gouging. Equipment leaving tracks

228

or indented areas which cannot be corrected in normal operation or which produces flushing or other permanent blemishes or otherwise fails to produce a uniform and even surface shall not be permitted. In backing trucks against the finisher, care shall be taken not to jar the finisher out of its proper alignment. Delivery of material to the finisher shall be at a uniform rate and in an amount well within the capacity of the paving and compacting equipment.

As soon as the first load of material has been spread, the texture of the unrolled surface shall be checked to determine its uniformity. The adjustment of the screed, tamping bars, set screws, hopper set, and other appliances shall be checked frequently to assure uniform spreading of the mix to proper line and grade and adequate initial compaction. Segregation of materials shall not be permitted. If segregation occurs, the spreading operation shall be immediately suspended until the cause is determined and corrected. Any irregularity in the surface of the paved course shall be corrected. Excess material forming high spots shall be removed. Indented areas shall be filled with hot mix and smoothed. Fanning of material over such areas will not be permitted. The required compacted thickness shall be 2-1/2 inches.

The bituminous material shall be compacted to a density of not less than 95 percent of the laboratory standard density, which shall be the average density value obtained on three laboratory specimens of the same materials in like proportions. Laboratory specimens shall consist of 4 by 4 inch cylinders of the mixture molded under a static pressure of 3,000 pounds per square inch for 2 minutes. The double-plunger method shall be used, and the temperature of the mixture and the molding equipment at the time of molding shall range between 250° to 300°F.

The compacting equipment shall consist of a sufficient number of rollers of the necessary types and weights to obtain the specified density. A minimum of one steel-wheeled roller and one pneumatic-tired roller is required for each job. Where the quantity of placed surfacing material exceeds 50 tons per hour, one roller in addition to the minimum required shall be used. This additional roller may be either steel-wheeled or pneumatic-tired depending on the need for obtaining the specified density. Rolling shall begin as soon as possible after the material is spread:

Provided, that no rolling will be permitted so long as the material "shoves" in front of the roller or undue displacement results. During rolling, the roller wheels shall be kept moist with only sufficient water to avoid picking up the material.

Rolling shall commence at the outside edges and progress towards the center of the pavement or as directed by the contracting officer. Under no circumstances shall the center of the pavement be rolled first. The rollers shall move at a slow, uniform speed. The speed shall not exceed 3 miles per hour for steel wheel rollers or 5 miles per hour for pneumatic tire rollers. During rolling, all lumps or compressed masses of the mixture shall be removed and disposed of and the area filled with additional material and again rolled. The edges of the completed surfacing shall be trimmed uniformly to the required cross section before they are finally rolled and shaped. Rolling shall be continued with steel and pneumatic wheel rollers until the layer has become thoroughly compacted throughout. The final rolling shall be made with a steel wheel roller to remove any rutting or marking of the pavement resulting from previous operations. All transverse and longitudinal joints shall be carefully constructed and rolled to provide a smooth surface at these points in the pavement. All areas inaccessible for the operation of standard rollers shall be compacted by hand tamping, manual or mechanical, subject to the approval of the contracting officer. The completed surfacing when ready for acceptance shall be thoroughly compacted, smooth, true to grade, and cross section, and free from ruts, humps, depressions, or irregularities. When a straightedge 10 feet long is laid on the finished surface and parallel with the centerline of the road, or the long dimension of the parking area, no point on the surface shall vary more than one-quarter of an inch from the lower edge of the straightedge.

g. Measurement -- The weight of plant-mix bituminous surfacing and asphalt cement for which payment will be made will be determined as provided in Paragraph 5.2.3 (Weights of Roadway Materials). The plant-mix bituminous surfacing material will be measured by the ton after mixing and no deduction will be made for the weight of the asphalt cement. All trucks used for hauling plant-mix bituminous surfacing shall be weighed empty daily at such times as the contracting officer may direct. Rejected loads or surfacing relaid shall be at the contractor's expense.

h. Payment -- Payment for plant-mix bituminous surfacing will be made at the unit price per ton bid in the schedule for plant-mix bituminous surfacing, which unit price shall include the cost of furnishing all materials except asphalt cement and shall include the cost of furnishing all tools, labor, and equipment required in the preparation of the aggregate, in the unloading, hauling, mixing, placing and compaction of the surfacing. Payment for asphalt cement, Penetration Grade 60-70, or Viscosity Grade AC-10 or AR-8000 as specified in Subparagraph b. above, will be made at the unit price per ton bid in the schedule, for asphalt cement Penetration Grade 60-70, which unit price shall include the cost of furnishing the asphalt and all labor and equipment required in unloading, hauling, and applying the asphalt.

5.2.10 Aggregate Seal Coat

a. Description -- The seal coat shall consist of an application of emulsified asphalt and a cover aggregate to the surface of the bituminous surfacing.

b. Asphalt -- Cationic Emulsified Asphalt, Grade CMS-2h, shall be furnished in accordance with ASTM Designation: D 2397-73, AASHTO Designation: M 208-72.

c. Cover aggregate -- Cover aggregate shall be crushed from rock or gravel, shall be uniform in quality and grading, and shall be free from clay, vegetable matter, and other deleterious substances.

(1) Grading -- The aggregate when tested by means of standard screens (Designation 4) shall conform to the following limits of gradation:

100 percent passing a screen with 1/2 inch square openings;
0 to 20 percent passing a No. 4 mesh screen;
0 to 5 percent passing a No. 10 mesh screen; and
0 to 2 percent passing a No. 200 mesh screen.

(2) Qualtiy -- When subject to the Los Angeles abrasion test (Designation 21), the aggregate shall have a loss, using grading B not to exceed 40 percent, by weight, at 500 revolutions.

The designations in parentheses refer to methods of test described in the Seventh Edition of the Bureau of Reclamation Concrete Manual. The Government will test the aggregate, and the contractor shall provide such facilities as may be necessary for procuring representative test samples (Designation 1).

231

d. Preparation of surface -- Immediately before application of the emulsified asphalt, the surface of the bituminous surfacing shall be cleaned by power brooms or hand sweeping, or both, so that the surface is free from all foreign substance.

e. Applying emulsified asphalt -- Emulsified asphalt shall be applied to the entire width of the bituminous surfacing at a temperature of 110° to 160°F and in the amount of approximately 0.32 gallon per square yard or as determined by the contracting officer. Amount and temperature will depend upon the nature of the bituminous surfacing, season of the year, and the grading of the cover aggregate. Spray bars on the distributor used in applying the liquid asphalt shall be of such length as to permit spraying at least 1 foot wider than the width of the spreader box used in applying cover aggregate.

f. Spreading cover aggregate -- After the emulsified asphalt has been applied, cover aggregate shall be spread evenly over the treated surface in the amount of 20 to 30 pounds of material per square yard of area or as determined by the contracting officer. The aggregate shall not contain more than 3 percent of moisture, by weight, when applied. The aggregate shall be applied by means of a mechanical spreader, of approved type, which shall be operated on the roadway in such a manner that it will spread the aggregate ahead of the propelling vehicle. In no case shall equipment be permitted on the tacked surface not covered by aggregate. After the aggregate has been spread, any unevenly covered places will be smoothed by hand spreading and hand sweeping. Excess material shall be removed and salvaged for reuse. Immediately after completion of spreading, the surface shall be rolled with a self-propelled pneumatic-tired or steel-wheeled tandum roller exerting a pressure from 200 to 270 pounds per linear inch on the compression roll. Rolling shall commence at the outer edges and proceed toward the center of the pavement. Broom dragging and rolling shall continue until the surface is cured to the satisfaction of the contracting officer. Surplus aggregate shall be swept off the surface and disposed of as directed by the contracting officer.

g. Measurement -- The quantities of materials for seal coat for which payment will be made will be determined as provided in Paragraph 5.2.3 (Weights of Roadway Materials).

h. Payment -- Payment for all work described in this paragraph will be made at the unit prices per ton bid in the schedule for aggregate for seal coat, and for cationic emulsified asphalt Grade CMS-2h, which unit prices shall include the cost of cleaning surfaces of the pavement to be sealed, if required, and of furnishing and placing the materials.

5.2.11 Tack Coat

a. Description -- The tack coat shall consist of an application of liquid asphalt applied to an existing asphalt or portland cement concrete surface.

b. Asphalt -- The material shall be an asphalt emulsion conforming to ASTM Specification D977-69, Type RS-1.

c. Preparation of Surface -- The surface shall be prepared as described in Paragraph 5.1.10d.

d. Applying Tack Coat -- Tack coat shall be applied to the existing asphalt in the amount of 0.05 to 0.15 gallons per square yard or as determined by the contracting officer.

e. Measurement -- The measurement of material shall be in accordance with Paragraph 5.2.3 (Weights of Roadway Materials).

f. Payment -- Payment for all work described in this paragraph will be made at the unit prices per ton bid in the schedule for tack coat and shall include the cost of surface preparation.

DIVISION 6--PIPE CULVERTS

SECTION 6.1--CULVERTS

6.1.1 Pipe Culverts

a. General-- Pipe culverts of corrugated metal pipe shall be constructed where shown on the drawings or where directed. All pipe and materials for culverts shall be furnished by the contractor.

b. Excavation and bedding--The trenches in which pipe is to be laid shall be excavated carefully to the established lines and grades to provide a firm and uniform bearing for the entire length of the pipe. Where the character of the material at any point in the bottom of a trench is such as might cause unequal settlement or provide unequal bearing for the pipe, the unsuitable material shall be removed to such depth as may be directed and the additional excavation shall be backfilled with approved material which shall be tamped thoroughly to insure an even and unyielding foundation for the pipe.

The cost of removing unsuitable material in the bottom of the trench and for all excavation and backfill required to provide adequate foundations for pipe shall be included in the respective unit price per linear foot bid in the schedule for furnishing and laying the 15-inch and 18-inch diameter corrugated metal pipe.

c. Backfilling--As each unit of pipe is laid, sufficient backfill material shall be tamped under and about the pipe to hold it rigidly in place until the joints are completed. After the joints have been completed, the backfilling shall be completed and compacted as provided in Paragraph 5.1.5 (Moistening and Compacting Roadway and Parking Area Embankments). The contractor will not be allowed to route construction equipment over a culvert until subgrade material has been placed to a minimum depth of one foot over the top of the pipe.

6.1.2 Furnishing and Laying Corrugated Metal Pipe

a. Furnishing pipe--The contractor shall furnish and lay corrugated metal pipe culverts at locations shown on the drawings. Galvanized corrugated iron or steel pipe and connecting bands for culverts shall be in accordance with Federal Specification WW-P-405B, Class I,

234

Shape 1. Galvanized sheet for fabricating Class I pipe and coupling bands shall be 16-gauge galvanized in accordance with ASTM Designation: A 444.

The pipe shall be hauled and handled in such a manner as to avoid damaging the coating. Where field cutting is performed or where the galvanized coating is damaged, the coating shall be repaired by application of two coats of Galvanox as manufactured by Subox, Incorporated, Hackensack, New Jersey, or equal. Any pipe unit that, in the opinion of the contracting officer, is damaged beyond repair by the contractor in hauling, handling, or otherwise, shall be removed from the site of the work and replaced at no cost to the Government.

b. Laying pipe--The pipe shall be laid to the established lines and grades with the separate sections jointed firmly together by means of connecting bands furnished for that purpose and with the outside laps of circumferential joints pointing upgrade, and with the longitudinal joints at the sides.

c. Temporary bulkheads--The contractor shall furnish and install temporary bulkheads at each end of the corrugated metal pipe culverts. Material for bulkheads shall be 1/2-inch plywood of good commercial quality approved by the contracting officer.

No direct payment will be made to the contractor for furnishing and installing the bulkheads and the cost thereof shall be included in the respective unit prices per linear foot bid in the schedule for furnishing and laying the 15-inch and 18-inch diameter corrugated metal pipe.

d. Measurement and payment--Measurement, for payment, for furnishing and laying corrugated metal pipe will be made along the centerline of the pipe, from end to end of the pipe in place, and no allowance will be made for lap at joints. Payment for furnishing and laying 15-inch and 18-inch diameter corrugated metal pipe will be made at the respective unit prices per linear foot bid therefor in the schedule, which unit prices shall include the cost of excavating and back-filling the trenches, preparing a suitable and even bedding, attaching connecting bands, and for furnishing and installing of temporary bulkheads.

DIVISION 7--PIPING ALTERATIONS

SECTION 7.1--PIPELINES

7.1.1. Pipelines

a. General.--The contractor shall furnish pipe and fittings and construct the pipeline alterations as shown on the drawings and as herein specified.

During manufacturing, transporting, storing, and installing pipe and pipe fittings, the pipe and pipe fittings shall not be dropped or subjected to any unnecessary impact or other treatment that could damage the pipe.

Pipe shall not be stored in the yard or on the jobsite under conditions which would cause damage. Any length of pipe that, in the opinion of the contracting officer, is damaged beyond repair by the contractor by hauling, handling, unloading, storing, or otherwise, shall be removed from the worksite and replaced by and at the expense of the contractor with another length of pipe of equal or greater strength.

b. Pipe.--The contractor shall furnish and install steel pipe and fittings as specified in Paragraph 7.1.4. (Steel Pipe and Fittings).

c. Measurement and payment for pipe.--Measurement, for payment, for furnishing and installing the 8-inch pipeline will be made along the centerline of the pipe between ends of the pipe in place and will be continuous through bends and other fittings with no allowance for lap at joints.

Payment for furnishing and installing the 8-inch Schedule 20 steel pipe will be made at the unit price per linear foot bid therefor in the schedule, which price shall include the cost of furnishing all materials, manufacturing, transportation, installing the pipe, and furnishing maintenance guarantee.

7.1.2. Testing the Pipeline

a. Pressure test.--After the pipeline has been laid, the joints completed, and the trenches partially backfilled, the contractor shall subject the pipe to a hydrostatic pressure of 200 lb/in^2 for a period of not less than one hour. No leakage will be allowed and any and all leaks shall promptly be made watertight.

The contractor shall furnish all pumping equipment, labor, tools, pressure gages, and other equipment, and water required for making the tests.

All exposed piping, fittings, and joints shall be carefully examined during the test. Any cracked or defective piping or fittings discovered during the pressure test shall be removed and replaced by the contractor with sound material and the test repeated as required, all at the expense of the contractor.

All testing shall be done in the presence of a duly authorized representative of the contracting officer.

b. Cost.--The entire cost of testing the pipelines and of furnishing all equipment, labor, and materials for making the tests shall be included in the unit price bid in the schedule for furnishing and installing 8-inch Schedule 20 steel pipe.

7.1.3 Guarantee

The contractor shall furnish a guarantee against leakage of the pipeline for a period of 1 year from date of acceptance. Any leaks shall be corrected by the contractor, on notice from the contracting officer and at no cost to the Government. Any repairs to the pipeline shall be made in an acceptable manner approved by the contracting officer.

In lieu of such guarantee the contractor may hydrostatically test the pipeline at 150 percent of the specified test pressure of the pipeline at the lowest point in the line. Any visible leaks shall be repaired. The installation will be considered acceptable when the specified test pressure has been maintained without loss for a period of not less than 2 hours or no leaks are observed during that period of time or such time as necessary for completing inspection of all joints along the pipeline.

7.1.4. Steel Pipe and Fittings

a. General.--The contractor shall furnish, install, and insulate the steel piping and fittings for the pipeline complete with accessories in accordance with the requirements of these specifications and as shown on the drawings.

b. Materials.--Materials shall be in accordance with the following requirements:

237

(1) 8-inch steel pipe--ASTM A53 (Schedule 20) plain end.

(2) Steel fittings--ASTM Designation A234.

(3) Insulation--Insulation for the steel pipe and fittings shall be equal to Johns-Manville "Metal-On" aluminum-jacketed, calcium silicate insulation in nominal thickness of 2 inches as furnished by Johns-Manville, 22 East 40th Street, New York, New York 10016, and shall comply with the requirements of Federal Specification HH-1-523c, Type II, Class C.

(4) Miscellaneous materials.--Where materials are required but are not specified herein, the contractor shall furnish standard commercial quality material suitable for the intended use.

c. Fabrication.--The steel pipe shall be fabricated in accordance with these specifications, the drawings and the requirements of the American Water Works Association Standard C201. Where provisions of the AWWA Standards conflict with provisions of these specifications and/or drawings, the provisions of these specifications and/or drawings shall govern. The requirements of Sections 5.1 to 5.4, inclusive, of the AWWA Standard C201 are not a part of these specifications. The shell thickness of the pipe shall not be less than 0.250 inches.

d. Installation.--The steel pipe and fittings shall be assembled and erected in place as shown in the drawings. The contractor shall furnish and install such temporary supports and bracing as may be required to hold the pipe in place and prevent distortion during placing of concrete; however, the embedment of timber supports or the welding of temporary supports to the pipe shell will not be permitted. Pipe insulation shall be installed in accordance with the manufacturer's instructions.

e. Measurement and payment.--Measurement for payment and payment for furnishing and installing steel pipe will be made as provided in Subparagraph 7.1.1.c (Measurement and Payment for Pipe).

Measurement, for payment, for furnishing and installing the pipe insulation will be made along the centerline of the pipe between ends of the pipe in place and will be continuous through bends with no allowance for lap at joints.

Payment for furnishing and installing pipe insulation will be made at the unit price per linear foot bid therefor in the schedule, which unit price shall include the cost of furnishing all materials, transportation, labor, and incidental costs associated therewith.

The weight of steel pipe fittings will be determined as specified in Paragraph 1.4.4 (Weights of Metal Parts) and payment for furnishing and installing the miscellaneous steel pipe fittings, including but not limited to: elbows, nipples, couplings, etc., will be made at the unit price per pound bid therefor in the schedule which unit price shall include the cost of all labor, materials, and incidentals associated therewith.

7.1.5 Pipe Supports and Saddles

The contractor shall furnish and install pipe supports and saddles according to the following requirements and as shown on the drawings.

(a) Pipe roller supports--pipe roller supports shall be equal to No. 177 as offered by the ITT Grinnell Corp. (Catalog PH-76).

(b) Protection saddles--Saddles for the protection of the pipe insulation at pipe supports shall be ITT Grinnell Corp. (Catalog PH-76) No. 162 protection saddle for 2-inch insulation, or approved equal.

(c) Skid pipe supports shall be fabricated as shown on the drawings.

239

DIVISION 8--CONSTRUCTION OF SHADE STRUCTURE BUILDING

SECTION 8.1--PREFABRICATED METAL BUILDING

8.1.1 General and Payment

a. General--The item in the schedule for furnishing and erecting a prefabricated metal building includes furnishing all material and performing all work required for constructing a shade structure building, except for those items listed in Subparagraph b. below. The building design shall be in accordance with Paragraph 8.1.6 (Design Stresses and Loads).

b. Work not included in the item of the schedule for furnishing and erecting a prefabricated metal building--The item in the schedule for furnishing and erecting a prefabricated metal building does not include the following items which are provided for elsewhere in these specifications:

(1) Furnishing and installing all electrical, lighting, and grounding systems;

(2) Reinforced concrete footings and anchor bolts.

c. Payment--Payment for furnishing and erecting a prefabricated metal building will be made at the lump sum price bid therefor in the schedule, which lump sum price shall include the cost of all materials and equipment for a standard prefabricated metal building and to erect the building complete with facilities as provided in these specifications. Included in the lump sum price bid shall be the cost of all painting and any special equipment as listed on the drawings and provided for in these specifications, but not limited thereto, as may be required for a complete building.

Payment for all required earthwork and gravel fills will be made in accordance with the applicable paragraphs in Division 3--Earthwork. Payment for concrete and reinforcement will be made in accordance with the applicable paragraphs in Section 4.1--Concrete.

8.1.2 Prefabricated Metal Building

The building shall be a high profile prefabricated metal building furnished by a firm regularly engaged in the manufacture of such buildings.

The drawings in these specifications were prepared on the basis of an uninsulated type roof prefabricated metal building, with open sides and ends as manufactured by Pascoe Steel Corporation, Pomona, California; or equal.

The building shall be furnished and erected complete in every detail, including monitors, battens, flashing, eave angles, and all necessary bolts, screws and fasteners.

The building shall conform to the requirements and standards of the Metal Building Manufacturers Association.

The building shall be of conventional gable design with a roof slope of 4 in 12. All parts shall be clearly stenciled or marked so that they may be rapidly assembled by inexperienced laborers working under supervision. Prefabricated sections and framing shall be fully fabricated in the shop and shall require a minimum of field drilling.

Concrete shall conform to the requirements of Section 4.1--Concrete.

8.1.3 Drawings and Data to be Furnished by the Contractor

a. Approval drawings and data--Within thirty (30) calendar days after date of receipt of notice to proceed and before proceeding with fabrication or procurement of material, the contractor shall submit, in duplicate, the following drawings and/or data to the Government for approval:

(1) Full foundation plan with anchor bolt layout.
(2) Erection drawings with complete framing details.
(3) Calculation or load design sheets for building span used.

Any fabrication or procurement performed prior to approval of the drawings and data shall be at the contractor's risk. The Government shall have the right to require the contractor to make any changes in the structural and

241

equipment design which the Government determines necessary to make the structure and equipment conform to the requirements of these specifications without additional cost to the Government. Approval by the Government of the contractor's drawings shall not be held to relieve the contractor of any part of the contractor's responsibility to meet all of the requirements of these specifications or of the responsibility for the correctness of the contractor's drawings.

b. Final drawings and data--When the equipment is ready for shipment, the contractor shall furnish 1 complete set of reproducibles and 2 complete sets of blackline prints of the final correct assembly drawings and of such construction drawings as may be required for erection, maintenance, or repair. The contractor shall also furnish 3 copies of sufficient information to facilitate the identification of parts, and shall furnish 3 sets of complete detailed instructions for the installation, operation, maintenance, and repair of the equipment.

The drawings shall show all changes and revisions, with revision dates, made up to the time the equipment is completed and ready for shipment.

c. Mailing address--All drawings, data, test reports, parts, lists, and operating instructions required under this paragraph shall be forwarded to the Construction Engineer, Yuma Projects Office, P. O. Bin 5569, Yuma, Arizona 85364. In addition to the above, the contractor shall submit one set of prints, a copy of other information submitted, and copy of his transmittal letter to the Regional Director, Bureau of Reclamation, P.O. Box 427, Boulder City, Nevada 89005, Attention: 200.

d. Costs--The costs of preparing drawings and of submitting drawings and data to the Government shall be included in the lump sum price bid in the schedule for furnishing and erecting a prefabricated metal building.

8.1.4 Dimensions

a. Buildings--The dimensions of the buildings as to length, width, and height as shown on the drawings, are nominal and may be varied slightly to conform to the building manufacturer's standards. Minimum dimensions of the buildings furnished shall not vary more than 12 inches less than the length, width, and height shown on the drawings.

242

8.1.5 Materials for Structural Framing

All materials shall conform to the following Federal Specifications or to other specific designations or standards as indicated:

a. Structural steel--All structural steel shall conform to: QQ-S-741D, ASTM Designation: A 7, A 36, or ASTM Designation: A 374, except that Government inspection at the mill will be waived.

b. Bolts--Connection bolts shall be American Standard regular with square heads. All bolts shall be Type I in accordance with FF-B-575C, except that length of threads shall be in accordance with the standards of the American Standards Association, Report 18.2, latest edition. All bolts shall be made from Class B or C bolt steel.

c. Nuts--All nuts shall be Type II, Style 4, in accordance with FF-N-836D(1).

d. Eyebolts--Materials for all eyebolts shall be forged steel conforming to ASTM Designation: A 235. Eyebolts shall otherwise conform to FF-B-575C.

e. Arc-welding electrodes--All arc-welding electrodes shall be of the E60 classification in accordance with the latest edition of the American Welding Society Specifications for Iron and Steel Arc-Welding Electrodes and shall be suitable for the positions and other conditions of intended use.

f. Miscellaneous materials--Miscellaneous materials not specifically covered herein by detailed specifications shall be of the top standard commercial quality and shall be approved by the contracting officer.

8.1.6 Design Stresses and Loads

The prefabricated metal building shall meet the design requirements of the Recommended Design Practices Manual of the Metal Building Manufacturers Association as set forth in Section 7, "Combinations of Loads," for the Southwestern United States for a wind load of 20 pounds per square foot and a live load of 12 pounds per square foot, minimum loadings **or as local conditions dictate.**

243

All members of the prefabricated building 1/8-inch thick and over shall be designed so as not to exceed allowable unit stresses prescribed in the latest edition of "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" of the American Iron and Steel Institute. All members shall be designed for the **requirements of the Uniform Building Code, latest edition, as published by the Pacific Coast Building Officials Conference.**

8.1.7 Fabrication

All fabrication of structural steel shall be performed in accordance with the applicable provisions of the "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," latest edition, of the American Institute of Steel Construction. Structural material to be used in fabrication of frames or members shall be straight and free from sharp kinks and bends. If straightening is necessary, it shall be done by methods that will not damage the metal. Shearing and cutting by torch or electric arc shall be performed carefully and all portions of the work which will be exposed to view after completion shall be finished neatly.

8.1.8 Erection

All anchor bolts for structural steel work shall be set accurately in the concrete when the concrete is placed. All bases and all bearing surfaces shall be set level, in exact position, and shall be given full and even bearing by means of concrete grout.

Erection in the field will be by bolting. No welding will be permitted without the approval of the contracting officer. The contractor shall be prepared to perform both classes of work. Only qualified welding operators shall be employed to perform the welding, and if requested by the contracting officer, each such welding operator shall submit satisfactory evidence of his ability before being allowed to perform the work.

All parts shall be assembled accurately and erected as shown in the contractor's approved erection drawings or as directed by the contracting officer, and all match marks of the fabricator shall be followed carefully. Members shall not

be overstressed during the process of erection and hammering that will injure or distort the members will not be permitted.

Bearing surfaces and surfaces to be in permanent contact shall be cleaned carefully before the members are assembled or erected.

All welding shall be done by the electric-arc method, using the process which will exclude the atmosphere from the molten metal. Welds shall be made as specified on the drawings and in accordance with the conventional welding symbols of the American Welding Society. All butt welds shall have complete penetration.

8.1.9 Protective Coating for Building Metalwork

All structural steel framing members, and all other ungalvanized steel shall be thoroughly cleaned and provided with the manufacturer's standard shop coating. After erection, all field bolts and serious abrasions to the shop coat shall be spot painted with the same type of material used for the shop coat. Mud and other objectionable foreign materials will be removed. Gilsonite paint or a similar quality paint shall be applied to all steel surfaces touching aluminum sheets. Painting shall be in accordance with Section 8.3--Painting.

8.1.10 Roofing and Siding

a. General--The contractor shall furnish and install roofing and siding as set forth below:

The siding and roofing for the building shall be a building manufacturer's standard siding and roofing pattern, except that the use of standard corrugated sheets with semicircular corrugations for either roofing or siding will not be acceptable.

b. Materials--

(1) Roofing and siding--The roofing and siding for the building shall be of zinc-coated steel, conforming to Federal Specification QQ-S-775d, 26-gage minimum for roofing and 24-gage minimum for siding.

243

The roofing and siding shall be adequately reinforced to withstand the loads imposed. The exterior and interior finishes shall be factory-applied, baked-on enamel, colors as specified on the drawings or as approved by the contracting officer.

(2) Flashings, weather seals, and ridge caps--Flashings, weather seals, and ridge caps shall be fabricated from flat flashing stock or standard preformed sections manufactured by the roofing and siding manufacturer and shall have the same thickness as the roofing and shall be otherwise in accordance with the manufacturer's recommendations. Metal forming equipment for field-formed flashings shall be subject to the approval of the contracting officer.

(3) Fasteners--Clips, bolts, self-tapping screws, sheet metal screws, neoprene washers, and similar fasteners shall be of an approved type as recommended by the manufacturer of the roofing and siding.

c. Installation--The roofing and siding shall be installed in a manner which will provide weathertight joints throughout. The sheeting shall be fitted neatly at all connections and joints and shall be attached to and sealed against eave struts. Structural steel and other ferrous metalwork which will be in contact with aluminum shall be coated with an asphalt varnish, Federal Specifications TT-V-51F, similar to a Gilsonite paint system to prevent electrolytic action.

The side lap for ribbed siding shall be made in accordance with the manufacturer's instructions. Suitable mastic or seal shall be used on all roof laps.

All sheets shall be fastened to the side wall and roof structural members so that sheets will become an integral part of the building. Approved fasteners for this purpose will be bolts, self-tapping screws, lock rivets, or other approved fasteners. Ferrous fasteners shall be galvanized or cadium plated. Aluminum, lead, or neoprene washers shall be used as required for weathertightness. Clinch rivets, straw nails, or purlin nails are not acceptable.

8.1.11 Monitors

Monitors of the types indicated in the drawings shall be installed as shown on the drawings. All fasteners, preformed and metal closures, and calking compound used as necessary for a weathertight installation shall be of standard commercial quality.

SECTION 8.2--MISCELLANEOUS METALWORK

8.2.1 Miscellaneous Metalwork

a. General--The contractor shall furnish and install miscellaneous metalwork for the shade structure building including all cap screws, nuts, washers, bolts, and other accessory materials, required for installing the metalwork.

b. Materials--

(1) Structural steel, shapes, plates, and bars --QQ-S-741D

(2) Expansion anchors--F-S-325, Group I, Type 1, Class 2: Group III, Type 1; or Group II, Type 2, Class 1, Style 1.

(3) Miscellaneous materials--Miscellaneous materials required for completion of the work and not specifically covered herein by detailed specifications shall be of the best standard commercial quality.

c. Fabrication--All work shall be equal to the best modern practice in the manufacture and fabrication of materials of the types covered by these specifications, notwithstanding any omissions from these specifications or drawings. Fabrication of miscellaneous metalwork shall be in accordance with the applicable provisions of Section 1.23 of the "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction and with the details shown on the drawings. All welding and work related thereto shall be performed in accordance with the latest edition of the American Welding Society "Code for Arc and Gas Welding in Building Construction." Before being laid out or worked, material shall be straight and free from sharp kinks and bends. Shearing and cutting by torch or electric arc shall be performed carefully, and all portions of the work which will be exposed to view after completion shall be finished neatly. Stud anchors shall be welded in place with automatic end-welding guns. After fabrication, all material shall be straight and true and free from kinks, twists, and warps. If straightening is necessary, it shall be done by methods that will not injure the metal.

d. Installation--All embedded metalwork shall be set accurately in position and shall be supported rigidly to prevent displacement during the placing of the concrete. Suitable blockouts shall be constructed in the concrete where required for installation of metalwork. After installation of the metalwork, blockouts shall be filled with concrete or grout as shown on the drawings. The contractor shall drill or drill and tap, as required, all holes in metalwork required for installation of the metalwork.

The miscellaneous metalwork shall be painted in accordance with Section 8.3--Painting.

e. Costs--The cost of furnishing and installing miscellaneous metalwork shall be included in the lump sum price bid in the schedule for furnishing and erecting a prefabricated metal building, which price shall include the cost of all labor, materials, transportation and all incidentals required for completion of the building herein specified and shown on the drawings.

SECTION 8.3--PAINTING

8.3.1 Painting

a. General--The contractor shall furnish all materials, clean surfaces and apply the paint and protective coatings listed in Paragraph 8.3.2 (Painting Tabulation) and in accordance with Paragraph 8.3.3 (Color Schedule for Painting).

Items or surfaces not required to be painted or coated but which are adjacent to surfaces to be cleaned and painted shall be protected against contamination and damage during the cleaning and painting operations. The cleaning and painting operations shall be so conducted that dust or other contamination from the cleaning process will not fall on wet, newly painted surfaces, and newly painted metalwork shall not be moved until the paint is dry hard. All contractor-applied coatings exposed to view, including any touchup repair painting, shall present a uniform color-matched appearance. Any items or surfaces damaged or contiminated by painting operations shall be returned to their original condition by and at the expense of the contractor. Before topcoating any coated surfaces, the contractor shall reclean any exposed metal and apply paint as necessary to restore to the specified condition all previously applied paint in areas which are defective or damaged. Materials which have been painted shall be handled with care and protected as necessary to preserve the coating in good condition.

Temporary or permanent welding for the convenience of the contractor will not be permitted on areas where the welding will damage paint or other protective coatings unless the areas of coatings which would be damaged thereby are accessible for repairing and inspection. Unless otherwise specified, the contractor will not be required to disassemble machinery, equipment or other metalwork for the purpose of painting the interiors. The contractor shall provide adequate ventilation, lighting and the necessary safety equipment for the protection of the workmen during painting and coating operation.

b. Preparation of surfaces--Surface preparation shall be in accordance with one of the following methods. The method to be used for each item is indicated in the painting tabulation. Weld spatter, slag burrs, or other objectionable surface irregularities shall be removed or repaired before cleaning. Any contaminants to the paint coating, from cleaning operations or other sources, shall be removed before the surfaces are painted. Cleaning solvent shall be mineral spirits or xylol. Cleaning cloths and solvents shall be discarded before they become contaminated to the extent that a greasy film would remain on the surface after preparation of the surface. In the event that rust forms or the surfaces become otherwise contaminated in the interval between cleaning and painting, or between coats of paint, recleaning will be required. Any coatings not required by and not shown in the painting tabulation shall be removed from the surfaces by suitable and effective means, unless otherwise directed.

Method A All oil, grease, and dirt shall be removed by the use of clean solvent and clean, lint-free wiping material or other effective means. Surfaces with gloss or semigloss paints shall also be sanded lightly.

Method B All oil and grease shall be removed by the use of clean solvent and clean, lint-free wiping materials. Following the solvent cleaning, the surfaces shall be cleaned of all defective or damaged areas of existing paint, and of all loose rust, loose mill scale, and other foreign substances by scraping, chipping, wire brushing, grit-blasting, commercial grade sandblasting, or other effective means.

c. Preparation of other surfaces--All surfaces not covered by the above subparagraphs shall be prepared by methods common to good practice for the particular surface being prepared.

d. Application--Materials shall be thoroughly mixed at the time of application. Surfaces shall be clean and free from moisture at the time of application. Items to be painted that are not thoroughly dry at the time of paint application shall be heated to a sufficient temperature (80°F) to drive off any moisture present before paint is applied. Effective means shall be provided

251

for removing free oil and moisture from the air-supply lines of all spraying equipment. Care shall be exercised during spray application to hold the nozzle sufficiently close to the 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. Nozzle pressure consistent with acceptable finish results shall be employed when spray painting.

Each coat shall be applied in such a manner as to produce an even film of uniform thickness which will completely cover irregularities, fill crevices, and be tightly bonded to the metal or previous coat. Each coat shall be free from runs, pinholes, and sags.

Each coat shall be allowed to dry or to harden before the succeeding coat is applied. Thicknesses shall be measured by an approved dry-film thickness gage and shall be not less than the minimum specified thickness at any point on the coating. Acceptance will be based on the total dry-film thickness as measured by an Elcometer, Mikrotest, or other suitable dry-film thickness gage, after the complete paint system has thoroughly dried.

Red lead priming paint, regular aluminum paint, and enamels, and oil base paints may be thinned if necessary to permit satisfactory application, in which event mineral spirits shall be used and the amount of thinner shall be kept to a minimum but in no event shall it exceed one pint per gallon of paint.

If necessary to improve application properties, cold-applied paints may be heated by means of a hot-water bath to temperatures not to exceed 100°F. Paint shall not be applied when the temperature of the item to be painted or of the surrounding air is under 45°F, except that vinyl resin paints shall not be applied when metal or air temperatures are above 100° or below 40°F. Painting shall proceed only when the humidity and the temperatures of atmosphere and of surfaces to be painted are such that evaporation rather than condensation will result. Brush coats may be applied by the conventional brushing procedure, or the paint may be delivered to the surface in a fluid stream by means of spray equipment employing air pressure only on the material and the paint then spread immediately by brushing to an even smooth coating.

Tinting, where required for color contrast, shall be accomplished by using not more than 3 ounces of tinting color per gallon of paint.

Application of specific materials shall be as follows:

(1) Red lead priming paint shall be applied at a maximum coverage of 500 square feet per gallon per coat for Type II. Following the first coat of red lead paints, an additional tinted coat shall be applied over all rivets, welds, bolts, seams, sharp corners, and edges before subsequent painting. Alternate coats shall be tinted for color contrast using 1B black. The first coat shall be applied by brush or roller and subsequent coats shall be applied by either brush, roller, or spray, except that Type II red lead priming paint may be applied by spraying when Method B surface preparation is specified and the surface is cleaned by "commercial" grade blast cleaning.

(2) Aluminum paints shall be applied by spraying at a maximum cover of 500 square feet per gallon per coat for regular aluminum paint. The paints shall be prepared by mixing 2 pounds of aluminum paste per gallon of mixing varnish and only enough paint for each day's use shall be prepared at one time. The first coat shall be tinted for color contrast using 2A blue. The final coat of aluminum paint shall be "stripe free" with a uniform appearance.

(3) Enamels, oil base paints, and tinted decorative paints shall be applied by brush, roller, or spray at a maximum coverage of 500 square feet per gallon per coat.

(4) Latex base primer shall be applied by brush, roller, or spray at a maximum coverage of 450 square feet per gallon.

e. Materials--All pigmented paints and primers shall be purchased in containers not larger than 5 gallons as packaged by the manufacturer. Colors of finish paints shall be as directed in accordance with Federal Standard No. 595A. All colors shall be factory mixed and ground. Tinting with universal tinting colors will not be permitted, and tinting with colors-in-oil is permitted

253

only where specified for slight contrast between coats. Materials shall be in accordance with the following specifications, or may be in accordance with the subsequent revisions thereto: Provided, That the samples or certifications are identified with the proper specifications revision:

Group I

(1) Federal Specifications--

(a) Red lead priming paint, TT-P-86g, Type II.

(b) Mixing varnish for regular aluminum paint, TT-V-81d, and aluminum paste, TT-P-320c, Type II, Class 2.

(c) Zinc dust-zinc oxide primer, TT-P-641f, Type II.

(d) Primer coating, zinc dust, chlorinated rubber, TT-P-001046(1), (Galvanizing repair compound).

(e) Enamel, gloss, TT-E-489f(1), Class A.

(2) Miscellaneous specifications--

(a) Paint and coating materials required to be used on work covered by these specifications and which are not covered by this paragraph will be classified as Group I materials, unless otherwise indicated.

Group II

(1) Federal Specifications--

(a) Pigment-in-oil (tinting colors), TT-P-381E(1). Colors 1B black and 2A blue, or equal tinting color in oil.

(b) Mineral spirits, TT-T-291E, Grade 1.

(c) Xylol (xylene), TT-X-916b, Grade A or B.

f. Sampling, testing, and certification of materials--The Government will test or require certification of each batch, type, or color of paints or related materials prior to use of application. However, acceptance of the material under the clause of the General Privisions entitled "Inspection and Acceptance" will not be made until the material has been satisfactorily applied and the equipment installed at the job site.

The contractor shall furnish copies of all purchase orders for paint or related materials to the contracting officer. Copies of purchase orders shall be furnished far enough in advance of planned use so that the samples, if required, will be available to the Government to allow a testing period of at least 45 days. The Government will then inform the contractor in writing whether materials covered by each purchase order will be tested or whether the manufacturer's certification will be required. The Government will act on certifications as to paint conformance within 16 days after receipt of the certifications by the Govermment, and will notify the contractor. Purchase orders and the required certifications or samples shall be furnished by the contractor to the Bureau of Reclamation, Construction Engineer, Yuma Projects Office, P. O. Bin 5569, Yuma, Arizona 85364, shipping costs pre-paid, and copies of all correspondence shall be sent to the authorized representative of the contracting officer at the job site.

Certifications for each type, batch, or color of Group I materials shall include detailed results of laboratory tests covering all of the applicable specifications requirements and a general statement that the materials comply with the requirements of the specifications. Certifications for quantities of 10 gallons or less of each type, batch, or color of Group I materials may be furnished with only the manufacturer's quality control and composition data, and a general statement that the materials comply with the requirements of the specifications. The certifications shall also contain specific identification data as to material identification, batch number, date of manufacture, quantity being furnished and the Bureau of Reclamation specifications number. Certifications for Group II materials need not include detailed laboratory testing data but shall comply in other respects with the requirements stated above. The Government reserves the right to test any materials furnished on certification when in the opinion of the Government, such tests are necessary. The Contractor shall be responsible for the accuracy of all certifications submitted or data contained therein whether submitted by him, a manufacturer, a supplier, or a subcontractor.

The contractor shall purchase the total quantity of each item of material that is expected to be used in a reasonable length of time to avoid repetitive purchases that would impose additional testing expense on the Government.
255 The costs and delays from additional testing required as a result of either

unnecessary small purchases or rejection of the materials submitted shall be the responsibility of the contractor.

g. Costs--The cost of furnishing, preparing and applying all materials for the cleaning, painting, or coating operations shall be included in the applicable prices bid in the schedule for the items of work requiring painting, with the single exception of finish color painting of the metal shade structure, which shall be bid per coat as a separate item.

8.3.2 Painting Tabulation

Contractor furnished items shall receive the cleaning and coating systems shown in the tabulation following. Coatings shall be applied as required under Paragraph 8.3.1 (Painting).

No.	Item	Surface Preparation Method	Paint Or Coating Material	Number of Coats
1	Exterior and interior surfaces of metal roofing, siding, trim, and building accessories furnished by the Building Manufacturer	Factory applied baked on enamel[1/]		
2	Structural steel roof and wall framing in buildings and other ungalvanized building metalwork and unexposed surfaces	Fabricator's standard rust inhibitive paint		
3	Damaged areas of paint on metalwork and equipment which are furnished complete painted or coated including:	Repair damaged areas to equal and color match undamaged contiguous areas.		
	a. Structural steel framing members for the prefabricated-metal building			
4	Damaged areas of galvanized surfaces that do not require finish painting	B	Zinc dust-zinc-oxide paint	2

256

1/ The metal roofing, siding, trim, vents, and building accessories shall be furnished with a factory applied painting system by a manufacturer regularly engaged in the manufacture of this type of product. The aluminum or galvanized steel-surfaces shall be given the manufacturer's standard cleaning preparation prior to the application of the prime coat. The prime coat and finish coat or coats shall be baked on.

The roofing panels and siding panels, if used, are to be furnished in a color approved by the contracting officer. The trim, vents, and building accessories in the standard color as supplied by the manufacturer of the prefabricated building.

8.3.3 Color Schedule for Painting

The colors and gloss of finish coats of paints will be as selected by the contracting officer except as provided in Paragraph 8.3.2 (Painting Tabulation). If items are furnished with a manufacturer's finish painting, the color and gloss of which are acceptable to the contracting officer and which meets the cleaning and painting requirements of Paragraph 8.3.1 (Painting), such items will not require field painting except for repair of damaged painted surfaces.

Recommended color schemes for the shade structure shall be harmonious with the surrounding terrain and shall be principally of a desert beige or similar color with contrasting trim. The contracting officer will provide written approval for the color scheme selected and may modify the selection of colors at his discretion.

257

DIVISION 9 - ELECTRICAL

SECTION 9.1 ELECTRICAL AND GROUNDING SYSTEMS

9.1.1 General

a. General -- The contractor shall furnish and install all electrical equipment and materials to complete and make ready for **service the electrical** and grounding systems.

The contractor shall place accurately in position, level and plumb, connect, adjust, and make ready **for service the circuit breaker enclosures,** lighting fixtures, wiring devices, grounding system, conduit system, insulated electrical wires, and all other materials required by these specifications. All installations, assembly operations, and adjustments shall be in accordance with the following, and in the event of conflicting requirements, precedence is established by the order of the following:

(1) The latest edition of "National Electrical Code," The National Electrical Safety Code, and the adopted electrical code of the county and state in which the construction will be performed.

(2) Manufacturer's instruction data furnished with the equipment.

(3) These specifications and the drawings included herein or as directed by the contracting officer.

(4) The Bureau of Reclamation Design Standards No. 5, "Field Procedures for Electrical Installation," a copy of which will be furnished to the contractor upon request.

The lighting and electrical systems shall be maintained and protected by the contractor in a satisfactory condition until final acceptance by the Government. Defective materials and equipment damaged in the course of installation or testing, shall be replaced or repaired by and at the expense of the contractor in a manner meeting the approval of the contracting officer.

Temporary lighting equipment, if required or necessary to accommodate and facilitate the contractor's work operations, shall be provided, installed, and removed by and at the expense of the contractor.

b. Earthwork -- The excavation of trenches, backfill and compacting of backfill in trenches for grounding conductor shall be performed in accordance with the provisions of Paragraph 3.1.6 (Excavation and Backfill for Trenches). The grounding conductor shall be buried to a minimum depth of 18 inches unless otherwise shown on the drawings or directed by the contracting officer. Suitable select backfill shall be placed around all grounding conductor and all backfill compacted as provided in Paragraph 3.1.6 (Excavation and Backfill for Trenches). No direct payment will be made for earthwork for burying the grounding conductor but the cost thereof shall be included in the prices bid in the schedule for related items of work.

c. Payment -- Payment will be made in accordance with Paragraph 9.1.9 (Payment).

9.1.2 Acceptance of Electrical and Grounding Systems

After the work required under these specifications has been completed, the systems will be tested and operated, by and at the expense of the Government. These acceptance tests are exclusive of the operational tests covered under other paragraphs of these specifications. The tests may be witnessed by the contractor or his representative. Final payment under the contract will not be made until each item is completed and accepted in its entirety, these tests are completed, and the contracting officer has determined that the requirements of these specifications have been fulfilled: Except, that if the Government, through no fault of the contractor or of the materials furnished by the contractor is delayed in making the acceptance tests beyond a period of 30 days from the date of final completion of the installation of all equipment, payment of the balance due under the contract will be made at the end of the 30-day period.

9.1.3 Drawings and Data to be Furnished by the Contractor

a. Approval drawings and data -- Within forty-five (45) calendar days after date of receipt of notice to proceed and before proceeding with procurement of materials, the contractor shall submit to the Government five sets of drawings and data for approval. The drawings and data shall include:

(1) Manufacturer's data and description of circuit breakers.

259

(2) Detailed data and description of lighting fixtures, brackets, conduit, cable, and wiring devices, including name of the manufacturer and item catalog number and sheets or bulletins.

Any material shipped before approval of drawings and data will be at the contractor's risk. The Government shall have the right to require the contractor to make any changes in the equipment design and installation details which may be necessary to make the equipment conform to the requirements and intent of these specifications without additional cost to the Government. Approval of drawings and data by the Government shall not be held to relieve the contractor of any part of the contractor's obligation to meet all of the requirements of these specifications nor of the responsibility for the correctness of the drawings and data submitted.

The submittal of data required under this paragraph shall be complete, shall be made at one time, and shall include all data required to be submitted under the provisions of this paragraph. Three copies of all data required above shall be forwarded by the contractor and not by subcontractors, to the Construction Engineer, Yuma Projects Office, P. O. Bin 5569, Yuma, Arizona 85364. The contractor shall forward a copy of his transmittal letter with the other two copies to the Regional Direction, Lower Colorado Region, P. O. Box 427, Boulder City, Nevada 89005.

b. Cost -- The cost of submitting drawings and data to the Government shall be included in the lump sum price bid in the schedule for furnishing and installing electrical and grounding systems.

9.1.4 Grounding System

a. General -- The grounding system shall be in accordance with Drawing No. 6821.22E-08 and as specified herein.

The contractor shall furnish and install the grounding system for the steel shade structure, consisting of bare stranded copper conductor and accessories. Accessories shall include connectors, ground clamps; materials for Cadweld, Thermoweld, or equivalent process, and other incidentals. The grounding system shall be connected to the existing ground mat.

260

b. Materials --

(1) Ground conductors -- All ground conductors shall be annealed, bare copper cable, concentric stranded, and in accordance with ASTM Designation: B 8, Class B. The solid wires used in forming the cables shall be in accordance with ASTM Designation: B 3.

(2) Lugs, and connectors -- All lugs and connectors shall be of the solderless type and shall have current-carrying capacity equal to that of the copper conductor with which they are used. All lugs and connectors, together with the bolts, nuts, and washers used therewith and the bolts, nuts, and washers which are used to make the connection to the structure, shall be of copper alloy, containing not more than 4 percent zinc. Cadweld, Thermoweld, or equivalent process, shall be used for embedded or buried connections. Connections to metal structures may be made with bolted-solderless connectors or with Cadweld, Thermoweld, or equivalent processes. All Cadweld, Thermoweld, or equivalent processes shall be of the heavy-duty type, made of new material from fresh stock and the installation shall be performed with heavy-duty welding equipment in accordance with manufacturer's instructions.

c. Installation --

(1) Connections -- The contractor shall make all necessary connections for the complete grounding system. The conduit system, if electrically continuous, may serve as the grounding system for 115-volt equipment or a grounding conductor shall be installed with the circuit conductors in accordance with the "National Electrical Code."

Grounding conductors shall be embedded, buried or concealed insofar as possible. Metallic nonelectrical items within reach of electrical items shall be bonded to the electrical item or to the same ground conductor at the closest point. All paint, scale, and enamel shall be removed from the points of contact on metal surfaces before ground connections are made. Where the finish has been removed from equipment to install ground connections, the finish shall be repaired in accordance with Section 8.3 -- PAINTING. All ground connections shall be made in accordance with the methods outlined on the drawings, and the "Field

261

Procedures for Electrical Installations, Chapter 2, Electrical Standards for Equipment Installation" of the Bureau of Reclamation.

(3) Upon completion of installation of the grounding system the contractor shall determine the ground resistance of the installation by the three-electrode method described in the ninth edition of the Standard Handbook for Electrical Engineers, by A. E. Knowlton, p. 1294, and shall report this value to the contracting officer.

d. Cost -- The cost of furnishing and installing the grounding system shall be included in the lump sum price bid in the schedule, for furnishing and installing electrical and grounding systems, which lump sum price shall include the cost of all materials, labor, and equipment, including earthwork, to install the grounding system.

9.1.5 Electrical Conduit System

a. General -- The contractor shall furnish and install all electrical rigid steel conduit and accessories required for the lighting system as shown on the drawing.

Conduit accessories shall include conduit fittings, elbows, nipples, junction boxes, caps, pipe plugs, locknuts, bondnuts, bushings, adapters, adhesive, sealing varnish, threaded joint compound, expansion couplings, sealtight conduit fittings, materials for sealing the ends of conduits terminating at outdoor equipment, and all other incidentals required to complete the conduit system, and to fasten, clamp, attach, and support conduit in place.

b. Materials -- Materials for the electrical conduit installations shall conform to the standards of Underwriters' Laboratories, Inc. and to the lastest edition and amendment of the following specifications:

(1) Rigid steel conduit -- WW-C-581d(3), zinc coated.

(2) Flexible metal conduit -- Shall be galvanized steel core with a copper bonding conductor between the spiral segments and with an

extruded synthetic jacket overall to insure a watertight conduit. Conduit shall be American Brass "Sealtite" Type UA or equal with grounding-type fittings approved for this type of flexible conduit.

(3) Conduit fittings -- W-F-406b(1) and W-F-408c(1).

(4) Protective varnish -- Protective varnish where used shall conform to General Electric Company "Glyptal" No. 1201-B, Westinghouse Electric Corporation No. B-6-614, or equal.

(5) Junction boxes; junction box extensions; and junction box covers (steel, cadmium, or zinc coated) -- W-J-800c(3).

(6) Expansion couplings -- Except as otherwise provided, expansion couplings where used for conduit systems shall be employed at expansion and contraction joints. For 2-inch metal conduit and smaller, couplings shall be equal to Dresser Manufacturing Company's Type 65A.

c. Installation -- All conduit shall be installed with necessary fittings and supports, and all bends shall be gradual and smooth to permit the pulling of insulated electrical wires and cables without undue stress or damage to the insulated electrical wires and cable sheath or to the conduit. All conduit runs and bends shall be entirely free from kinks, indentations, or flattened surfaces. All metal conduit bends made in the field shall be bent cold to prevent damage to the protective coating. Burrs and sharp corners at the ends of each piece of metal conduit shall be removed.

The male threads of rigid conduit joints shall be tightened securely to prevent the entrance of moisture or any other foreign material. For steel conduit, the completed joints and terminations, all wrench marks, and all other places where the zinc covering is damaged shall be covered entirely

263

with a protective varnish to provide protection from corrosion. Bushings or chase nipples shall be installed on the ends of conduit to protect the insulation or sheath of the wires or cables from abrasion; and locknuts and bondnuts shall be installed to provide tight ground connections between conduit boxes, panelboards, and cabinets.

Where conduits cross expansion or contraction joints, the required special fittings or expansion couplings shall be installed.

The exposed conduit runs shall be straight and shall be parallel with each other, unless otherwise directed. All exposed conduits shall be rigidly supported at intervals of not more than 10 feet, unless otherwise specified or directed. The supports shall be of a design acceptable to the contracting officer. The installation of exposed conduit shall include, where required, the drilling of holes in the bottom and top of enclosures or plates and in the side of enclosures of electrical equipment. The contractor shall use suitable clamp for fastening exposed conduit runs to structural members. Where possible, drilling or welding of conduit supports to structural members shall be avoided.

At electrical equipment enclosures not equipped with threaded hubs, conduits shall be terminated in accordance with page 9-12 (Drawing No. 104-D-254) unless otherwise noted.

9.1.6 Insulated Electrical Wires and Cables

a. General -- The contractor shall furnish and install all single-conductor insulated electrical wires, cables, fixture wire, and cable installation accessories for the electrical system. Cable installation accessories shall include marking tags, insulating tape, connectors, fittings, and other incidentals required for completing the installations. Aluminum connectors using aluminum screws will not be permitted.

For the electrical installation, the term "wire" applies only where a single solid insulated electrical conductor is used and the term "cable" shall apply to either a stranded electrical conductor (single-conductor cable) or a combination of electrical conductors insulated from one another (multiple-conductor cable), except grounding cable shall be uninsulated.

All wire and cable sizes shall be as shown on the drawings and as specified herein.

b. Materials -- Insulated electrical wires and cables shall be "National Electrical Code" grade of the types listed below and shall have been manufactured within 24 months prior to receipt of notice to proceed. Unless otherwise specified, conductors shall be soft annealed, Class B, stranded copper. All conductors No. 8 AWG and larger shall be stranded.

(1) 600-volt, single-conductor, copper:

(a) For 75°C conductor temperature, general use service: Type THW.

(b) For 90°C conductor temperature: Types THHW or XHHW.

(c) Fixture wire: No. 14 AWG stranded, Type SO

All No. 10 AWG and smaller single-conductor wire and cable used in branch circuits for the lighting system shall be color coded in accordance with the requirements of the "National Electrical Code" and the "Field Procedures for Electrical Installations." Branch circuit conductors shall have colored or identified insulation as follows:

Phase A -- black or *orange

Phase B -- red or *yellow

Phase C -- blue or *brown

Neutral -- white or *gray

* To be used only where more than one multiwire branch circuit of the same size is contained in a single circuit.

c. Installation -- The contractor shall install the wires and cables in conduits, wireways, or enclosures, where required.

Sufficient length shall be left at the ends of wires and cables to make connections conveniently to the equipment and devices.

Wires and cables shall not be pulled into conduits until the conduit runs have been cleaned and are free from obstructions and sharp corners. A clean, dry, tight-fitting rag shall be drawn through the conduit immediately before installing the wire or cable. The wires and cables shall be installed so that there will be no cuts or abrasions in the insulation or protective covering or kinks in the wires and cables. No splices shall be made in wires or cables, except at boxes, wireways, outlets, panelboards, or electrical equipment enclosures. Only gradual and uniform pulling stresses will be

265

permitted on wires and cables. Where a lubricant is needed as an aid to the pulling of wires and cables, only soapstone or other approved material not injurious to the wire or cable sheath shall be used. Any wire or cable damaged during installation shall be removed and replaced with equivalent wire or cable at the contractor's expense.

All wires and cables shall be marked with circuit designation at each end and where the wires or cables are connected to terminals, terminal blocks, or connectors. The designations shall be applied to the wire or cable ends by using identification markers similar to the W. H. Brady Company No. B-500 vinyl-cloth tape with a silicone-plastic overcoating.

All runs, connections, and taping of wires and cables shall be made carefully and neatly. Bolted solderless-type terminal lugs and connectors shall be used for joining or connecting cables larger than No. 8 AWG. All terminal lugs and connectors shall have current-carrying capacity equal to that of the conductor with which they are used. No. 8 AWG and smaller stranded cables shall have suitable solderless lugs for connecting to terminal blocks and terminal studs. When No. 8 AWG and smaller size wires and cables are spliced, they shall be joined so as to be mechanically and electrically secure. All insulated wire and cable splices and terminations shall be performed in accordance with the cable manufactuer's recommendations and in all cases the contractor shall obtain this information for each type and size of cable being furnished, and shall submit copies of such information to the contracting officer.

9.1.7 Circuit Breaker

a. General -- The contractor shall furnish and install all circuit breakers indicated on the drawing for the control and overcurrent protection of the floodlight circuits.

b. Equipment -- Circuit breakers shall be molded case units, with thermal-magnetic trip having a minimum interrupting capacity of 14,000 symetrical RMS amperes at 480 volts and with number of poles and trip rating as indicated on the drawing. The circuit breaker shall be in a Nema 3R weatherproof enclosure.

c. Installation -- The circuit breaker unit shall be mounted on the existing steel framework at power station No. 2. The contractor shall provide all other materials and accessories required for the complete installation of the circuit breaker units.

9.1.8 Lighting Fixtures

a. General -- The contractor shall furnish and install all new lighting fixtures required for the lighting system. In addition, the contractor shall install the floodlights relocated from existing poles to locations indicated on Drawing 6821.22E-08. All new lighting fixtures shall include lamp, ballasts, mounting bracket, fixture hangers, fixture stems, anchor bolts, flexible cord, and all other materials and accessories required for the complete lighting fixture installations.

b. Materials -- Materials for the lighting fixture installations shall conform in addition to the following specifications, to standards of Underwriters' Laboratories, Inc., Certified Ballast Manufacturers Association, and Electrical Testing Laboratories.

(1) Lighting fixtures -- All lighting fixtures shall be equal to the fixtures described in Drawing No. 6821.22E-08. The lighting fixture shall be completely assembled and prewired, with built-in ballast and complete with lamp.

(2) Lamps -- Lamps shall be of the wattages and types shown on the drawing.

(3) Hangers -- Hangers for fixtures shall be of a type as indicated on the drawing.

(4) Miscellaneous materials -- For materials shown on the drawing, but not covered herein by detailed specifications, the contractor shall furnish standard commercial grades of materials that are satisfactory to the contracting officer.

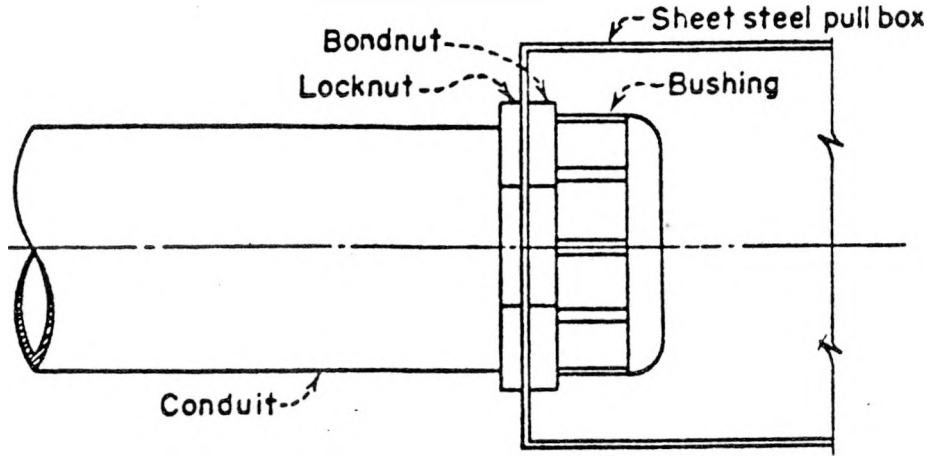
c. Installation -- The contractor shall assemble, install, connect, and adjust lighting fixtures as shown on the drawings, in accordance with the requirements of the "National Electrical Code," and in a manner approved by the contracting officer.

267

9.1.9 Payment

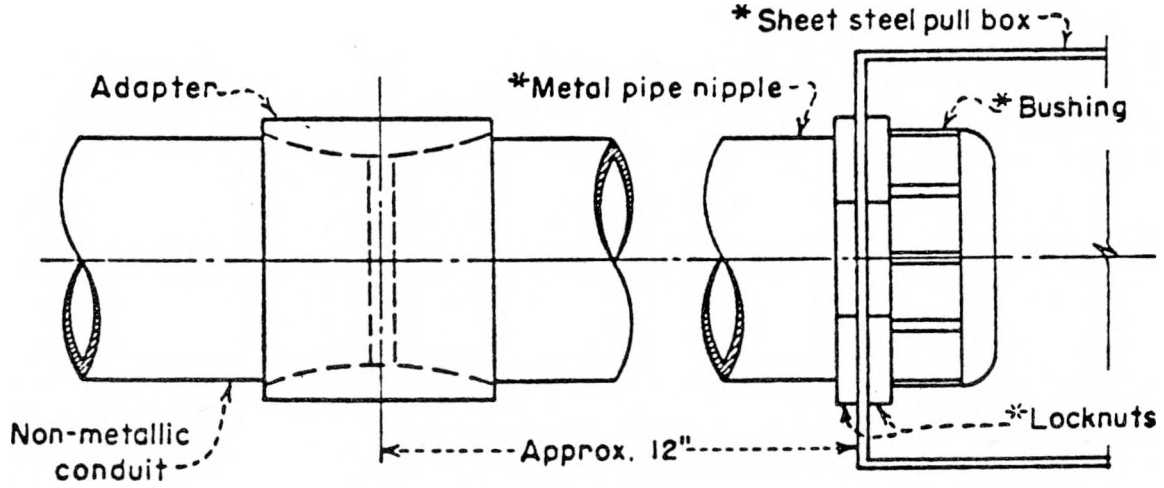
Payment for furnishing and installing the electrical and grounding systems shown on the drawing and herein specified will be made at the lump sum price bid therefor in the schedule, and which lump sum price shall include all labor, materials, transportation, and all incidentals required for complete installation of the lighting and grounding systems including branch circuit connections to the existing panelboard, all earthwork required, grounding conductors, all conduits, electrical wires, lighting fixtures, wiring devices, and all incidentals associated therewith.

BOX TERMINATION



DETAIL "C"

TERMINATING METAL CONDUIT IN SHEET STEEL PULL BOXES



DETAIL "D"

TERMINATING NON-METALLIC CONDUIT IN SHEETSTEEL PULL BOXES

*Use aluminum or brass and slot steel box between knockouts for single phase.

FORMERLY X-D-1523-7

ALWAYS THINK SAFETY

REV. 3-25-46	REV. 4-1-42	DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION DENVER OFFICE ELECTRICAL STANDARDS		
			DENVER, COLO. 6-14-38	104-D-254

300C-388

DIVISION 10--FENCING

SECTION 10.1--CHAIN LINK FENCE

10.1.1 General

a. General--The contractor shall remove such portions of chain link fence at locations as shown in the drawings. The contractor shall fill and compact all resulting post holes, as directed in specification paragraphs 3.1.4 and 3.1.5. The contractor shall erect a chain link fence at locations shown in the drawings and according to the details therein, reusing such materials, with the approval of the contracting officer, from the removed fencing as he deems appropriate. Additional fencing materials beyond the amount available for reuse from this site shall be new material, furnished by the contractor. Any material proposed for reuse by the contractor, and which is deemed unsuitable for reuse by the contracting officer, shall be replaced with new material in conformance with these specifications, by the contractor and at his expense.

The contractor shall furnish all additional materials and all labor for the chain link fence, including fabric, posts, gates and accessories, cement, sand, and coarse aggregate, and other materials required for complete erection of the fence.

The fence shall be standard chain link fence in accordance with the details shown on the drawings. Height of fabric for the fence shall be six feet.

b. Materials--

(1) Fabric--The chain link fabric shall have barbed selvage top and bottom and shall be one of the following only:

(a) Zinc-coated steel fabric--Federal Specification RR-F-191d, Type I, Grade A, 2 inch mesh, No. 11 gage (0.120 inch nominal wire diameter before coating).

(b) Aluminum-coated steel fabric--Federal Specification RR-F-191d, Type III, Grade A, 2 inch mesh, No. 11 gage (0.120 inch nominal wire diameter before coating).

(c) Aluminum fabric--Aluminum fabric shall be a 2 inch mesh fabric and shall be fabricated from 0.148 inch nominal diameter aluminum wire. The aluminum fabric shall be in accordance with the latest specifications for Aluminum Alloy Chain Link Fencing of the Chain Link Fence Manufacturers Institute, 630 Third Avenue, New York, New York 10017.

(2) Fence posts, and accessories--Except as otherwise provided in this paragraph, or shown on the drawings, all fence posts and accessories, including toprails, braces, post caps, stretcher bars, stretcher-bar bands, wire, truss rods, turnbuckles, fabric bands, clips, bolts and nuts, shall be in accordance with Federal Specification RR-F-183.

Line and corner posts and rails shall be standard weight pipe, or the equivalent U-section or H-section, in accordance with pipe size designations of Table I, Federal Specification RR-F-183, except as otherwise provided in these specifications. All posts, rails, and accessories shall be galvanized.

Two No. 12 and 1/2 gage twisted barbless galvanized strands may be substituted for the No. 7 gage bottom reinforcing wire.

c. Erection--Trees, brush, and other obstacles which would interfere with proper erection of the fence shall be cleared and removed in advance of starting fencing work. The contractor shall perform all required excavating, backfilling, and compacting of backfill for posts. Posts shall be plumb and in alignment. Posts shall be set in concrete as shown. Where the nature of the material to be excavated is such that the holes for the footings can not be excavated to the required dimensions and the concrete placed directly against the surfaces of the excavation, forms shall be used for the concrete.

271

The cement content of the concrete shall be not less than 5 and 1/2 sacks per cubic yard of concrete.

Damaged areas of galvanizing shall be cleaned with mineral spirits or xylene, followed by wire brushing. After wire brushing, these areas shall be recleaned with the solvent to remove residue. After cleaning, the damaged areas shall be given two coats of zinc dust-zinc oxide paint. Except for painting damaged areas of galvanizing, no other painting of the fence is required.

d. Measurement and payment--Measurement, for payment, of chain link fence will be made from end to end of fence sections along the centerline of the fence, including overhangs. Payment for furnishing and erecting chain link fence will be made at the unit price per linear foot bid therefor in the schedule, which unit price shall include the cost of furnishing all materials; of excavating, backfilling, and compacting backfill; and placing concrete for posts.

DIVISION 11--DRAWINGS

SECTION 11.1--DRAWINGS

11.1.1 Drawings, General

a. General--In the event there are minor differences as determined by the contracting officer between details and dimensions shown on the drawings and those of existing features at the site, the details and dimensions of existing features at the site shall govern.

The contractor shall check all drawings carefully and advise the contracting officer of any errors or omissions discovered.

b. Additional or revised drawings--Except as otherwise provided in these specifications for drawings to be furnished by the contractor, the specifications drawings will be supplemented by such additional or revised general and detail drawings as may be necessary or desirable as the work progresses; and the contractor shall do no work without proper drawings and instructions. The contractor will be required to perform the work in accordance with the additional general and detail drawings or revisions furnished by the Government at the applicable prices bid in the schedule for such work.

c. Additional copies of drawings--The contractor will be furnished such additional copies of the specifications and drawings as may be required for carrying out the work.

d. Mailing address--All drawings and data submitted by the contractor for which a specific mailing address is not given in these specifications shall be submitted to the Construction Engineer, Bureau of Reclamation, Yuma Projects Office, 3800 Avenue 3 East, P. O. Bin 5569, Yuma, Arizona 85364

11.1.2 List of Drawings

The following drawings are made a part of these specifications:

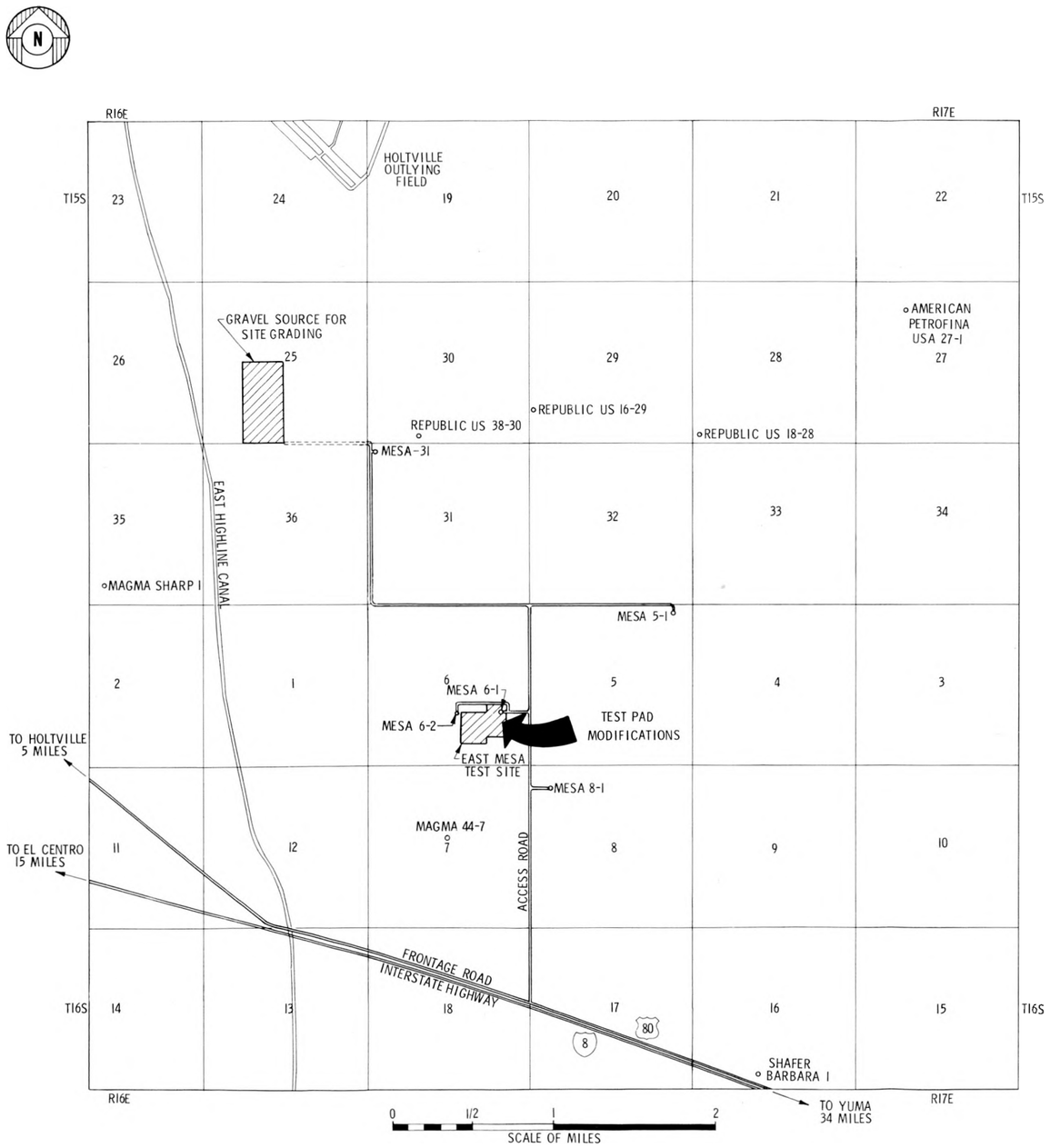
TEST PAD MODIFICATIONS
EAST MESA TEST SITE

Construction Design Drawings

6821.22E-01	Location Plan
6821.22E-02	Site Plan
6821.22E-03	Paving, Grading and Demolition Plan
6821.22E-04	Concrete Test Pad Floor Plan and Details
6821.22E-05	Building Elevations, Sections and Details
6821.22E-06	Miscellaneous Details
6821.22E-07	Fence Details
6821.22E-08	Lighting and Grounding Plan

Standard Drawings

40-D-2567	Standard Nameplates
40-D-6123	General Notes and Minimum Requirements for Detailing Reinforcements - Class 60
104-D-254	Electrical Standards



LOCATION MAP
EAST MESA TEST SITE

TEST PAD MODIFICATIONS

DRAWING INDEX

DRAWING NO.	DRAWING TITLE
6821.22E-01	LOCATION PLAN, DRAWING INDEX, AND GENERAL NOTES
6821.22E-02	SITE PLAN
6821.22E-03	PAVING AND GRADING PLAN
6821.22E-04	CONCRETE TEST PAD, FLOOR PLAN, AND DETAILS
6821.22E-05	BUILDING ELEVATIONS, SECTIONS, AND DETAILS
6821.22E-06	MISCELLANEOUS DETAILS
6821.22E-07	FENCE DETAILS
6821.22E-08	LIGHTING AND GROUNDING PLAN

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

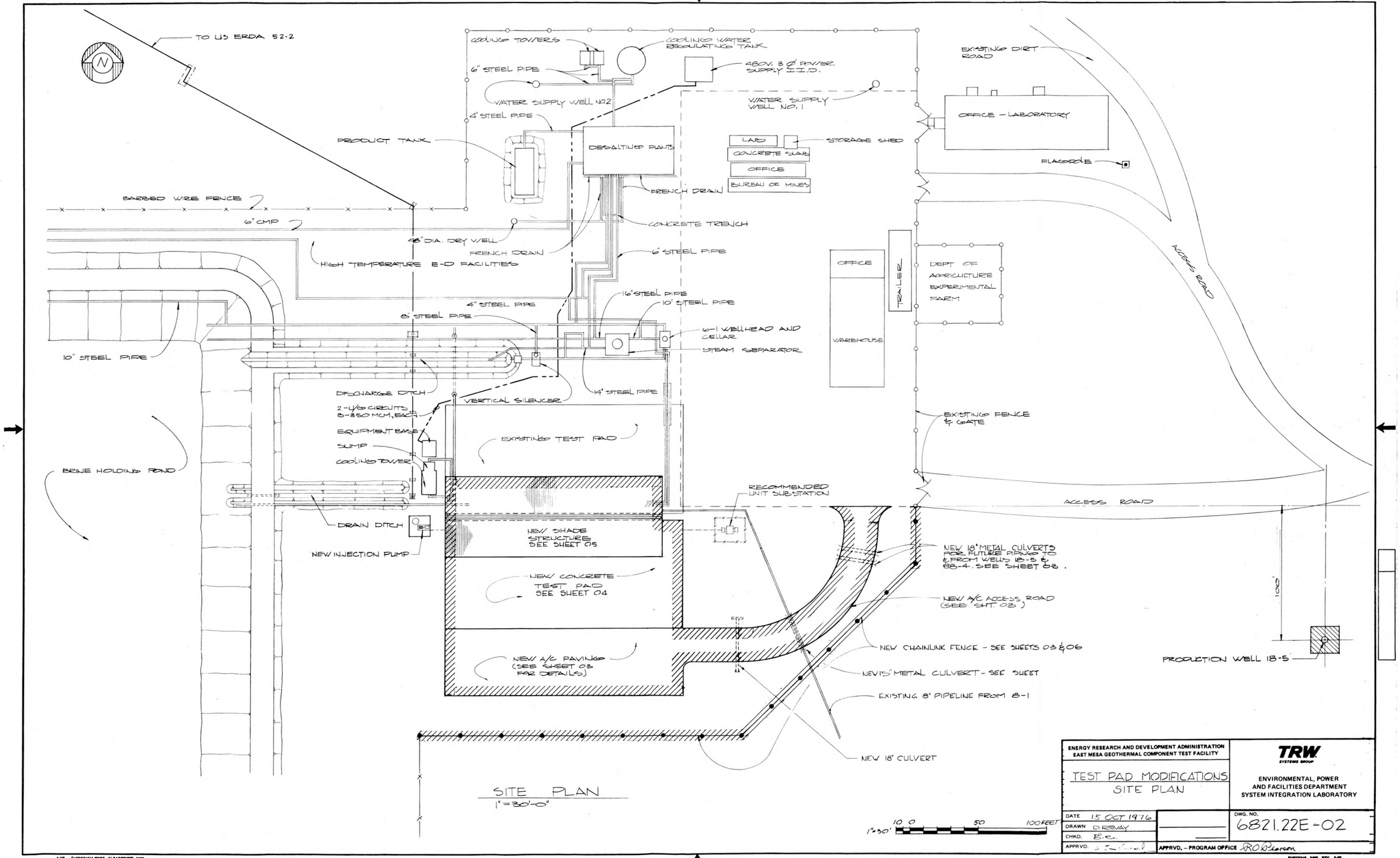
TEST PAD MODIFICATIONS
LOCATION PLAN

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 DEC 1976
DRAWN D.DREW/D.RENAY
CHKD
APPRVD

APPRVD. – PROGRAM OFFICE R.O. Pierson

DWG. NO. 6821.22E-01



ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

TEST PAD MODIFICATIONS
SITE PLAN

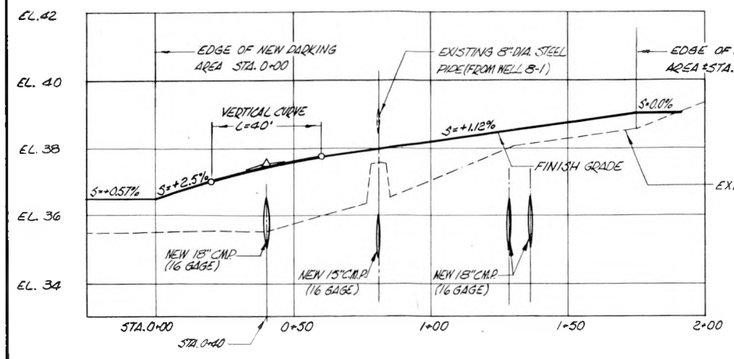
TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE	15 OCT 1976
DRAWN	D.REVAY
CHKD.	B.E.
APPRVD.	
APPRVD, – PROGRAM OFFICE	R.O.Pierson

DWG. NO. 6821.22E-02

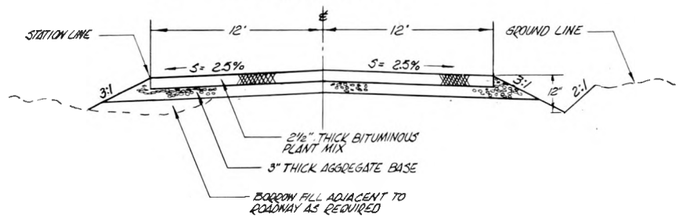
SYSTEMS 3455 REV. 5-75

4/75 DIETERICH-POST CLEARPRINT 3020



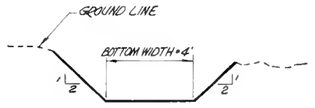
1/03 PROFILE - ACCESS ROAD

SCALE - HOR: 1"=25'; VERT: 1"=2'



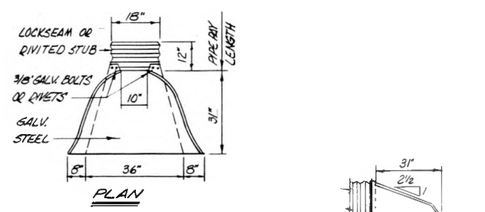
2/03 TYPICAL ROAD SECTION

NOT TO SCALE



5/03 TYPICAL DITCH SECTION

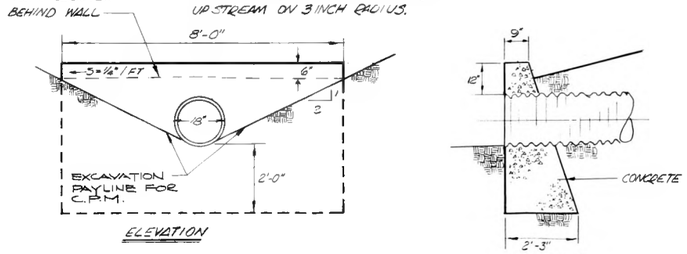
NOT TO SCALE



NOTE: MATERIAL FOR END SECTIONS SHALL BE 16 GAGE.

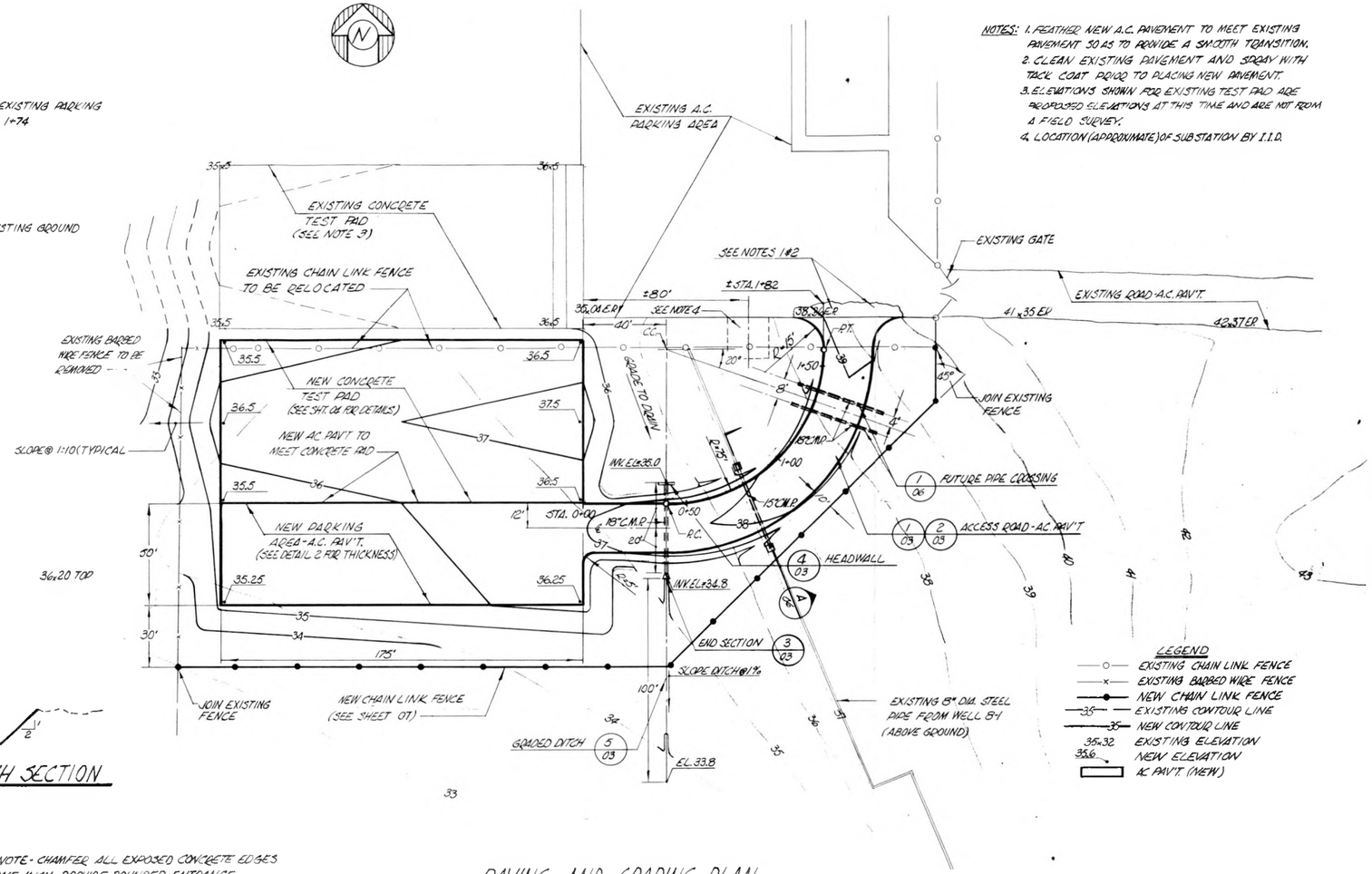
3/03 CULVERT END SECTION

NOT TO SCALE



4/03 CULVERT HEADWALL

NOT TO SCALE



NOTES:
1. FEATHER NEW A.C. PAVEMENT TO MEET EXISTING PAVEMENT SO AS TO PROVIDE A SMOOTH TRANSITION.
2. CLEAN EXISTING PAVEMENT AND SPRAY WITH TACK COAT PRIOR TO PLACING NEW PAVEMENT.
3. ELEVATIONS SHOWN FOR EXISTING TEST PAD ARE PROPOSED ELEVATIONS AT THIS TIME AND ARE NOT FROM A FIELD SURVEY.
4. LOCATION (APPROXIMATE) OF SUBSTATION BY I.I.D.

PAVING AND GRADING PLAN

SCALE - 1"=30'

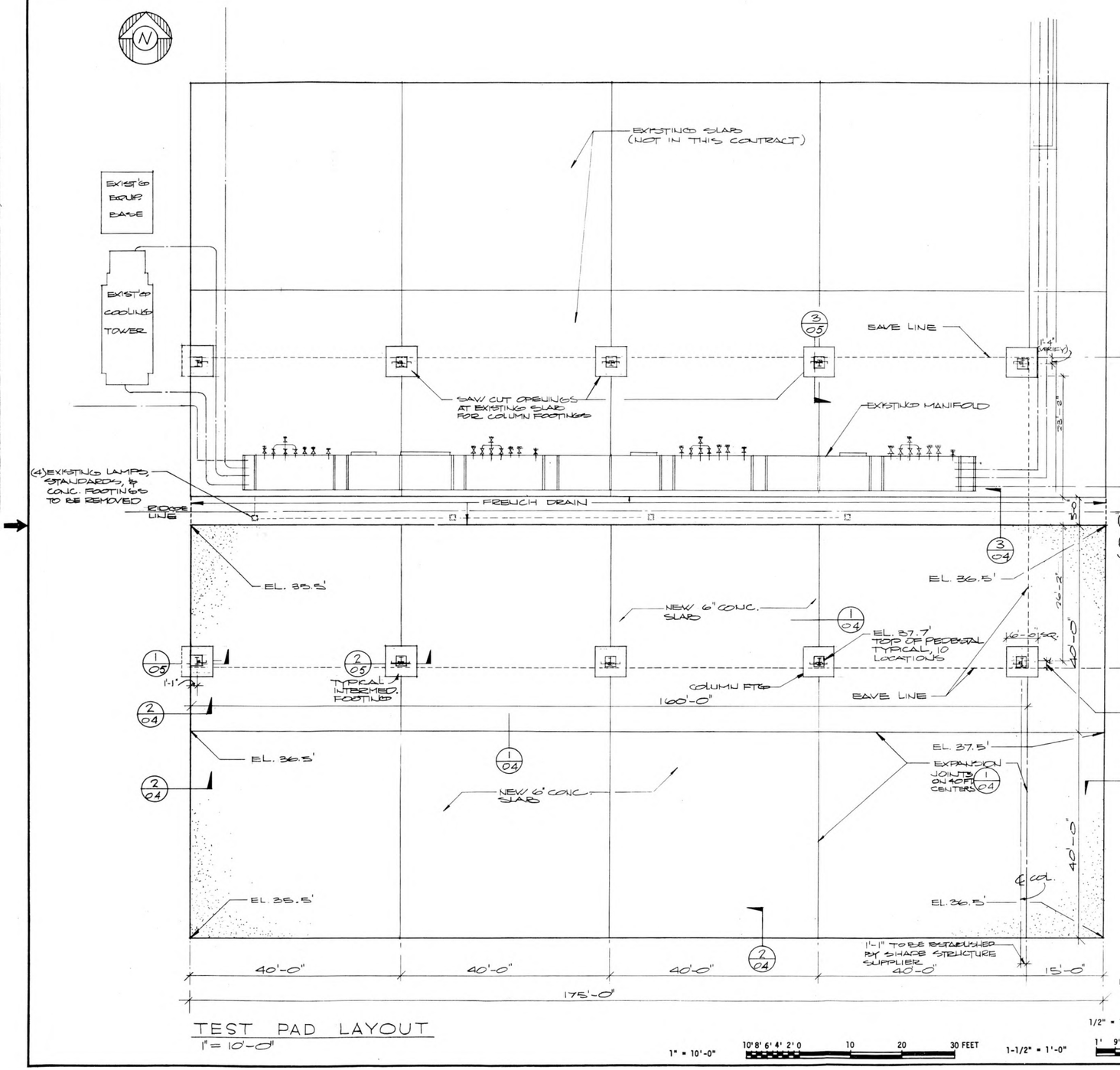
ABBREVIATIONS:
P.C. - POINT OF CURVATURE
P.T. - POINT OF TANGENTCY
C.C. - CURVE CENTER
E.P. - EDGE OF PAVEMENT
C.M.P. - CORRUGATED METAL PIPE
℄ - CENTER LINE
A.C. - ASPHALT CONCRETE
EL. - ELEVATION

1"=2' 1 0 5 FEET

1"=25' 10 0 50 100 FEET

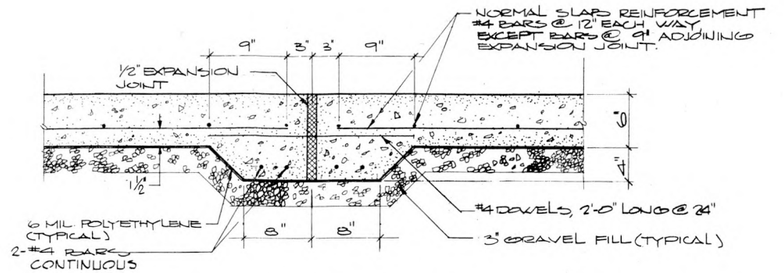
1"=30' 10 0 50 100 FEET

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
TEST PAD MODIFICATIONS PAVING AND GRADING PLAN & MISCELLANEOUS DETAILS	
DATE 15 OCT 1976 DRAWN K. COATES CHKD. B.E. APPRVD.	DWG. NO. 6821-22E-03 APPRVD. — PROGRAM OFFICE R.O. Pearson

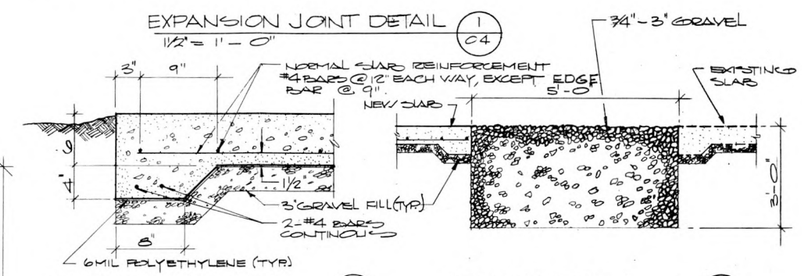


TEST PAD LAYOUT
1" = 10'-0"

1" = 10'-0" 10' 8' 6' 4' 2' 0 10 20 30 FEET

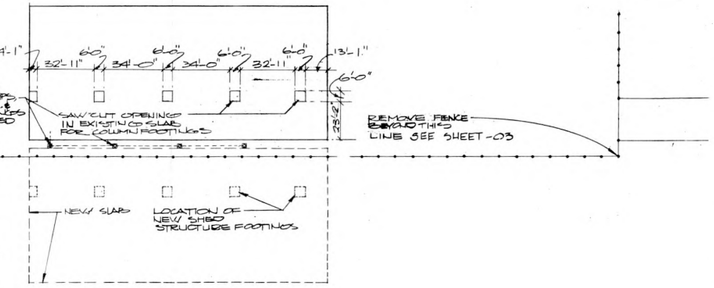


EXPANSION JOINT DETAIL 1/04
1 1/2" = 1'-0"



SLAB EDGE DETAIL 2/04
1 1/2" = 1'-0"

FRENCH DRAIN 3/04
1/2" = 1'-0"



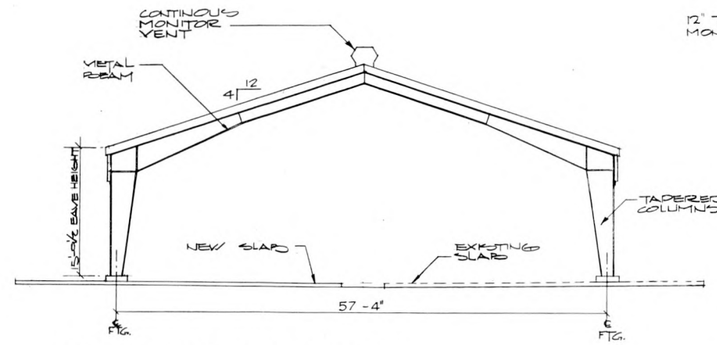
DEMOLITION KEY PLAN
1" = 40'-0"

1" = 40'-0" 20 10 0 10 20 30 40 50 60 70 80 FEET

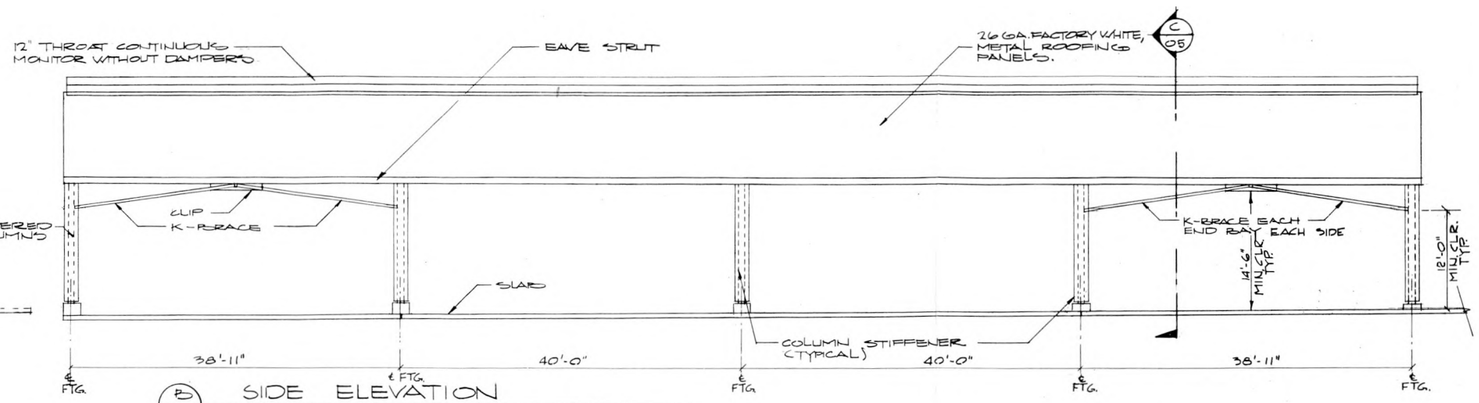
1/2" = 1'-0" 2' 1' 0 2 4 FEET

1-1/2" = 1'-0" 1' 9" 6" 3" 0 1 2 FEET

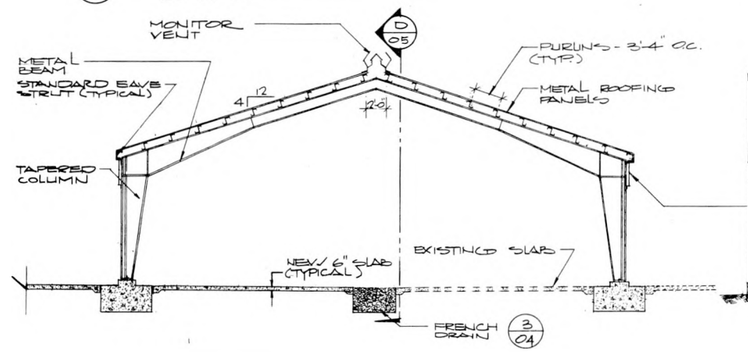
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
TEST PAD MODIFICATIONS CONCRETE TEST PAD FLOOR PLAN AND DETAILS	
DATE 15 OCT 1976 DRAWN B.E./DRR. CHKD. B.E. APPRVD.	DWG. NO. 6821.22E-04 APPRVD. – PROGRAM OFFICE



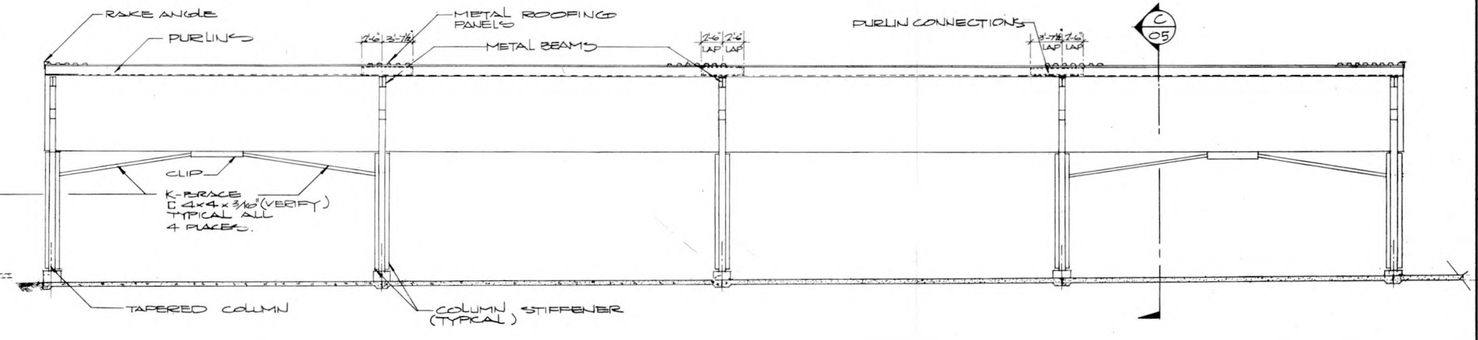
A/05 END ELEVATION
1/8" = 1'-0"



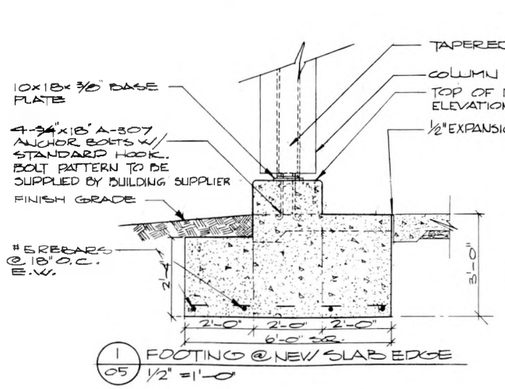
B/05 SIDE ELEVATION
1/8" = 1'-0"



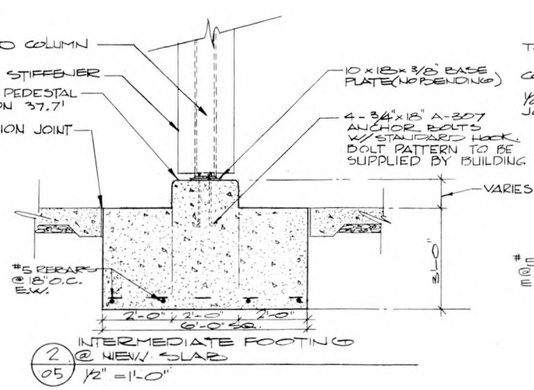
C/05 TRANSVERSE SECTION
1/8" = 1'-0"



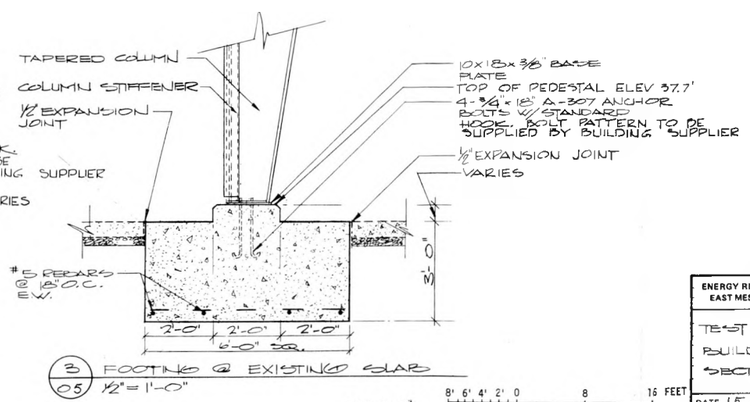
D/05 LONGITUDINAL SECTION
1/8" = 1'-0"



1/05 FOOTING @ NEW SLAB EDGE
1/2" = 1'-0"



2/05 INTERMEDIATE FOOTING @ NEW SLAB
1/2" = 1'-0"

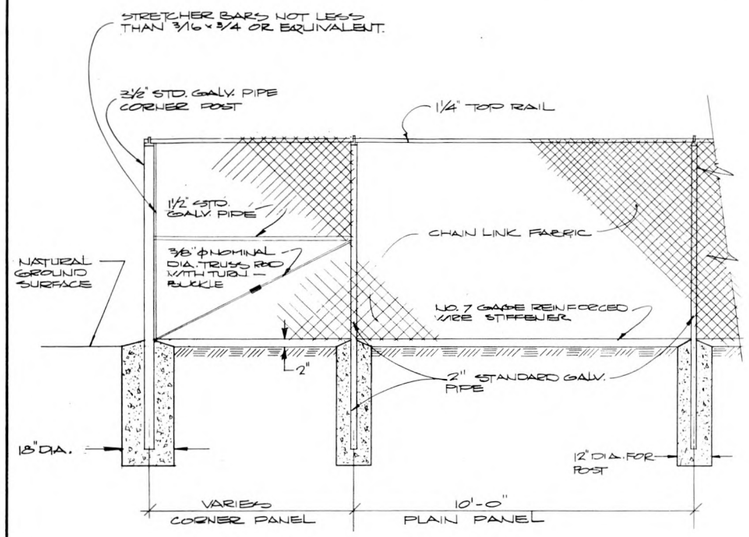


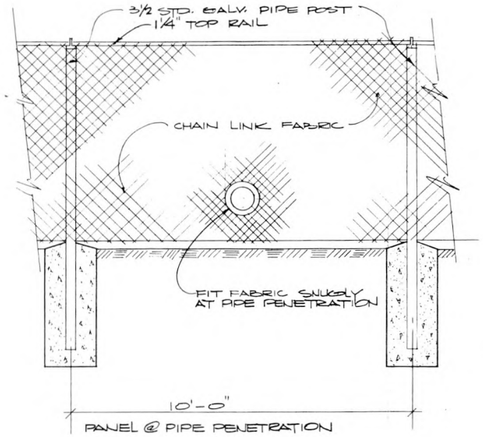
3/05 FOOTING @ EXISTING SLAB
1/2" = 1'-0"

1/8" = 1'-0" 8' 6' 4' 2' 0 8 16 FEET

1/2" = 1'-0" 2' 1' 0 2 4 FEET

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
TEST PAD MODIFICATIONS BUILDING ELEVATIONS, SECTIONS, AND DETAILS	
DATE 15 OCT 1976	DWG. NO. 6821.22E -05
DRAWN D. REVAT	
CHKD. B. R.	
APPRVD R. S. C.	APPRVD. – PROGRAM OFFICE R O Pearson





GENERAL NOTES

FABRIC SHALL HAVE BARBED SELVAGE TOP AND BOTTOM.

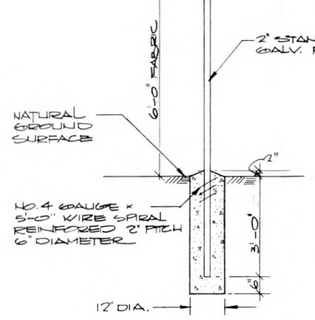
ON LONG RUNS, PROVIDE BRACED PULL POSTS AS REQUIRED FOR PROPER STRETCHING OF FABRIC.

ALL PIPE SIZES OR DIAMETERS SHOWN ARE FOR STANDARD WEIGHT PIPE WITH NOMINAL INSIDE DIAMETER OF THE SIZE SHOWN.

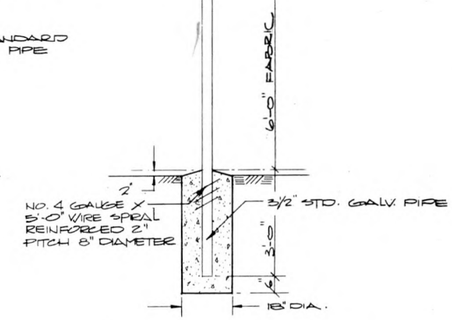
ALL PIPE POSTS SHALL CONFORM TO FEDERAL SPECIFICATION'S RR-F-183, TABLE I, OR SHALL BE EQUIVALENT U SECTION OR H SECTION.

ALL POSTS AND RAILS SHALL BE GALVANIZED.

A ROLLED 'I' SECTION WITH ROUND FLANGES WEIGHT NOT LESS THAN 2.2 POUNDS PER LINEAR FOOT, MAY BE SUBSTITUTED FOR TOP RAILS AND BRACING.



LINE POST DETAIL

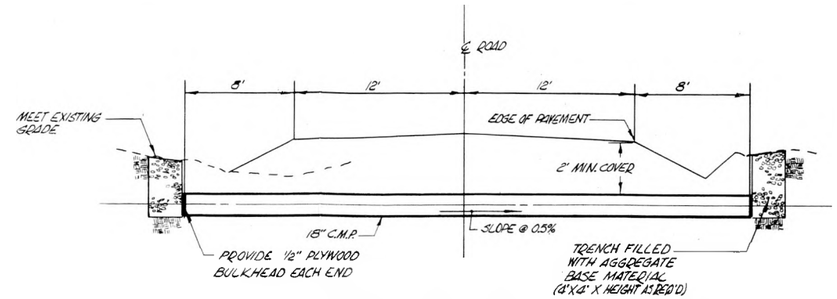


CORNER POST DETAIL

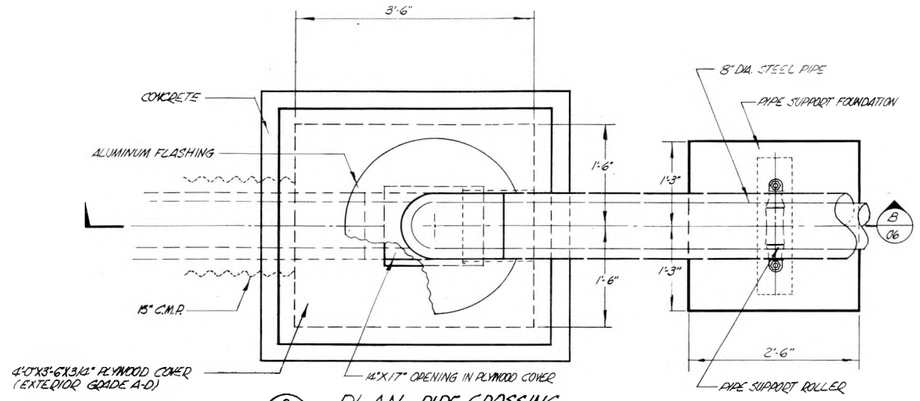
1/2" = 1'-0"

2' 1' 0 2 4 FEET

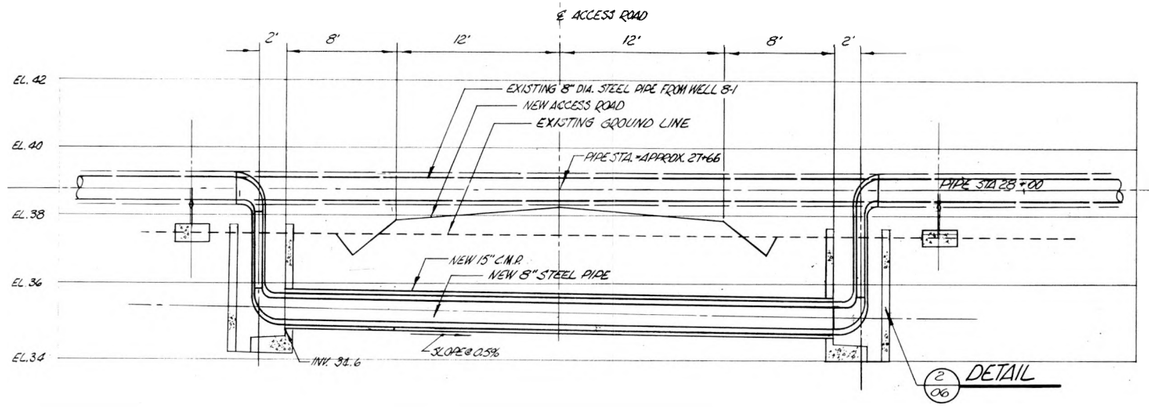
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
TEST PAD MODIFICATIONS FENCE DETAILS	
DATE 15 OCT 1976 DRAWN D REMAY CHKD. BE. APPRVD.	DWG. NO. 6821.22E-07 APPRVD. – PROGRAM OFFICE RO Pearson



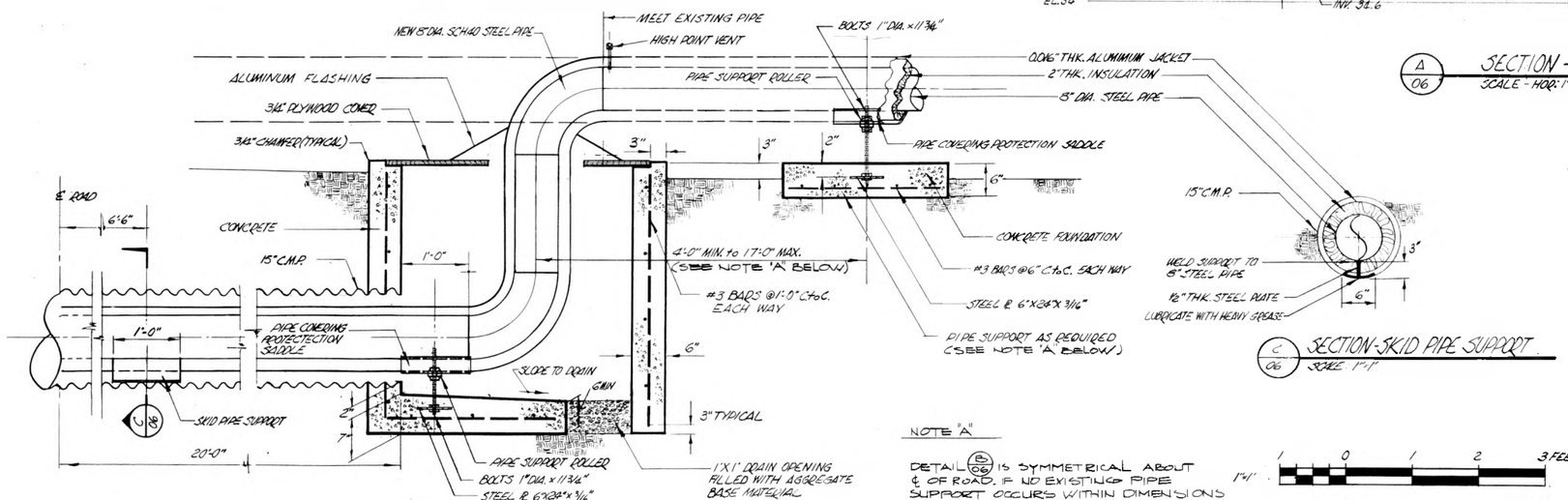
1/06 FUTURE PIPELINE CROSSING (2 PLACES)
NOT TO SCALE



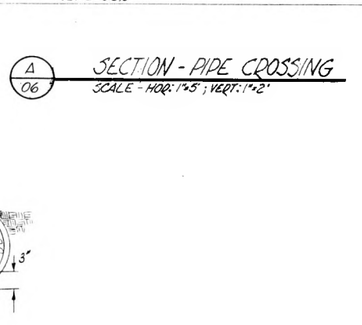
2/06 PLAN - PIPE CROSSING
SCALE: 1"=1'
NOTE: CONCRETE ENCLOSURE AND PIPE DETAILS ARE THE SAME FOR EACH SIDE OF CROSSING.



2/06 DETAIL



B/06 SECTION
SCALE - 1"=1'



C/06 SECTION - SKID PIPE SUPPORT
SCALE 1"=1'

A/06 SECTION - PIPE CROSSING
SCALE - HOR: 1"=5' ; VERT: 1"=2'

NOTE "A"

DETAIL (B/06) IS SYMMETRICAL ABOUT ℄ OF ROAD. IF NO EXISTING PIPE SUPPORT OCCURS WITHIN DIMENSIONS SHOWN, PROVIDE @ NEW SADDLE, ROLLER SUPPORT @ NEW SADDLE, ROLLER SUPPORT & FOUNDATION, AS SHOWN, @ 4'-0" FROM ℄ OF VERTICAL PIPE RUN.

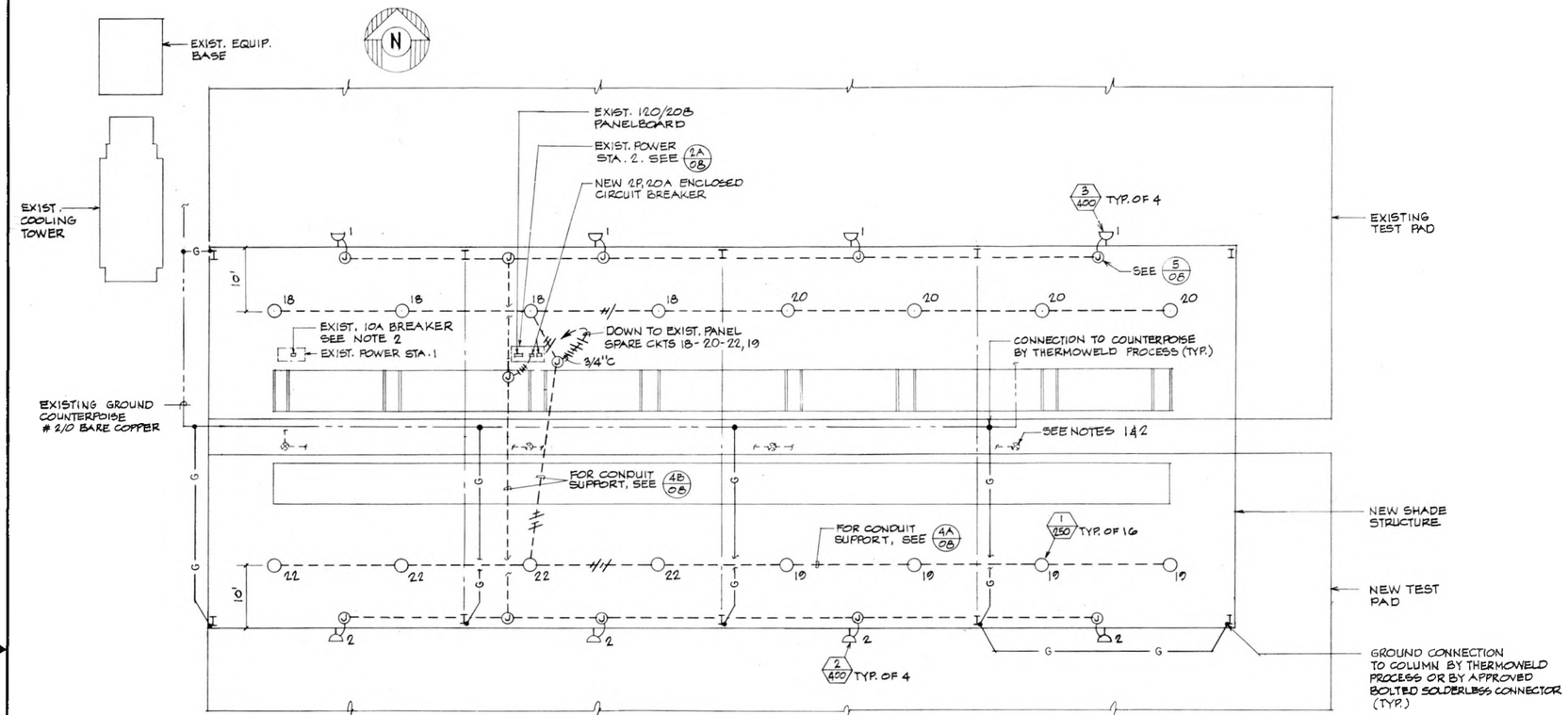
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

TEST PAD MODIFICATIONS
MISCELLANEOUS DETAILS

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 OCT 1976
DRAWN M. CLOATED
CHKD. [illegible]
APPRVD. [illegible]
APPRVD. — PROGRAM OFFICE R O Pearson

DWG NO. 6821-22E-06



1/08 LIGHTING & GROUNDING PLAN
SCALE: 1" = 10'-0"

SYMBOLS

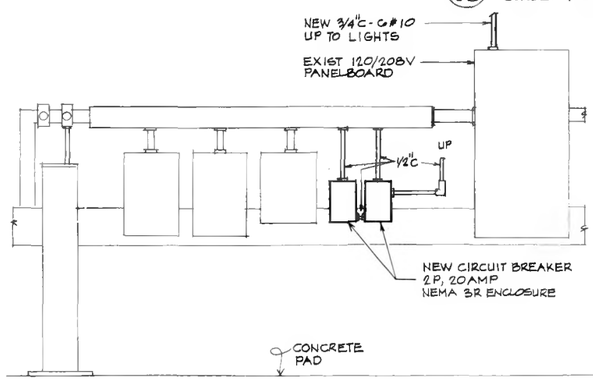
- 18 — HIGH PRESURE SODIUM LIGHTING FIXTURE, STEM MOUNTED. NUMBER INDICATES PANEL BRANCH CIRCUIT CONNECTION.
- HIGH PRESURE SODIUM FLOODLIGHT MOUNTED ON EAVE-STRUT
- J — JUNCTION BOX
- PHASE WIRES / NEUTRAL — WIRING IN CONDUIT RUN EXPOSED, ARROW INDICATES HOMERUN TO PANELBOARD. HASH MARKS DENOTE NUMBER OF WIRES. CONDUIT RUN WITHOUT HASH MARK INDICATE TWO WIRES. UNLESS OTHERWISE NOTED, CONDUIT SHALL BE 1/2" AND WIRE SHALL BE # 10 AWG.
- —G— GROUND WIRE, # 2/0 BARE COPPER RUN 18" BELOW GRADE
- 1/150 — FIXTURE NUMBER / LAMP WATTAGE — LIGHTING FIXTURE DESIGNATION
- EXISTING POLE-MOUNTED FLOODLIGHT

NOTES

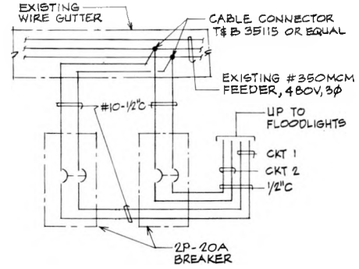
1. REMOVE FOUR EXISTING POLE STANDARDS AND FLOODLIGHTS. RELOCATE FLOODLIGHTS TO NORTH EAVES OF NEW SHADE STRUCTURE. RETURN POLE STANDARDS TO CONTRUCTING OFFICER.
2. DISCONNECT AND SALVAGE ALL WIRES AND CONDUITS CONNECTED TO 10AMP BREAKER AND POLE STANDARDS. EXISTING 10AMP BREAKER WILL BECOME SPARE.

LIGHTING FIXTURE SCHEDULE

FIXTURE SYMBOL	DESCRIPTION	LAMP TYPE	MOUNTING
1/150	HIGH PRESSURE SODIUM LUMINAIRE WITH MULTIFACETED SPECULAR REFLECTOR ENCLOSED WITH REMOVABLE TEMPERED GLASS LENS, DIE-CAST SOCKET AND BALLAST ASSEMBLIES, AUTO-REGULATOR BALLAST FOR 120 VOLT CIRCUIT, 1.55 S/MH RATIO, GE CAT. NO. C776G520 OR APPROVED EQUAL	250 W LU 250/BU	15' SEE 3/08
2/400	HIGH PRESSURE SODIUM FLOODLIGHT WITH OPTICAL REFLECTOR ENCLOSED WITH REMOVABLE TEMPERED GLASS LENS, 6X5 BEAM SPREAD, COMPLETE WITH BALLAST FOR 480 V CIRCUIT, DIE-CAST WEATHERPROOF HOUSING, TRUNNION MOUNT, GE CAT. NO. C539G508 OR APPROVED EQUAL	400W LU 400/BU	ON EAVE-STRUT
3/400	400 W HIGH PRESSURE SODIUM FLOOD-LIGHT RELOCATED FROM EXISTING POLES	—	ON EAVE-STRUT

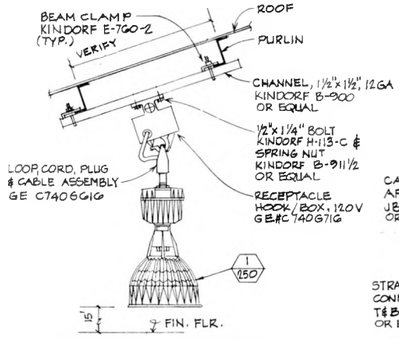


2A/08 ELEVATION - EXIST. POWER STA. 2
NO SCALE

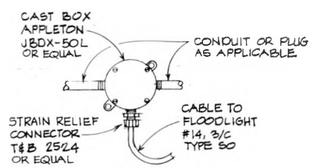


2B/08 WIRING DIAGRAM

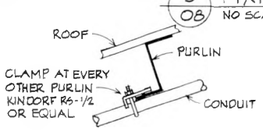
2/08 FLOODLIGHT CIRCUIT



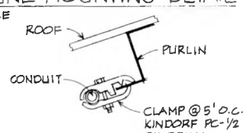
3/08 FIXTURE MOUNTING DETAIL
NO SCALE



5/08 FLOODLIGHT J-BOX (TYP. OF 8)
NO SCALE



4A/08 RIGHT ANGLE TO PURLIN



4B/08 PARALLEL TO PURLIN

4/08 TYP. CONDUIT SUPPORT
NO SCALE

10' 8' 6' 4' 2' 0 10 20 30 FEET
1" = 10'-0"

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

TEST PAD MODIFICATIONS
LIGHTING AND GROUNDING PLAN

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 OCT 1976
DRAWN E.D.
CHKD. A...
APPRVD R.S.C.
APPRVD. – PROGRAM OFFICE R.O. Pearson

DWG. NO. 6821.22E-08

1

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Contract No. E(04-3) - 1140

TASK 4.1.6
TEST PAD PIPING HEADERS
SPECIFICATION 6821.22F-S

Prepared by:

Environmental, Power and Facilities Department

TRW
SYSTEMS GROUP

FOREWORD

The work is situated approximately 10 miles east of Holtville, California, in Imperial County. Work to be performed includes construction of ERDA Test Facilities at the site.

The principal features of the work to be performed include:

1. Furnishing and erecting a steel support rack for a pipe manifold system.
2. Furnishing and installing a pipe manifold of Schedule 40 pipe insulated with aluminum-jacketed calcium silicate insulation.
3. Electrical and grounding systems for test stations and outdoor lighting.
4. All earthwork, including trenches, required for completion of ERDA Test Facilities.

DESCRIPTION OF THE WORK

The principal components of the work to be performed under these specifications include the following:

A. Furnish, fabricate, erect and paint the concrete test base, a steel support rack for manifold piping, including steel frames, for four test stations.

B. Furnish and install manifold piping consisting of 8-, 6-, and 4-inch diameter Schedule 40 steel pipe insulated with 1-, 1-1/2-, and 2-inch thicknesses of aluminum-jacketed calcium silicate insulation, complete with pipe supports, pipe rollers, pipe expansion joints, pipe protection saddles, 8-, 6-, and 4-inch gate valves, and miscellaneous fittings, as required.

C. The provision of electrical and grounding systems which include the furnishing, installation, and putting to operation two 480V busway distribution systems; one 30 KVA, 480V-208Y/120V dry-type transformer, one 120/208V panelboard; 480V power feeder from substation to busway distribution system; secondary circuit breaker at substation; and grounding system composed of four grounding plates and associated No. 2 bare copper conductors.

D. All earthwork for completion of the work described in this specification, as required.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
1	Furnishing, fabricating and erecting steel manifold piping support rack and steel frames for four test stations	For the lump sum of		
2	Furnishing and installing electrical and grounding systems	For the lump sum of		
	Furnishing and installing steel pipe as follows:			
3	8-inch diameter, schedule 40	790 lin. ft.		
4	6-inch diameter, schedule 40	380 lin. ft.		
5	4-inch diameter, schedule 40	30 lin. ft.		
6	1-1/2 inch diameter, schedule 40	470 pounds		
	Furnishing and installing pipe insulation:			
7	On 8-inch diameter pipe, fittings, valves and appurtenances	520 lin. ft.		
8	On 6-inch diameter pipe, fittings, valves and appurtenances	175 lin. ft.		
9	On 4-inch diameter pipe, fittings, valves and appurtenances	30 lin. ft.		

BIDDING SCHEDULE FOR
SPECIFICATION NO. 6821.22F-S

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
	Furnishing and installing bellows-type expansion joints:			
10	8-inch	24 ea.		
11	6-inch	8 ea.		
	Furnishing and installing valves, including gaskets, as follows:			
12	8-inch diameter gate valves, class 300	10 ea.		
13	6-inch diameter gate valves, class 300	13 ea.		
14	4-inch diameter gate valves, class 300	9 ea.		
15	1-1/2 inch gate valves	4 ea.		
16	Furnishing and installing miscellaneous steel pipe fittings, including, but not limited to: tapers, tees, elbows, crosses, flanges, and caps	10,200 pounds		
17	Miscellaneous metalwork	2,800 pounds		

TEST PAD PIPING HEADERS

GENERAL OUTLINE

DIVISION 2--EARTHWORK

Section 2.1--EARTHWORK

- 2.1.1 Excavation and Backfill for Trenches
- 2.1.2 Compacting Earth Materials

DIVISION 3--PIPELINES AND PIPE MANIFOLDS

Section 3.1--PIPELINES AND PIPE MANIFOLDS

- 3.1.1 Pipelines and Pipe Manifolds
- 3.1.2 Testing the Pipeline
- 3.1.3 Guarantee
- 3.1.4 Steel Pipe and Fittings

DIVISION 4--MANIFOLD PIPING SUPPORT RACK

Section 4.1--MANIFOLD PIPING SUPPORT RACK

- 4.1.1 Manifold Piping Support Rack

DIVISION 5--MISCELLANEOUS METALWORK

Section 5.1--MISCELLANEOUS METALWORK

- 5.1.1 Miscellaneous Metalwork

DIVISION 6--PAINTING

Section 6.1--PAINTING

- 6.1.1 Painting
- 6.1.2 Painting Tabulation
- 6.1.3 Color Schedule for Painting

DIVISION 7--ELECTRICAL AND GROUNDING SYSTEMS

Section 7.1--ELECTRICAL AND GROUNDING SYSTEMS

- 7.1.1 General
- 7.1.2 Acceptance of Electrical and Grounding Systems
- 7.1.3 Drawings and Data to be Furnished by the Contractor
- 7.1.4 Grounding System
- 7.1.5 Electrical Conduit System
- 7.1.6 Insulated Electrical Wires and Cables
- 7.1.7 Transformer
- 7.1.8 Busway
- 7.1.9 Panelboard
- 7.1.10 Wiring Devices
- 7.1.11 Installation of Power Feeder
- 7.1.12 Payment

DIVISION 8--DRAWINGS

Section 8.1--DRAWINGS

8.1.1 Drawings, General
8.1.2 List of Drawings

DIVISION 2 -- EARTHWORK

SECTION 2.1--EARTHWORK

2.1.1 Excavation and Backfill for Trenches

a. General--Excavation, backfill, and compacting backfill for trenches include all excavation, backfill, and compacting backfill required for trenches for electrical cable, conduits, and grounding cables.

b. Excavation--All excavation for trenches shall be made to the lines, depths, and grades shown on the drawings or directed by the contracting officer. The bottom of the trench shall be finished accurately to the lines and grades shown on the drawings or established by the contracting officer and in a manner suitable and as provided for the facility to be placed in the trench. The bottom of the trenches shall be prepared so as to provide a firm, even, and unyielding foundation. Trenches for small diameter pipe, conduit, or cable may be excavated by trencher but the backfill shall be compacted as provided for in this paragraph.

If at any point in excavation the material is excavated beyond the lines required, the overexcavation shall be filled with suitable materials and compacted in accordance with Paragraph 2.1.2 (Compacting Earth Materials). If at any point in excavation the natural foundation material is disturbed or loosened during the excavation process or otherwise, it shall be compacted in place, or where directed, it shall be removed and replaced with suitable material and compacted in accordance with Paragraph 2.1.2 (Compacting Earth Materials). Any and all excess excavation or overexcavation performed by the contractor for any purposes or reason, except for such additional excavation as may be prescribed by the contracting officer and, whether or not due to the fault of the contractor, shall be at the expense of the contractor. Fill and compaction of fill for such excess excavation or overexcavation shall be at the expense of the contractor.

c. Backfill--All backfill shall be placed carefully to give the conduit or cable a continuous even bearing on the bottom and sides. Backfill shall not be dropped directly on the conduit or cable. Rocks and clods, larger than 3 inches in maximum dimensions, shall not be placed within six inches of the conduit or cable.

9

d. Compacting backfill--All backfill in trenches under paving, structures, and where otherwise directed by the contracting officer, shall be compacted. All backfill shall be placed, moistened, and compacted in accordance with the applicable provisions of Paragraph 2.1.2 (Compacting Earth Materials). The backfill shall be compacted in layers having the same elevation on both sides of the pipe or cable to prevent unequal loading and displacement.

e. Costs--The cost of excavation for trenches, backfill for trenches, and compacting backfill for trenches shall be included in the prices bid in the schedule for other items of work, which prices shall include the cost of all labor and equipment required to perform the excavation, backfill, and compacting backfill for the various trenches.

2.1.2 Compacting Earth Materials

a. General--Where compacting of earth materials is required, the materials shall be deposited in horizontal layers and compacted as specified in this paragraph. The excavation, placing, moistening, and compacting operations shall be such that the material will be uniformly compacted throughout the required section and will be homogeneous, free from lenses, pockets, streaks, laminations, or other imperfections.

b. Compacting clayey and silty materials--Where compaction of earth materials containing appreciable amounts of clay or silt is required, the materials shall be deposited in horizontal layers. The thickness of each horizontal layer after compaction shall be not more than 6 inches. The excavation and placing operations shall be such that the materials when compacted will be blended sufficiently to secure the highest practicable unit weight and best impermeability and stability.

Prior to and during compacting operations, the materials shall have a moisture content of not greater than 2 percent wet or less than 2 percent dry of optimum moisture, as determined by the contracting officer and the moisture content shall be uniform throughout each layer.

Insofar as practicable, as determined by the contracting officer, moistening of the material shall be performed at the site of excavation but such moistening shall be supplemented by sprinkling at the site of compaction, if necessary. If the moisture content is less than optimum for compaction by more than 2 percentage points or is greater than optimum for compaction by more than 2 percentage points, the compaction operations shall not proceed, except with the specific approval of the contracting officer, until the material has been wetted or allowed to dry out, as may be required, to obtain optimum moisture content within the tolerances permitted above, and no adjustment in price will be made on account of any operations of the contractor in wetting or drying the materials or on account of any delays occasioned thereby.

When the material has been conditioned as hereinbefore specified, it shall be compacted by rollers or by hand or power tampers. Where hand or power tampers are used to compact soils in confined areas such as under pipe, they shall be equipped with suitably shaped heads to obtain the required density.

The density (dry) of the soil fraction in the compacted material shall not be less than 95 percent of the laboratory standard maximum soil density (dry) as determined by the Bureau of Reclamation Proctor Compaction Tests for the materials being compacted.

(1) Compaction test--The compaction tests will be made by the Government. The standard maximum soil density is the dry weight per cubic foot of the soil compacted at optimum moisture content of laboratory procedure. The compaction test is the same as ASTM designation: D 698, Method A, except that a 1/20-cubic-foot compaction mold is used and the rammer is dropped from a height of 18 inches, resulting in the same energy of compaction per unit volume.

c. Compacting cohesionless materials--

(1) Compacting cohesionless free-draining materials--Where compaction of cohesionless free-draining materials, such as sands

11

and gravels, is required, the materials shall be deposited in horizontal layers and compacted to the relative density specified below. The excavating and placing operations shall be such that the materials, when compacted, will be blended sufficiently to secure the highest practicable unit weight and best stability. Water shall be added to the materials as may be required to obtain the specified density by method of compaction being used.

The thickness of the horizontal layers after compaction shall not be more than 6 inches if compaction is performed by tampers or rollers; not more than 12 inches if compaction is performed by treads of crawler-type tractors, surface vibrators, or similar equipment; and not more than the penetrating depth of the vibrators if compaction is performed by internal vibrators.

The relative density of the compacted materials shall be not less than 70 percent as determined by the standard Bureau of Reclamation relative density tests for cohesionless free-draining soils.

(a) Relative density test--The relative density tests will be made by the Government. The relative density of a cohesionless free-draining soil, expressed as a percentage, is defined as its state of compactness with respect to the loosest and most compact states at which it can be placed by laboratory procedures. The relative density will be based on the following formula, wherein the maximum density is the highest unit weight of the soil, minimum density is the lowest unit weight of the soil, and in-place density is the unit weight of the soil in place. Tests for moisture content are made on the materials and the unit weights are expressed in terms of ovendry weights.

$$\text{Rel. Den. } (\%) = \frac{\text{max.den. x (in-place den. - min. den.)}}{\text{in-place den. x (max. den. - min. den.)}} \times 100$$

(2) Compacting cohesionless materials containing some clay and silt--Cohesionless materials containing clay and silt may not be free-draining. When compaction of cohesionless materials containing sufficient clay and silt as to impede free drainage is required, the material shall be placed and compacted in accordance with the provisions of c.(1) above. These materials shall be compacted to a dry density in accordance with either of the following control tests whichever shows the higher dry unit weight.

(a) Ninety-five percent of the laboratory standard maximum soil density (dry) as determined by the Bureau of Reclamation Proctor Compaction Test as prescribed in b.(1) above, or,

(b) The dry density of the material at 70 percent relative density as determined by the relative density test as prescribed in c.(1) above.

d. Costs--The costs of compacting earth materials as described in this paragraph shall be included in the prices bid in the schedule for other items of work.

DIVISION 3 -- PIPELINES AND PIPE MANIFOLDS

SECTION 3.1--PIPELINES AND PIPE MANIFOLDS

3.1.1 Pipelines and Pipe Manifolds

a. General--The contractor shall furnish pipe and fittings and construct the pipelines and pipe manifold as shown on the drawings and as herein specified.

During manufacturing, transporting, storing, and installing pipe and pipe fittings, the pipe and pipe fittings shall not be dropped or subjected to any unnecessary impact or other treatment that could damage the pipe.

Pipe shall not be stored in the yard or on the jobsite under conditions which would cause damage. Any length of pipe that, in the opinion of the contracting officer, is damaged beyond repair by the contractor by hauling, handling, unloading, storing or otherwise, shall be removed from the worksite and replaced by and at the expense of the contractor with another length of pipe of equal or greater strength.

b. Pipe--The contractor shall furnish and install steel pipe and fittings as specified in Paragraph 3.1.4 (Steel Pipe and Fittings).

Gaskets furnished with flanged fittings shall be suitable to withstand temperatures of 500°F.

c. Measurement and payment for pipe--Measurement, for payment, for furnishing and installing the 8-, 6-, and 4-inch pipeline and pipe manifolds will be made along the centerline of the pipe between ends of the pipe in place and will be continuous through bends and other fittings with no allowance for lap at joints. Measurement for payment, for furnishing the 1-1/2 inch galvanized standard weight pipe will be made in pounds of pipe furnished and installed. Weight of pipe will be determined in accordance with Paragraph 1.4.4 (Weights of Metal Parts).

Payment for furnishing and installing the 8-, 6-, and 4-inch Schedule 40 steel pipe will be made at the unit price per linear foot bid therefor in the

schedule, which price shall include the cost of furnishing all materials, manufacturing, transportation, installing the pipe, and furnishing maintenance guarantee.

Payment for furnishing and installing 1-1/2 inch galvanized standard weight pipe will be made at the unit price per pound bid therefor in the schedule which price shall include the cost of all labor, materials, installation, testing, and furnishing guarantee.

3.1.2 Testing the Pipeline

a. Pressure test--After the pipeline has been laid, and all joints completed, the contractor shall subject the pipe to a hydrostatic pressure of 200 lb/in^2 for a period of not less than one hour. No leakage will be allowed and any and all leaks shall promptly be made watertight.

The contractor shall furnish all pumping equipment, labor, tools, pressure gages, and other equipment, and water required for making the tests.

All exposed piping, fittings, and joints shall be carefully examined during the test. Any cracked or defective piping or fittings discovered during the pressure test shall be removed and replaced by the contractor with sound material and the test repeated as required, all at the expense of the contractor.

All testing shall be done in the presence of a duly authorized representative of the contracting officer.

b. Cost--The entire cost of testing the pipelines and of furnishing all equipment, labor, and materials for making the tests shall be included in the respective unit price bid in the schedule for furnishing and installing 8-, 6-, and 4-inch Schedule 40 steel pipe.

3.1.3 Guarantee

The contractor shall furnish a guarantee against leakage of the pipeline for a period of one year from date of acceptance. Any leaks shall be corrected by the contractor, on notice from the contracting officer and at no cost to the Government. Any repairs to the pipeline shall be made in an acceptable manner as approved by the contracting officer.

15

In lieu of such guarantee the contractor may hydrostatically test the pipeline at 150 percent of the specified test pressure of the pipeline at the lowest point in the line. Any visible leaks shall be repaired. The installation will be considered acceptable when the specified test pressure has been maintained without loss for a period of not less than 2 hours or no leaks are observed during that period of time or such time as necessary for completing inspection of all joints along the pipeline.

3.1.4 Steel Pipe and Fittings

a. General--The contractor shall furnish, install, and insulate the steel piping, valves, and fittings for the pipeline complete with accessories in accordance with the requirements of these specifications and as shown on the drawings.

b. Materials--Materials shall be in accordance with the following requirements:

(1) 4-, 6-, and 8-inch steel pipe--ASTM, Type E or S, Class A53A (Schedule 40), plain end.

(2) 1-1/2 inch steel pipe--ASTM A120 Type S (Schedule 40) galvanized.

(3) Flange gaskets--flat, asbestos, metallic reinforced.

(4) Bolts and nuts--Bolts - FF-B-575C, Grade II, Type II, or stud bolts; Nuts - FF-H-336D, Type II (Hexagon), Style 4; VNC coarse thread series.

(5) Steel welding flanges--ASTM Designation A181, Grade I, 300# Class, raised face for all spools.

(6) Steel fittings--ASTM Designation A234, Schedule 40, long radius welding type, except where designated on the drawings. Fittings for air piping shall be Class 150 Malleable iron, screwed end.

(7) Insulation--Insulation for the steel pipe, fittings, valves, and appurtenances, shall be equal to Johns-Manville "Metal-ON" aluminum-jacketed, calcium silicate insulation in nominal thickness as shown on the drawings as furnished by Johns-Manville, 22 East 40th Street, New York, New York, 10016, and shall comply with the requirements of Federal Specification HH-1-523c, Type II, Class C. Insulation shall be installed in accordance with the manufacturer's recommendations.

(8) Gate valves--Cooling water gate valves shall be CS body, 50% exelloy and 50% stellite trim, OS&Y bolted bonnet, ASA 300 RF FLGD, Crane Model 33 x UF or approved equal. All others shall be as above, except shall be Class 300.

(9) Bellows type stainless steel expansion joints-- Expansion joints shall be of the multi-ply, laminated, corrugated bellows construction; constructed of type 347 stainless steel. Each expansion joint shall be provided with ends consisting of rigid flanges with elongated bolt holes. Self-equalizing stainless steel contour rings shall be provided in each corrugation. Each expansion joint shall be so constructed as to require not more than one hundred pounds to compress through its full rated traverse. Expansion joints shall be designed for 300 pounds working pressure and provided with self-guiding internal liners or guides. Expansion joints when installed shall be protected against both end loading and torsional stresses. Expansion joints when installed shall be protected against both end loading and torsional stresses. Expansion joints shall be type 308-1230 supplied by Keflex, Inc., General Offices-San Francisco California 94111, or approved equal.

(10) 1-1/2 inch gate valves shall conform to Federal Specification No. WW-V-54D, Type I, Class C, Style 2.

(11) Miscellaneous materials--Where materials are required but are not specified herein, the contractor shall furnish standard commercial quality material suitable for the intended use.

17

c. Fabrication--The steel pipe shall be fabricated in accordance with these specifications, the drawings and the requirements of the American Water Works Association Standard C200. Where provisions of the AWWA Standards conflict with provisions of these specifications and/or drawings, the provisions of these specifications and/or drawings shall govern.

d. Installation--The steel pipe and fittings shall be assembled and erected in place as shown on the drawings. The contractor shall furnish and install such temporary supports and bracing as may be required to hold the pipe in place and prevent distortion during welding; however, the embedment of timber supports or the welding of temporary supports to the pipe shell will not be permitted. Expansion joints and pipe insulation shall be installed in accordance with the manufacturer's instructions.

e. Cleaning--Finished spools shall be thoroughly cleaned and flushed with water or blown with steam or air to clear the spool of dirt, mill scale, filings and other debris. Cleaning or flushing shall continue until no trash is evident in the exhaust or a clean stream of water is obtained at the outlet.

f. Measurement and payment--Measurement for payment and payment for furnishing and installing steel pipe will be made as provided in Subparagraph 3.1.1.c (Measurement and Payment for Pipe).

Measurement, for payment, for furnishing and installing the pipe insulation will be made along the centerline of the pipe between ends of the pipe in place and will be continuous through bends and other fittings with no allowance for lap at joints.

Payment for furnishing and installing pipe insulation and the various sizes of pipe will be made at the respective unit price per linear foot bid therefor in the schedule, which unit price shall include the cost of furnishing all materials, transportation, labor, and incidental costs associated therewith.

Payment for furnishing and installing the various sizes of gate valves will be made at the respective unit price per each bid therefor in the schedule which unit price shall include the cost of all labor, materials, and incidentals associated therewith.

Payment for furnishing and installing expansion joints will be made at the unit price each bid therefor in the schedule which unit price shall include the cost of all labor and materials and incidentals associated therewith.

The weight of steel pipe fittings will be determined as specified in Paragraph 1.4.4 (Weights of Metal Parts) and payment for furnishing and installing the miscellaneous steel pipe fittings, including but not limited to: tapers, tees, elbows, crosses, flanges, nuts, bolts, gaskets, and caps, will be made at the unit price per pound bid therefor in the schedule which unit price shall include the cost of all labor, materials, and incidentals associated therewith.

DIVISION 4 -- MANIFOLD PIPING SUPPORT RACK

SECTION 4.1--MANIFOLD PIPING SUPPORT RACK

4.1.1 Manifold Piping Support Rack

a. General--The contractor shall furnish, fabricate, and erect the manifold piping support rack and supports for panelboards at test stations 5 through 8, as shown on the drawings and hereinafter specified. Furnishing and erecting anchor bolts and other related accessory materials required for the complete erection of the support rack and frames as shown on the drawings and herein specified. The steel frames required for test stations 5 through 8 on the concrete test base shall conform to the applicable provisions of this paragraph.

For the purpose of these specifications, the term "steel" includes all materials defined as structural steel in the AISE "Code of Standard Practice for Steel Buildings and Bridges" as given in pages 5-172 and 5-173 of the Seventh Edition of the Manual of Steel Construction of the American Institute of Steel Construction, Inc.

The contractor shall furnish all materials, including steel, anchor bolts, and other related accessory materials, required for the complete erection of steel for the support rack and frames notwithstanding any omissions from these specifications or drawings.

b. Materials

(1) Structural steel -- All structural steel shall conform to: QQ-S-741D, ASTM Designation: A 7, A 36, or ASTM Designation: A 374, except that Government inspection at the mill will be waived. Structural steel tubing shall conform to ASTM Designation: A 500 or A 501. "Unistrut" steel shall conform to ASTM Sheet Steel Specification A-570 Grade C.

(2) Expansion anchors -- Wedge anchors shall be "Red-Head" ITT Phillips Co., type WS7860, Catalog F-500-1 or approved equal.

(3) Nuts and Bolts -- Nuts shall be Type II, Style 4, steel nuts in accordance with FF-N-836D(1), coarse thread series. Bolts shall be FF-B-575C, Grade II, Type II, Coarse thread series.

(4) Washers -- All washers shall be round, carbon steel washers in accordance with FF-W-92B, Type A, Grade I, Class A, or ASTM Designation: A 325.

(5) Arc-welding electrodes -- All arc-welding electrodes shall be of the E60 classification in accordance with the latest edition of the American Welding Society Specifications for Iron and steel Arc-Welding Electrodes and shall be suitable for the base materials, positions, and other conditions of intended use.

(6) Miscellaneous materials -- Miscellaneous materials not specifically covered herein by detailed specifications shall be of the top standard commercial quality.

c. Details of design -- In detailing the structures, details and setting dimensions for embedded materials shall be adhered to exactly. The details for connections shown on the drawings are typical and may be varied slightly provided that the change is in accordance with these specifications. Splices shall be made only where indicated on the drawings, or where authorized by the contracting officer. The details of the splices shall be as shown on the drawings.

d. Workmanship and defective materials -- All work shall be equal to the best modern practice in the manufacture and fabrication of materials of the types covered by these specifications, notwithstanding any omissions from these specifications or drawings. The contractor shall be responsible for the correct fitting of all parts. The contractor shall replace, free of cost to the Government, any defective materials discovered during erection, and shall pay all cost of the correction in the field of any errors not previously discovered.

e. Fabrication

(1) General -- All work shall be equal to the best modern practice in the manufacture and fabrication of materials of the types covered by these specifications or drawings. Details of design or fabrication not covered by the drawings or by these specifications shall conform to the applicable provisions of the latest "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" including all supplementary provisions of the American Institute of Steel Construction, and "Specifications for Architecturally Exposed Structural Steel."

21

(2) Inspection and tests -- All materials furnished and all work performed shall be subject to rigid inspection. No materials shall be shipped until inspection at the contractor's fabricating plant has been made, and certified copies of tests and analyses have been accepted. Inspection and tests of materials by the Government at the mill will be waived. Inspection of materials at the contractor's plant will be made in accordance with the provisions of these specifications. As soon as practicable after receipt by the contractor of notice to proceed, the contractor shall submit to the Government certified mill test reports of the chemical analysis and physical tests of all structural steel.

(3) Straightening material -- Before being laid out or worked in any way, structural material shall be straight and free from sharp kinks and bends. If straightening is necessary, it shall be done by methods that will not damage the serviceability or affect the metallurgy of the member.

(4) Shearing and cutting -- Shearing and cutting by torch or electric arc shall be performed carefully, and all portions of the work which will be exposed to view after completion shall be finished neatly. Reentract cuts and copies shall be filleted before cutting.

(5) Baseplates -- Baseplates shall be straight and true and square cut. Baseplates shall be finished where called for on the drawings. Baseplates to be finished shall be planed to obtain satisfactory contact bearing with columns. Edges cut by torch shall be ground straight and smooth.

(6) Machine finish -- Where finished surfaces are specified on the drawings, and where the type of finish is not specified, the type of finish required shall be that most suitable for the part to which it applies and shall be average or rough as defined herein. Where an average finish is required, smooth surfaces shall be produced, but slight toolmarks will be allowed. Where a rough finish is required, rough machining sufficient only to produce a plane surface true to dimensions will be allowed. In general, an average finish will be required for surfaces in permanent contact where a tight joint is required and a rough finish will be required for all other machine surfaces. Where finish is called for on the drawings, the

members shall be finished true to line and free from twists, bends, and open joints. All columns marked finish shall be milled.

All machined surfaces which will be exposed during shipment shall be protected by a heavy coat of rust-preventative compound in the shop after machining.

(7) Holes --

(a) General -- All holes shall be cylindrical, unless otherwise shown on the drawings, perpendicular to the members, and clean cut and without burred or ragged edges. Holes in material more than 3/16 inch thick shall be drilled or subpunched and reamed. Holes for pins shall be bored. All other holes may be punched or drilled to full size.

(b) Drilled holes -- Unless otherwise shown on the drawings, drilled holes shall be 1/16 of an inch larger than the nominal diameter of the bolt. Outside burrs resulting from drilling shall be removed with a tool making a 1/16-inch bevel. Holes shall be drilled so accurately that after assembly not more than 15 percent of any group of contiguous holes in the same place shall show an offset greater than 1/32 of an inch between adjacent thicknesses of metal.

(c) Punched holes -- Unless otherwise shown on the drawings, the diameter of the punch for punching to full size shall be 1/16 of an inch larger than the nominal diameter of the bolt. The diameter of the die shall be not more than 3/32 of an inch larger than the diameter of the punch. The holes shall be punched so accurately that, after the component parts of a member are assembled, a cylindrical pin one-eighth of an inch smaller in diameter than the nominal diameter of the punched hole may be entered perpendicular to the face of the member without drifting in not less than 75 percent of any group of contiguous holes in the same plane. All holes shall pass a pin 3/16 of an inch smaller in diameter than the nominal diameter of the hole.

(8) Edge distances and bolt spacing -- Unless otherwise shown on the drawings or noted in the specifications, edge distances and bolt spacing shall conform to the requirement of the latest "Specifications for Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction.

23

(9) Bolts, anchors, washers, and nuts -- The length of connection bolts shall be in 1/4-inch variations, and when in the structure, the bolts shall extend at least one-fourth of an inch beyond the nuts. Anchor bolts shall be as shown on the drawings. Threads of anchor bolts for the structural-steel framing shall be given a heavy coat of rust-preventive compound in the shop. Washers shall be used under heads of all connection bolts where shown or called for on the drawings.

(10) Welding -- All welding and work related thereto shall comply with the latest edition of the American Welding Society "Code for Welding in Building Construction." All welding terms shall be interpreted in accordance with the American Welding Society definitions of welding terms. Welding symbols shown on the drawings comply with American Welding Society symbols, unless otherwise noted.

All welds shall be of the types specified on the drawings, shall be continuous unless otherwise noted, and shall be made in such a manner that residual shrinkage stresses will be reduced to a minimum. No stress-relieving treatment will be required unless otherwise noted on the drawings.

(11) Qualifications of welding process and operators -- If not previously qualified, the welding process and all welding operators employed in performing the work covered by these specifications shall be qualified in accordance with the American Welding Society Standard Qualification Procedure and certified to the contracting offices.

(12) Compression joints -- The surfaces of compression joints depending on contact bearings shall be faced so as to have full contact bearings when alined and welded.

(13) Stiffeners -- Stiffeners shall be fitted neatly and, when tight fits are required to transmit bearing, shall be milled or ground and brought to true contact with the flanges or structural tubing.

(14) Temperature correction -- The overall length of any member or assembly of members shall be as shown on the shop drawings, within tolerances permitted in standard shop practice, with the temperature of the ambient air at 68°F. If there is any considerable variation from this temperature when measurements are made, the measured dimensions shall be corrected, based on a coefficient of linear expansion of 0.00000636 per unit of length per degree Fahrenheit.

d. Erection -- All steel for the support rack, control center frame, and frames for test stations, shall be assembled and erected in accordance with the approved erection drawings, and the applicable provisions of the "Specifications for Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction.

The contractor shall perform all required grouting operations. In connection with installation of work anchored to concrete slab. Bolted connections shall be made with high-strength structural bolts or machine bolts as shown on the approved erection drawings. Installation of high-strength structural bolts shall be in accordance with the applicable provisions of "Specifications for Structural Joints Using ASTM: A 325 Bolts: as approved by the Research Council on Riveted and Bolted Structural Joints fo the Engineering Foundation and endorsed by the American Institute of Steel Construction." Stud anchors, stud shear connectors, and studbolts shall be welded with automatic end-welding guns.

All structural steel and other related accessory materials for the support rack and frames shall be painted in accordance with the provisions of Section 6.1 -- PAINTING.

e. Payment -- Payment for furnishing, fabricating and erecting the steel manifold piping support rack, and steel frames for motor control center, four test stations, will be made at the lump sum price bid therefore in the schedule, which price shall include the cost of all labor and materials and incidental cost relative to the completion of the rack and frames and all appurtenances as shown on the drawings and herein specified.

DIVISION 5 -- MISCELLANEOUS METALWORK

SECTION 5.1 -- MISCELLANEOUS METALWORK

5.1.1 Miscellaneous Metalwork

a. General--The contractor shall furnish and install the shims, serviceline straps, hangers, pipe supports, pipe anchor chairs, and protection saddles, as shown on drawings as miscellaneous metalwork.

b. Materials--Materials shall conform to the following requirements:

(1) Structural steel--Structural shapes, plates, and bars shall conform to Federal Specification QQ-S-741D, ASTM Designation: A36.

(2) Steel pipe--ASTM A120, seamless black steel.

(3) Bolts and nuts--Bolts shall conform to Federal Specification FF-B-575C, Type I or II; Nuts - FF-B-836D, Type I or II, Style 1 or 4.

(4) Pipe supports, Types B, C and E shall be fabricated as shown on the drawings.

(5) Pipe roller supports--Pipe roller supports for Type A pipe supports shall be equal to No. 177 as offered by the ITT Grinnell Corp. (Catalog PH-76).

(6) Pipe supports, Type D, adjustable, shall be ITT Grinnell Corp. No. 264 or approved equal, with appurtenances as shown in the drawings.

(7) Protection saddles--Saddles for the protection of the pipe insulation at pipe supports shall be ITT Grinnell Corp. (Catalog PH-76). No. 160 protection saddle for 1-inch insulation and No. 162 protection saddle for 2-inch insulation, or approved equal.

(8) Materials for miscellaneous metalwork not specifically covered herein by detailed specifications shall be of good commercial quality approved by the contracting officer.

c. Fabrication--Metalwork shall be fabricated in accordance with the drawings and with the applicable provisions of the "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction.

d. Zinc coating (galvanizing)--Zinc coating (galvanizing) shall conform to ASTM Designations: A123 and A153.

e. Welding--Welding shall conform with the requirements of the American Welding Society Code AWS D1.0.

f. Measurement and payment--Measurement, for payment, for miscellaneous metalwork shall be made in pounds of metalwork incorporated into the work, as determined in accordance with Paragraph 1.4.4. (Weights of Metal Parts).

Payment for types A, B, C, D, and E pipe supports, pipe anchor chairs, and pipe protection saddles will be made at the unit price per pound bid therefore in the schedule, which price shall include the cost of all labor, materials, fabricating, installing and any incidentals associated therewith.

Payment for furnishing and installing all other metalwork for which unit prices are not provided in the schedule will be made as miscellaneous metalwork at the unit price per pound bid therefore in the schedule, which price shall include the cost of all labor, materials and incidentals associated therewith.

DIVISION 6 -- PAINTING

SECTION 6.1--PAINTING

6.1.1 Painting

a. General--The contractor shall furnish all materials, clean surfaces and apply the paint and protective coatings listed in Paragraph 5.1.2. (Painting Tabulation) and in accordance with Paragraph 5.1.3. (Color Schedule for Painting).

Items or surfaces not required to be painted or coated but which are adjacent to surfaces to be cleaned and painted shall be protected against contamination and damage during the cleaning and painting operations. The cleaning and painting operations shall be so conducted that dust or other contamination from the cleaning process will not fall on wet, newly painted surfaces, and newly painted metalwork shall not be moved until the paint is dry hard. All contractor-applied coatings exposed to view, including any touchup repair painting, shall present a uniform color-matched appearance. Any items or surfaces damaged or contaminated by painting operations shall be returned to their original condition by and at the expense of the contractor. Before topcoating any coated surfaces, the contractor shall reclean any exposed metal and apply paint as necessary to restore to the specified condition all previously applied paint in areas which are defective or damaged. Materials which have been painted shall be handled with care and protected as necessary to preserve the coating in good condition.

Temporary or permanent welding for the convenience of the contractor will not be permitted on areas where the welding will damage paint or other protective coatings unless the areas of coatings which would be damaged thereby are accessible for repairing and inspection. Unless otherwise specified, the contractor will not be required to disassemble machinery, equipment or other metalwork for the purpose of painting the interiors. The contractor shall provide adequate ventilation, lighting and the necessary safety equipment for the protection of the workmen during painting and coating operation.

b. Preparation of surfaces--Surface preparation shall be in accordance with one of the following methods. The method to be used for each item is indicated in the painting tabulation. Weld spatter, slag burrs, or other objectionable surface irregularities shall be removed or repaired before cleaning. Any contaminants to the paint coating, from cleaning operations or other sources, shall be removed before the surface is painted. Cleaning solvent shall be mineral spirits or xylol. Cleaning cloths and solvents shall be discarded before they become contaminated to the extent that a greasy film would remain on the surface after preparation of the surface. In the event that rust forms or the surfaces become otherwise contaminated in the interval between cleaning and painting, or between coats of paint, recleaning will be required. Any coatings not required by and not shown in the painting tabulation shall be removed from the surfaces by suitable and effective means, unless otherwise directed.

Method A All oil, grease, and dirt shall be removed by the use of clean solvent and clean, lint-free wiping material or other effective means. Surfaces with gloss or semigloss paints shall also be sanded lightly.

Method B All oil and grease shall be removed by the use of clean solvent and clean, lint-free wiping materials. Following the solvent cleaning, the surfaces shall be cleaned of all defective or damaged areas of existing paint, and of all loose rust, loose mill scale, and other foreign substances by scraping, chipping, wire brushing, grit-blasting, commercial grade sandblasting, or other effective means.

c. Preparation of other surfaces--All surfaces not covered by the above sub-paragraphs shall be prepared by methods common to good practice for the particular surface being prepared.

d. Application--Materials shall be thoroughly mixed at the time of application. Surfaces shall be clean and free from moisture at the time of application. Items to be painted that are not thoroughly dry at the time of paint application shall be heated to a sufficient temperature (80°F) to drive off any moisture present before paint is applied. Effective means shall be provided for removing free oil and moisture from the air-supply lines of all spraying equipment. Care shall be exercised during spray application to hold the nozzle sufficiently

close to the 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. Nozzle pressure consistent with acceptable finish results shall be employed when spray painting.

Each coat shall be applied in such a manner as to produce an even film of uniform thickness which will completely cover irregularities, fill crevices, and be tightly bonded to the metal or previous coat. Each coat shall be free from runs, pinholes, and sags.

Each coat shall be allowed to dry or to harden before the succeeding coat is applied. Thicknesses shall be measured by an approved dry-film thickness gage and shall be not less than the minimum specified thickness at any point on the coating. Acceptance will be based on the total dry-film thickness gage and shall be not less than the minimum specified thickness at any point on the coating. Acceptance will be based on the total dry-film thickness as measured by an Elcometer, Mikrotest, or other suitable dry-film thickness gage, after the complete paint system has thoroughly dried.

Red lead priming paint, regular aluminum paint, and enamels, and oil base paints may be thinned if necessary to permit satisfactory application, in which event mineral spirits shall be used and the amount of thinner shall be kept to a minimum but in no event shall it exceed 1 pint per gallon of paint.

If necessary to improve application properties, cold-applied paints may be heated by means of a hot-water bath to temperatures not to exceed 100°F. Paint shall not be applied when the temperature of the item to be painted or the surrounding air is under 45°F., except that vinyl resin paints shall not be applied when metal or air temperatures are above 110° or below 40°F. Painting shall proceed only when the humidity and the temperatures of atmosphere and of surfaces to be painted are such that evaporation rather than condensation will result. Brush coats may be applied by the conventional brushing procedure, or the paint may be delivered to the surface in a fluid stream by means of spray equipment employing air pressure only on the material and the paint then spread immediately by brushing to an even smooth coating.

Tinting, where required for color contrast, shall be accomplished by using not more than 3 ounces of tinting color per gallon of paint.

Application of specific materials shall be as follows:

(1) Red lead priming paint shall be applied at a maximum coverage of 500-square-feet-per gallon per coat for Type II but the dry film thickness shall be not less than 1.0 mil for the first coat. Zinc-dust-zincoxide paint shall be applied at a maximum coverage of 500-square feet-per-gallon per coat. Following the first coat of red lead paints, an additional tinted coat shall be applied over all rivets, welds, bolts, seams, sharp corners, and edges before subsequent painting. Alternate coats shall be tinted for color contrast using 1B black. The first coat shall be applied by brush or roller and subsequent coats shall be applied by either brush, roller, or spray, except that Type II red lead priming paint may be applied by spraying when Method B surface preparation is specified and the surface is cleaned by "commercial" grade blast cleaning.

(2) Aluminum paints shall be applied by spraying at a maximum coverage of 500-square-feet-per-gallon per coat for regular aluminum paint. The paints shall be prepared by mixing 2 pounds of aluminum paste per gallon of mixing varnish and only enough paint for each day's use shall be prepared at one time. The first coat shall be tinted for color contrast using 2A blue. The final coat of aluminum paint shall be "stripe free" with a uniform appearance.

(3) Enamels, and oil base paints, shall be applied by brush, roller, or spray at a maximum coverage of 500-square-feet-per-gallon per coat.

e. Materials--All pigmented paints and primers shall be purchased in containers not larger than 5 gallons as packaged by the manufacturer. Colors of finish paints shall be as directed in accordance with Federal Standard No. 595a. All colors shall be factory mixed and ground. Tinting with universal tinting colors will not be permitted, and tinting with colors-in-oil is permitted only where specified for slight contrast between coats. Materials shall be in accordance with the following specifications, or may be in accordance with the subsequent revisions thereto: Provided, that the samples or certifications are identified with the proper specifications revision:

31

Group I

(1) Federal Specifications--

(a) Red lead priming paint, TT-P-86g, Type II.

(b) Mixing varnish for regular aluminum paint, TT-V-81d, and aluminum paste, TT-P-320c, Type II, Class 2.

(c) Zinc dust-zinc oxide primer, TT-P-641f, Type II.

(d) Primer coating, zinc dust, chlorinated rubber, TT-P-001046(1), (Galvanizing repair compound.)

(e) Enamel, gloss, TT-E-489f(1), Class A.

(2) Miscellaneous Specifications--

(a) Paint and coating materials required to be used on work covered by these specifications and which are not covered by this paragraph will be classified as Group I materials, unless otherwise indicated.

Group II

(1) Federal Specifications--

(a) Pigment-in-oil (tinting colors), TT-P-381E(1). Colors 1B black and 2A blue, or equal tinting color in oil.

(b) Mineral spirits, TT-T-291E, Grade 1.

(c) Xylol (xylene), TT-X-916b, Grade A or B.

f. Sampling, testing, and certification of materials--The Government will test or require certification of each batch, type, or color of paints or related materials prior to use of application. However, acceptance of the material under the clause of the General Provisions entitled "Inspection and Acceptance" will not be made until the material has been satisfactorily applied and the equipment installed at the jobsite.

The contractor shall furnish copies of all purchase orders for paint or related materials to the contracting officer. Copies of purchase orders shall be furnished far enough in advance of planned use so that the samples, if required, will be available to the Government to allow a testing period of at least 45 days. The Government will then inform the contractor in writing whether materials covered by each purchase order will be tested or whether the manufacturer's certification will be required. The Government

will act on certifications as to paint conformance within 16 days after receipt of the certifications by the Government, and will notify the contractor. Purchase orders and the required certifications or samples shall be furnished by the contractor to the Bureau of Reclamation, Construction Engineer, Yuma Projects Office, P.O. Bin 5569, Yuma, Arizona 85364, shipping costs prepaid, and copies of all correspondence shall be sent to the authorized representative of the contracting officer at the jobsite.

Certifications for each type, batch, or color of Group I materials shall include detailed results of laboratory tests covering all of the applicable specifications requirements and a general statement that the materials comply with the requirements of the specifications. Certifications for quantities of 10 gallons or less of each type, batch, or color of Group I materials may be furnished with only the manufacturer's quality control and composition data, and a general statement that the materials comply with the requirements of the specifications. The certifications shall also contain specific identification data as to material identification, batch number, date of manufacture, quantity being furnished, and the Bureau of Reclamation specifications number. Certifications for Group II materials need not include detailed laboratory testing data but shall comply in other respects with the requirements stated above. The Government reserves the right to test any materials furnished on certification when in the opinion of the Government, such tests are necessary. The contractor shall be responsible for the accuracy of all certifications submitted or data contained therein whether submitted by him, a manufacturer, a supplier, or a subcontractor.

The contractor shall purchase the total quantity of each item of material that is expected to be used in a reasonable length of time to avoid repetitive purchases that would impose additional testing expense on the Government. The costs and delays from additional testing required as a result of either unnecessary small purchases or rejection of the materials submitted shall be the responsibility of the contractor.

g. Costs--The cost of furnishing, preparing, and applying all materials for the cleaning, painting, or coating operations shall be included in the applicable prices bid in the schedule for the items of work requiring painting.

6.1.2 Painting Tabulation

Contractor furnished items shall receive the cleaning and coating systems shown in the tabulation following. Coatings shall be applied as required under Paragraph 6.1.1 (Painting).

No.	Item	Surface Preparation Method	Paint or Coating Material	Number of Coats
1	Damaged areas of paint on metalwork and equipment which are furnished complete painted or coated including:	Repair damaged areas to equal and color match undamaged contiguous areas.		
2	Damaged areas of galvanized surfaces that do not require finish painting	B	Zinc dust-zinc-oxide paint	2
3	Exterior exposed metalwork and exposed piping	B	Red lead priming paint, Type II	1
	a. Structural steel manifold piping support rack and test stations 5 through 8		Regular aluminum paint	2

6.1.3 Color Schedule for Painting

The colors and gloss of finish coats of paints will be as selected by the contracting officer except as provided in Paragraph 6.1.2 (Painting Tabulation). If items are furnished with a manufacturer's finish painting, the color and gloss of which are acceptable to the contracting officer and which meet the cleaning and painting requirements of Paragraph 6.1.1. (Painting), such items will not require field painting except for repair of damaged painted surfaces.

Color schedules for painting will be provided by the contracting officer.

DIVISION 7 -- ELECTRICAL AND GROUNDING SYSTEMS

SECTION 7.1--ELECTRICAL AND GROUNDING SYSTEMS

7.1.1 General

a. General--The contractor shall furnish and install all electrical equipment and materials to complete and make ready for service the electrical and grounding systems.

The contractor shall place accurately in position, level and plumb, grout, connect, adjust, and make ready for service the transformer, power panelboard, wiring devices, grounding system, conduit system, insulated electrical wires and cables, and all other equipment and materials required by these specifications. All installations, assembly operations, and adjustments shall be in accordance with the following, and in the event of conflicting requirements, precedence is established by the order of the following:

(1) The latest edition of "National Electrical Code", the National Electrical Safety Code, and the adopted electrical code of the county and state in which the construction will be performed.
(2) Manufacturer's instruction data furnished with the equipment.
(3) These specifications and the drawings included herein or as directed by the contracting officer.
(4) The Bureau of Reclamation Design Standards No. 5, "Field Procedures for Electrical Installation", a copy of which will be furnished to the contractor upon request.

The electrical system shall be maintained and protected by the contractor in a satisfactory condition until final acceptance by the Government. Defective materials and equipment damaged in the course of installation or testing, shall be replaced or repaired by and at the expense of the contractor in a manner meeting the approval of the contracting officer.

35

Temporary lighting equipment, if required or necessary to accommodate and facilitate the contractor's work operations, shall be provided, installed, and removed by and at the expense of the contractor.

b. Earthwork--The excavation of trenches, backfill and compacting of backfill in trenches for conduit and grounding cable shall be performed in accordance with the provisions of Paragraph 2.1.1 (Excavation and Backfill for Trenches). Conduits shall be buried to a minimum depth of 18 inches unless otherwise shown on the drawings or directed by the contracting officer. Suitable select backfill shall be placed around all conduit and all backfill compacted as provided in Paragraph 2.1.1 (Excavation and Backfill for Trenches). No direct payment will be made for earthwork for burying conduit and cable but the cost thereof shall be included in the prices bid in the schedule for related items of work.

c. Payment--Payment will be made in accordance with Paragraph 7.1.12 (Payment).

7.1.2 Acceptance of Electrical and Grounding Systems

After the work required under these specifications has been completed, the systems will be tested and operated, by and at the expense of the Government. These acceptance tests are exclusive of the operational tests covered under other paragraphs of these specifications. The tests may be witnessed by the contractor or his representative. Final payment under the contract will not be made until each item is completed and accepted in its entirety, these tests are completed, and the contracting officer has determined that the requirements of these specifications have been fulfilled: Except, that if the government, through no fault of the contractor or of the materials furnished by the contractor is delayed in making the acceptance tests beyond a period of 30 days from the date of final completion of the installation of all equipment, payment of the balance due under the contract will be made at the end of the 30 day period.

7.1.3 Drawings and Data to be Furnished by the Contractor

a. Approval drawings and data--Within forty-five (45) calendar days after date of receipt of notice to proceed and before proceeding with procurement of materials, the contractor shall submit to the Government five sets of drawings and data for approval. The drawings and data shall include:

(1) Working drawings of the electrical and grounding systems, including wiring diagrams marked to show circuit designations.
(2) Manufacturer's detailed drawings, data, and description of the power panelboards, including manufacturer and catalog numbers and sheets or bulletins of circuit breakers and solderless terminal lugs.
(3) Data and drawings for the transformer showing outline dimensions, wiring, nameplate information, catalog sheets or bulletins, manufacturer, and type of transformer.
(4) Catalog number and sheet or bulletins for 500 MCM feeder cables.

Any material shipped before approval of drawings and data will be at the contractor's risk. The Government shall have the right to require the contractor to make any changes in the equipment design and installation details which may be necessary to make the equipment conform to the requirements and intent of these specifications without additional cost to the Government. Approval of drawings and data by the Government shall not be held to relieve the contractor of any part of the contractor's obligation to meet all of the requirements of these specifications nor of the responsibility for the correctness of the drawings and data submitted.

The submittal of data required under this paragraph shall be complete, shall be made at one time, and shall include all data required to be submitted under the provisions of this paragraph. Three copies of all data required above shall be forwarded by the contractor and not by subcontractors, to the Construction Engineer, Yuma Projects Office, P.O. Bin 5569, Yuma, Arizona 85364. The contractor shall forward a copy of his transmittal letter with the other two copies to the Regional Director, Lower Colorado Region, P.O. Box 427, Boulder City, Nevada 89005.

37

b. Cost--The cost of submitting drawings and data to the Government shall be included in the lump sum price bid in the schedule for furnishing and installing electrical and grounding systems.

7.1.4 Grounding System

a. General--The grounding system shall be in accordance with Drawing No. 6821.22F-09 and as specified herein.

The contractor shall furnish and install the grounding system, consisting of bare stranded copper cables, ground plates, and accessories. Accessories shall include cable clamps; connectors, ground clamps, and other incidentals. The grounding system shall be connected to the existing ground plate as indicated on the drawing.

b. Materials--

(1) Ground cables--All ground cables shall be annealed, bare copper cable, concentric stranded, and in accordance with ASTM designation: B 8, Class B. The solid wires used in forming the cables shall be in accordance with ASTM Designation: B 3.

(2) Cable fittings, lugs, and connectors--All cable fittings shall be of the solderless type and shall have current-carrying capacity equal to that of the copper cable with which they are used. All cable fittings, lugs, connectors, together with the bolts, nuts, and washers used therewith and the bolts, nuts, and washers which are used to make the connection to the equipment, shall be of copper alloy, containing not more than 4 percent zinc. Connections to metal structures may be made with bolted-solderless connectors or with Cadweld, Thermoweld, or equivalent processes. All Cadweld, Thermoweld, or equivalent processes shall be of the heavy-duty type, made of new material from fresh stock and the installation shall be performed with heavy-duty welding equipment in accordance with manufacturer's instructions.

(3) Ground plates--All ground plates shall be 1/4-inch thick copper plates, 8-inch by 10-inch size and perforated with 1/4-inch holes at approximately 1-1/2-inch spacing both ways.

(4) Ground straps--All ground straps shall be copper, 1/16-inch thick, 1-inch wide, and perforated with 1/4-inch holes spaced at approximately 3/4-inch center.

(5) Machine screws, nuts, and washers--Machine screws, nuts, and washers used with the ground straps shall be of corrosion-resistant material similar to bronze or brass. The machine screws shall be No. 10-32 and shall be one inch in length.

c. Installation--

(1) Ground plates--Ground plates shall be mounted on the manifold piping support rack as shown on the drawing and shall be connected to the nearest existing ground plate at north test pad with No. 2 AWG bare copper conductor.

(2) Connections--The contractor shall make all necessary connections for the complete grounding system. All panelboards, transformers, busways, conduits, structural members, and metallic enclosures of electrical equipment shall be connected to the ground plate by means of No. 2 AWG copper grounding conductors. The conduit system, if electrically continuous, may serve as the grounding system for 115-volt equipment or a grounding conductor shall be installed with the circuit conductors in accordance with the "National Electrical Code." All 120/208 and 480-volt outlets and equipment shall be connected to the grounding system with a grounding conductor.

Grounding conductors shall be buried or concealed insofar as possible. Metallic non-electrical items within reach of electrical items shall be bonded to the electrical item or to the same ground cable at the closest point. All paint, scale, and enamel shall be removed from the points of contact on metal surfaces before ground connections are made. Where the finish has been removed from

equipment to install ground connections, the finish shall be repaired in accordance with Section 6.1 (Painting). Where it is required that the external surfaces of conduit be protected by a factory-applied protective coat of polyethylene compound, ground connections to conduit shall be made on the exposed portion of the conduit; if the conduit is embedded in concrete, so that there is no break made in the protective covering on the conduit. All ground connections shall be made in accordance with the methods outlined on the drawings, and the "Field Procedures for Electrical Installation , Chapter 2, Electrical Standards for Equipment Installation" of the Bureau of Reclamation.

d. Cost--The cost of furnishing and installing the grounding system shall be included in the lump sum price bid in the schedule, for furnishing and installing electrical and grounding systems, which lump sum price shall include the cost of all materials, labor, and equipment, including earthwork, to install the grounding system.

7.1.5 Electrical Conduit System

a. General--The contractor shall furnish and install all electrical rigid steel conduit and accessories required for the power system as shown on the drawings.

Conduit accessories shall include conduit fittings, bushed elbows, nipples, chase nipples, connectors, reducers, outlet bodies, 1/2-inch pipe extensions for conduit drains, outlet boxes, outlet box extensions, caps, pipe plugs, locknuts, bondnuts, bushings, pull boxes, concrete yard pull boxes, junction boxes, junction box extensions, octagonal concrete rings and backplates, adapters, adhesive, sealing varnish, threaded joint compound, expansion couplings sealtight conduit fittings, materials for sealing the ends of conduits terminating at outdoor equipment, and all other incidentals required to complete the conduit system, and to fasten, clamp, attach, and support conduit in place.

b. Materials--Materials for the electrical conduit installations shall conform to the standards of Underwriters' Laboratories, Inc., and to the latest edition and amendments of the following specifications:

(1) Tubing, electrical, metallic (thin-wall)-- WW-C-563A.

(2) Rigid steel conduit-- WW-C-581d(3), zinc coated.

(3) Flexible metal conduit-- Shall be galvanized steel core with a copper bonding conductor between the spiral segments and with an extruded synthetic jacket overall to insure a watertight conduit. Conduit shall be American Brass "Sealtite" Type UA or equal with grounding-type fittings approved for this type of flexible conduit.

(4) Conduit fittings-- W-F-406b(1) and W-F-408c(1).

(5) Plastic-coated conduit and plastic-coated conduit fittings-- Shall be rigid steel conduit WW-C-581d(3), W-F-406b(1), and W-F-408c(1), zinc coated, with factory-applied plastic-compound protective coat at least .040 inch thick and placed uniformly around the conduit and equal to Republic Steel Corporation DEKORAN, Pittsburg Standard PLASTI-BOND, General Electrical Company plastic-jacketed rigid conduit, or OCAL, made by Occidental Coating Company. All joints of plastic-coated conduit shall be taped so that a complete and positive seal is assured (see Subparagraph (11) below).

(6) Protective varnish-- Protective varnish shall conform to General Electric Company "Glyptal" No. 1201-B, Westinghouse Electric Corporation No. B-6-614, or equal.

(7) Outlet bodies-- W-C-586b, cast iron, malleable iron, or cast aluminum, Class 1 for embedded conduit systems. Covers for outlet bodies shall be metal and covers on bodies exposed to moisture shall be provided with gaskets.

(8) Junction boxes; junction box, extensions; and junction box covers (steel, cadmium, or zinc coated)-- W-J-800c(3).

(9) Pull boxes, terminal boxes, and junction boxes-- Unless stated otherwise in these specifications, these boxes shall be constructed of sheet steel of not less than No. 10 United States Standard gage and shall be thoroughly cleaned and have a primer coat of red vinyl resin paint followed by a coat of gray vinyl resin paint. Terminal blocks shall be provided where required.

41

(10) Expansion couplings-- Except as otherwise provided, expansion couplings for conduit systems shall be employed at expansion and contraction joints. For 2-inch metal conduit and smaller, couplings shall be equal to Dresser Manufacturing Company's Type 65A. For 2-1/2-inch metal conduit and larger, couplings shall be equal to Dresser Manufacturing Company's Type 38.

(11) Tape-- Tape for wrapping the joints of plastic-coated conduit shall be not less than 2 inches wide and not less than 0.01 inch thick and shall consist of a polyvinyl-chloride or polyethylene film having high-strength and close-molding properties and having a pressure-sensitive adhesive.

c. Installation--All conduit shall be installed with necessary fittings and supports, and all bends shall be gradual and smooth to permit the pulling of insulated electrical wires and cables without undue stress or damage to the insulated electrical wires and cable sheath or to the conduit. All conduit runs and bends shall be entirely free from kinks, indentations, or flattened surfaces. All metal conduit bends made in the field shall be bent cold to prevent damage to the protective coating. Burrs and sharp corners at the ends of each piece of metal conduit shall be removed.

The male threads of rigid conduit joints shall be coated with a suitable sealing material before making joints and shall be tightened securely to prevent the entrance of moisture or any other foreign material. For steel conduit, the completed joints and terminations, all wrench marks, and all other places where the zinc covering is damaged shall be covered entirely with a protective varnish to provide protection from corrosion. Bushings or chase nipples shall be installed on the ends of conduit to protect the insulation or sheath of the wires or cables from abrasion; and locknuts and bondnuts shall be installed to provide tight ground connections between conduit boxes, panelboards, and cabinets.

Where conduits cross expansion or contraction joints, the required special fittings or expansion couplings shall be installed.

The exposed conduit runs shall be straight and shall be parallel with each other and with the centerline of the manifold piping support rack, unless otherwise directed. All exposed conduits shall be rigidly supported at intervals of not more than 10 feet, unless otherwise specified or directed. The supports shall be of a design as shown on the drawing, or equal and acceptable to the Contracting Officer. The installation of exposed conduits shall include, where required, the drilling of holes in the bottom and top of enclosures or plates and in the side of enclosures of electrical equipment. The contractor shall drill all holes in concrete or structural members required for installation of expansion anchors or clamps for exposed conduit runs. All exposed conduit shall be tightened securely and shall be supported rigidly in place.

All metal conduit buried directly in earth shall be protected by a factory-applied plastic coat. All joints of plastic-coated conduit shall be made with watertight fittings which shall be taped with polyvinyl-chloride or polyethylene tape or covered in accordance with the manufacturer's instructions and any damaged portions of the protective coat shall be repaired or covered in accordance with the manufacturer's instructions. The covering shall extend at least three inches into the concrete or above the ground surface, as applicable. See Paragraph 7.1.4 (Grounding System) for method of grounding this conduit.

Bending of plastic-coated conduit shall be performed in accordance with the manufacturer's recommendations. Where the manufacturer warns of possible damage to plastic coating when bending the larger size of conduit, factory bends shall be used.

Buried electrical conduit shall have two inches of sand or fine earth around each conduit. The remaining portions of the trenches shall be backfilled and compacted as provided in Paragraph 2.1.1 (Excavation and Backfill for Trenches).

At electrical equipment enclosures not equipped with threaded hubs, conduits shall be terminated in accordance with drawings included in this specification, unless otherwise noted.

Conduit low points shall be drained where and as directed by the contracting officer. Conduits used solely as drains shall be 1/2 inch.

43

7.1.6 Insulated Electrical Wires and Cables

a. General--The contractor shall furnish and install all single-conductor insulated electrical wires, cables, fixture wire, and cable installation accessories for the electrical system. Cable installation accessories shall include marking tags, insulating tape, connectors, fittings, and other incidentals required for completing the installations. Aluminum connectors using aluminum screws will not be permitted.

For the electrical installation, the term "wire" applies only where a single solid insulated electrical conductor is used and the term "cable" shall apply to either a stranded electrical conductor (single-conductor cable) or a combination of electrical conductors insulated from one another (multiple-conductor cable), except grounding cable shall be uninsulated.

All wire and cable sizes shall be as shown on the drawings and as specified herein.

b. Materials--Insulated electrical wires and cables shall be "National Electrical Code" grade of the types listed below and shall have been manufactured within 24 months prior to receipt of notice to proceed. Unless otherwise specified, conductors shall be soft annealed, Class B, stranded copper. All conductors No. 8 AWG and smaller shall be solid. Conductors No. 6 AWG and larger shall be stranded.

(1) 600-volt, single-conductor, copper:

(a) For 75°C conductor temperature, general use service: Type THW.

(b) For 90°C conductor temperature: Types THHW or XHHW.

All No. 10 AWG and smaller single-conductor wire and cable used in branch circuits for the distribution system shall be color coded in accordance with the requirements of the "National Electrical Code" and the "Field Procedures for Electrical Installations." Branch circuit conductors shall have colored or identified insulation as follows:

Phase A - black or *orange

Phase B - red or *yellow

Phase C - blue or *brown

Neutral - white or *gray

*To be used only where more than one multiwire branch circuit of the same size is contained in a single circuit.

c. Installation--The contractor shall install the wires and cables in conduits, wireways, or enclosures, where required.

Sufficient length shall be left at the ends of wires and cables to make connections conveniently to the equipment and devices.

Wire and cables shall not be pulled into conduits until the conduit runs have been cleaned and are free from obstructions and sharp corners. A clean, dry, tight-fitting rag shall be drawn through the conduit immediately before installing the wire or cable. The wires and cables shall be installed so that there will be no cuts or abrasions in the insulation or protective covering or kinks in the wires and cables. No splices shall be made in wires or cables, except at boxes, wireways, outlets, panelboards, or electrical equipment enclosures. Only gradual and uniform pulling stresses will be permitted on wires and cables. Where a lubricant is needed as an aid to the pulling of wires and cables, only soapstone or other approved material not injurious to the wire or cable sheath shall be used. Any wire or cable damaged during installation shall be removed and replaced with equivalent wire or cable at the contractor's expense.

All wires and cables shall be marked with circuit designation at each end and where the wires or cables are connected to terminals, terminal blocks, or connectors. The designations shall be applied to the wire or cable ends by using identification markers similar to the W. H. Brady Company No. B-500 vinyl-cloth tape with a silicone-plastic overcoating.

All runs, connections, and taping of wires and cables shall be made carefully and neatly. Bolted solderless-type terminal lugs and connectors shall be used for joining or connecting cables larger than No. 8 AWG. All terminal lugs and connectors shall have current-carrying capacity equal to that of the conductor

45

with which they are used. No. 8 AWG and smaller cables shall have suitable solderless lugs for connecting to terminal blocks and terminal studs. When No. 8 AWG and smaller size wires and cables are spliced, they shall be joined so as to be mechanically and electrically secure. All insulated wire and cable splices and terminations shall be performed in accordance with the cable manufacturer's recommendations and in all cases the contractor shall obtain this information for each type and size of cable being furnished, and shall submit copies of such information to the contracting officer.

7.1.7 Transformer

a. General--The contractor shall furnish and install a transformer at the location shown on the drawing.

b. Equipment--The transformer shall be distribution, dry type, weatherproof, and unless otherwise specified, shall be in accordance with applicable provisions included in the latest American National Standard C89.1. Primary and secondary windings shall be insulated from each other (autotransformer will not be accepted). The windings shall be formed with Class H insulation and shall be suitably treated to resist the effects of moisture and dirt. The transformer shall carry its normal continuous, self-cooled kVA rating with a temperature rise by resistance not to exceed 115 C above a 40°C ambient. Terminals for connecting external cables shall be located so that the insulation on the incoming cable will not be adversely affected by the heat from the transformers.

The transformer shall be rated as follows:

Type:	3-phase, 60 Hz
Capacity:	30 kVA
High voltage rating:	480 Delta volts
Low voltage rating:	208 Y/120 volts
Taps:	Two 2-1/2% full capacity taps above and four 2-1/2% full capacity taps below primary voltage
Mounting:	Wall bracket mounted

The transformer shall be finished with the manufacturer's standard finish.

c. Installation--The transformer shall be leveled and anchored securely to the steel frame as shown on the drawings. The locations and terminations of the conduits shown on the drawings for the transformers shall be modified as required to accommodate the equipment. The contractor shall make all conduit, cable and wiring, and grounding conductor connections required to put the equipment into normal operation.

d. Cost--The cost of furnishing and installing the transformer shall be included in the lump sum price bid in the schedule for furnishing and installing electrical and grounding systems, which lump sum price shall include the cost of all materials, including all labor and equipment to install the transformer as shown on the drawings and described herein and making all required connections.

7.1.8 Busway

a. General--The contractor shall furnish and install a complete prefabricated busway distribution system as shown on the drawings. The busway shall be with plug-in openings, rated 480 volts, 3-phase, 3-wire and complete with accessories. Accessories shall include cable tap box, end closures, plug-in circuit breaker units, hangers and other incidentals required to complete the installation.

b. Materials--

(1) Housing--The busway shall be of the low impedance and enclosed for protection against mechanical damage and dust accumulation. The housing shall be finished with the manufacturer's standard finish.

(2) Joint--The busway joint shall be of the one-bolt type. The bolt shall be fully insulated and at ground potential. It shall be possible to remove any one length in a run without disturbing adjacent lengths.

(3) Bus Bars--The bus bars shall be electrolytically plated copper. All bolted connections shall be equipped with Belleville washers. Each bus bar shall be insulated over its entire length. The temperature rise at any point in the basway shall not exceed 55°C rise above ambient temperature when operating at rated load current.

(4) Plug-in openings--There shall be three plug-in openings on each side of a six foot length and all openings shall be useable simultaneously. It shall be possible to tap at least 50% of the busway nameplate ampere rating from any single plug-in opening. Busway shall be insulated so that plugs are side mounted to permit practical use of all plug-in openings. Hangers shall not block any plug-in opening. Each phase position of a plug-in opening shall be individually insulated. It shall be possible to inspect the plug-in opening and bus bars prior to installation of the plug-in unit.

(5) Plug-in units--Plug-in units shall be circuit breaker type with minimum interrupting rating of 14,000 RMS Symmetrical Amperes. Number of poles, ampere, and voltage rating of the circuit breakers shall be as indicated on the drawing.

(6) Plug-in unit safety devices--Each plug-in unit rated 200 amperes or below shall be mechanically interlocked with the busway housing to prevent installation or removal of plug-in units while the switch is in the ON position, and be equipped with an operating handle which always remains in control of the switch mechanism. Plug-in unit enclosures shall make positive ground connection to the busway housing before the jaws make contact with the bus bars. The grounding method shall be such that it can not be defeated by future painting of the busway housing. The plug-in units shall be equipped with internal barriers to prevent accidental contact of fish tape and conductors with live parts on the line side of the protective device during time of wire pulling. Covers of all plug-in units shall have releaseable type locks to prevent the cover from being opened while the switch is in the ON position. The plugs shall be provided with means of padlocking the switch in the OFF position. Plug-in units shall be equipped with means for direct positioning of the busway before the plug-in jaws make contact.

c. Installation--The busway system shall be installed in accordance with the manufacturer's instructions. The busway shall be independently supported by steel channels welded to the piping support rack as detailed on the drawing. Spacing of steel channel supports shall not exceed 10'-0". Painting removed from piping support rack in the process of welding shall be restored in accordance with Section 6.1.1 (Painting).

7.1.9 Panelboard

a. General--The contractor shall furnish and install the steel frame, and power panelboard at the location shown on the drawing. Materials and erection of the steel frame shall be in accordance with applicable provisions of Paragraph 4.1.1 (Manifold Piping Support Rack).

b. Equipment--Panelboards shall be surface-mounted type for mounting on the steel frame as shown on the drawings. Enclosures shall be the one-piece box type, fabricated of sheet steel having a zinc-coated galvanized finish. The finish shall be applied by hot-dip or electrochemical (plating) process. Enclosures shall be without knockouts and shall be drilled and punched in the field. Steel sheet in cabinets shall have a minimum thickness of No. 14 United States Standard gage. Mounting bolt shall be provided through back surfaces of cabinets. Cabinet fronts shall be made of stretcher-leveled steel sheets. Thickness of cabinet front shall be not less than No. 12 United States Standard gage. Fronts shall be attached to cabinets with adjustable, indicating-type trim clamps. Panelboards shall be dead-front construction with doors. A directory frame with completed directory shall be provided on the back of each door. Panelboard enclosures shall be finished with the manufacturer's standard finish.

Clamp-type lugs or terminals suitable for copper conductors shall be provided on each breaker for the branch circuit wires and on each bus for the feeder cables. The lugs shall be sized in accordance with the cable sizes shown on the drawings. Aluminum connectors using aluminum screws will not be permitted.

Circuit breakers shall be in accordance with the latest NEMA Standards (Publication No. AB1) Molded Case Circuit Breakers. Each circuit breaker shall be trip-free and shall be furnished with thermal and instantaneous overload trip devices. The circuit breakers shall have an interrupting rating of not less than 10,000 symmetrical amperes at 120 or 208 volts. All 120 volt receptacles shall be fed from 20- ampere circuit breakers equipped with Ground Fault Interrupter Protection equivalent to Bryant Catalog No. GFCB 120.

An engraved nameplate shall be furnished and mounted on the outside of each panelboard. Nameplates shall be similar to nameplates shown on drawings. Nameplates shall be size 6 and shall be Type "B" material. Nameplate shall be lettered "PANEL LB" on first line and "208Y/120 VOLT" on second line.

The panelboards shall be finished with the manufacturer's standard finish.

c. Installation--The panelboard shall be mounted on steel channel frame welded securely to the piping support rack as detailed on the drawing. Paint removed from the piping support rack in the process of welding shall be restored in accordance with Section 6.1.1 (Painting). Conduits terminating at panelboards shall be provided with short nipples, locknuts, bondnuts, and bushings. The locations and terminations of the conduits shown on the drawing for the panelboards shall be modified as required to accommodate the equipment. The contractor shall make all conduit, cable and wiring, and grounding conductor connections required to put the panelboards into normal operation.

7.1.10 Wiring Devices

a. General--The contractor shall furnish and install all wiring devices which shall include plug receptacles and miscellaneous devices, all forming a part of the test pad power distribution system.

b. Materials--

(1) 120 volts receptacles--120 volts convenience outlets shall be Nema 5-20R, duplex type, installed in a single-gang cast metal box with weatherproof cover plate.

(2) 208 volt, 3-phase receptacles--Shall be rated 30 ampere, 4-pole, 5-wire, 250 volts, installed in a cast metal weather-proof box. The receptacle shall be equipped with gasketed cover.

c. Installation--The contractor shall install wiring devices at locations shown on the drawing. All weatherproof and surface mounted wiring devices shall be contained on Type FD outlet bodies unless otherwise indicated on the drawing.

7.1.11 Installation of Power Feeder

a. General--The contractor shall furnish and install power feeder from a unit substation located east of the test pad to the busway system at test station 5 as shown on Drawing No. 6821.22F-09. The power feeder shall consist of three 500 MCM copper conductors in 3-inch conduit.

The contractor shall also furnish, install, and connect at the secondary section of the unit substation, one 3-pole, 400 ampere, 600 volt, interchangeable trips molded case circuit breaker, equipped with shunt trip and ground fault interrupter, to which the aforementioned power feeder shall be connected. Electrical work at the unit substation shall be coordinated with the contracting officer.

The contractor shall excavate and backfill all trenches required for the underground power feeder.

b. Cost--The cost for furnishing and installing power feeder shall be included in the lump sum price bid in the schedule for furnishing and installing electrical and grounding systems, which price shall include cost of all materials, labor, and equipment to provide the power feeder from the substation to the busway system at test station 5. Included in the price for furnishing and installing the power feeder shall be all earthwork associated with the installation of the feeder.

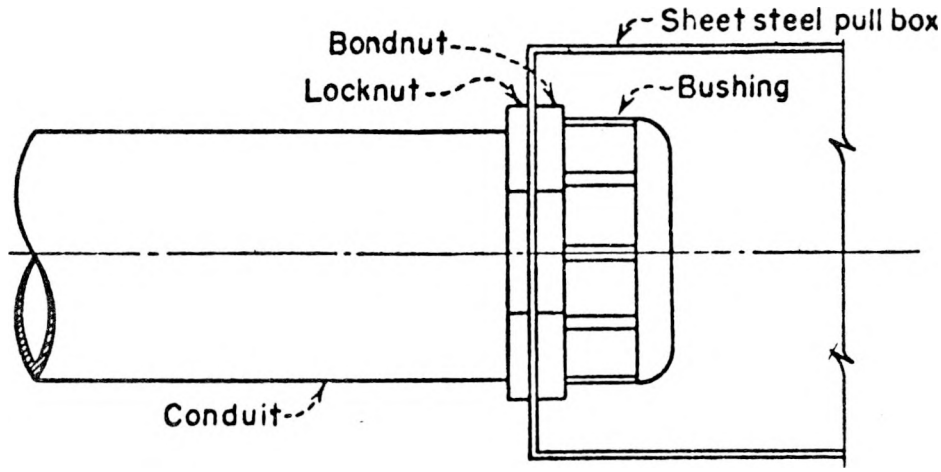
7.1.12 Payment

Payment for furnishing and installing electrical and grounding systems shown on the drawings and herein specified will be made at the lump sum price

51

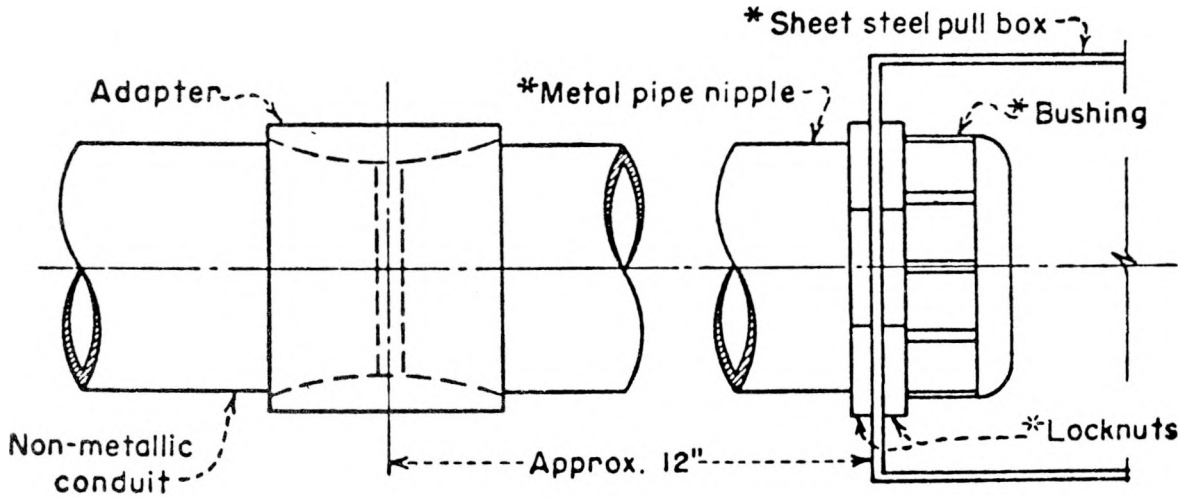
bid therefor in the schedule, which price shall include installation of busway distribution system, transformer, panelboard, power outlets, and construction of all steel frame associated therewith; installation of grounding system, all conduits, electrical wires and cables, and wiring devices; installation of power feeder from a substation to test station 5; and furnishing of all equipment, labor, materials, incidental painting, earthwork, transportation, and all incidentals required for complete installation of the electrical and grounding systems.

BOX TERMINATION



DETAIL "C"

TERMINATING METAL CONDUIT IN SHEET STEEL PULL BOXES



DETAIL "D"

TERMINATING NON-METALLIC CONDUIT IN SHEET STEEL PULL BOXES

*Use aluminum or brass and slot steel box between knockouts for single phase.

FORMERLY X-D-1523-7

ALWAYS THINK SAFETY

REV. 3-25-46
REV. 4-1-42

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
DENVER OFFICE
ELECTRICAL STANDARDS

DENVER, COLO. 6-14-38 | 104-D-254

300C-388

DIVISION 8 -- DRAWINGS

SECTION 8.1--DRAWINGS

8.1.1 Drawings, General

a. General--In the event there are minor differences as determined by the contracting officer between details and dimensions shown on the drawings and those of existing features at the site, the details and dimensions of existing features at the site shall govern.

The contractor shall check all drawings carefully and advise the contracting officer of any errors or omissions discovered.

b. Additional or revised drawings--Except as otherwise provided in these specifications for drawings to be furnished by the contractor, the specifications drawings will be supplemented by such additional or revised general and detail drawings as may be necessary or desirable as the work progresses; and the contractor shall do no work without proper drawings and instructions. The contractor will be required to perform the work in accordance with the additional general and detail drawings or revisions furnished by the Government at the applicable prices bid in the schedule for such work.

c. Additional copies of drawings--The contractor will be furnished such additional copies of the specifications and drawings as may be required for carrying out the work.

d. Mailing address--All drawings and data submitted by the contractor for which a specific mailing address is not given in these specifications shall be submitted to the Construction Engineer, Bureau of Reclamation, Yuma Projects Office, 3800 Avenue 3 East, P.O. Bin 5569, Yuma, Arizona 85364.

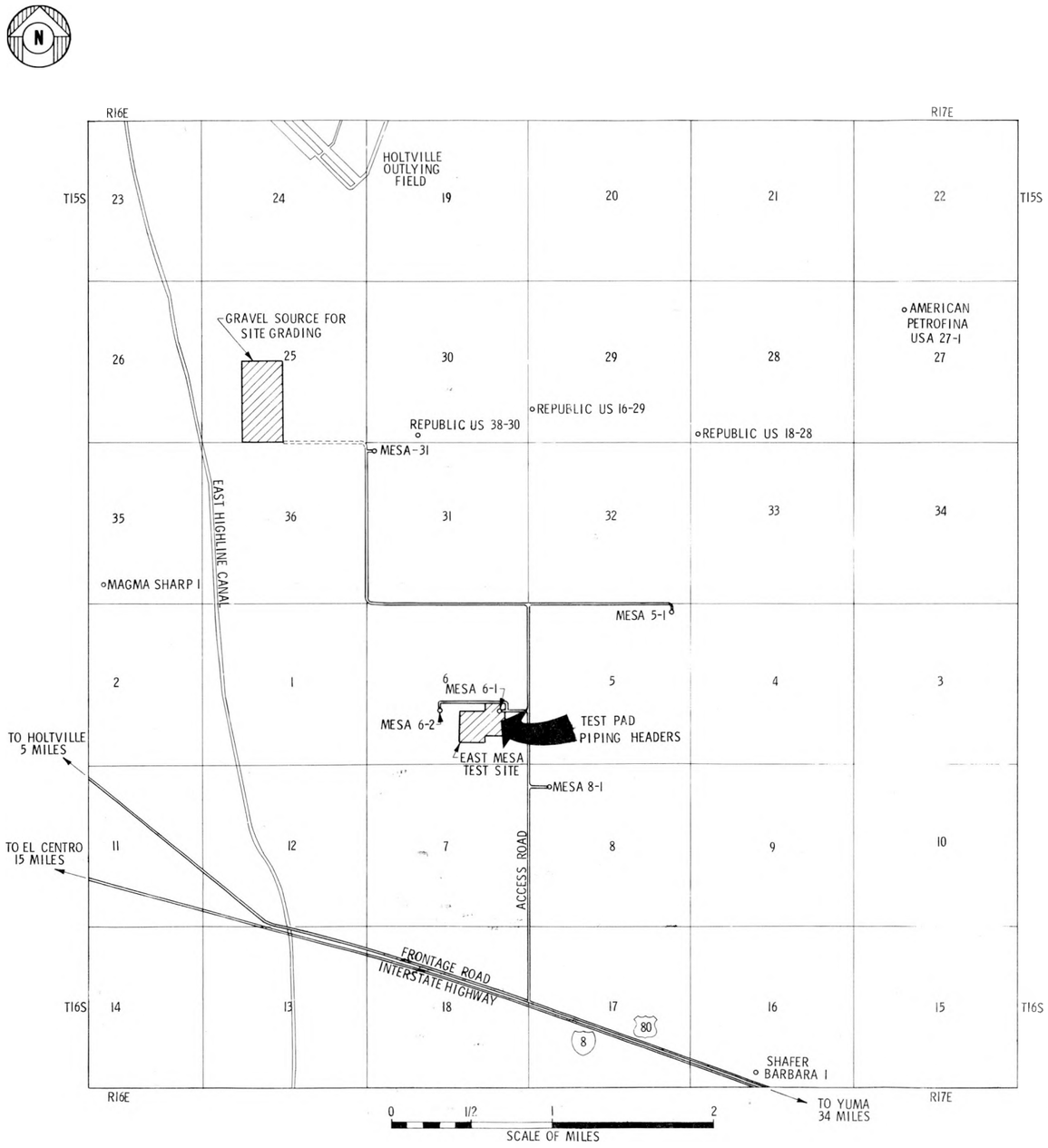
8.1.2 List of Drawings

The following drawings are made a part of these specifications:

TEST PAD PIPING HEADERS
EAST MESA TEST SITE

Construction Design Drawings

6821.22F-01	Location Plan
6821.22F-02	Site Plan
6821.22F-03	Piping and Instrumentation Diagram
6821.22F-04	Piping Plan and Details
6821.22F-05	Header Piping Station and Details
6821.22F-06	Piping Header Section and Miscellaneous Details
6821.22F-07	Header Piping Support Rack
6821.22F-08	Electrical Single Line Diagram
6821.22F-09	Power and Grounding Plan
6821.22F-10	Power Station Details



LOCATION MAP
EAST MESA TEST SITE

TEST PAD PIPING HEADERS

DRAWING INDEX

DRAWING NO.	DRAWING TITLE
6821.22F-01	LOCATION PLAN
6821.22F-02	SITE PLAN
6821.22F-03	PIPING AND INSTRUMENTATION DIAGRAM
6821.22F-04	PIPING PLAN & DETAILS
6821.22F-05	HEADER PIPING STATION & DETAILS
6821.22F-06	PIPING HEADER SECTION & DETAILS
6821.22F-07	HEADER PIPING SUPPORT RACKS
6821.22F-08	ELECTRICAL SINGLE LINE DIAGRAM
6821.22F-09	POWER AND GROUNDING PLAN
6821.22F-10	POWER STATION DETAILS
6821.22F-11	HEADER PIPING CROSSOVER PLAN, SECTION, & DETAILS

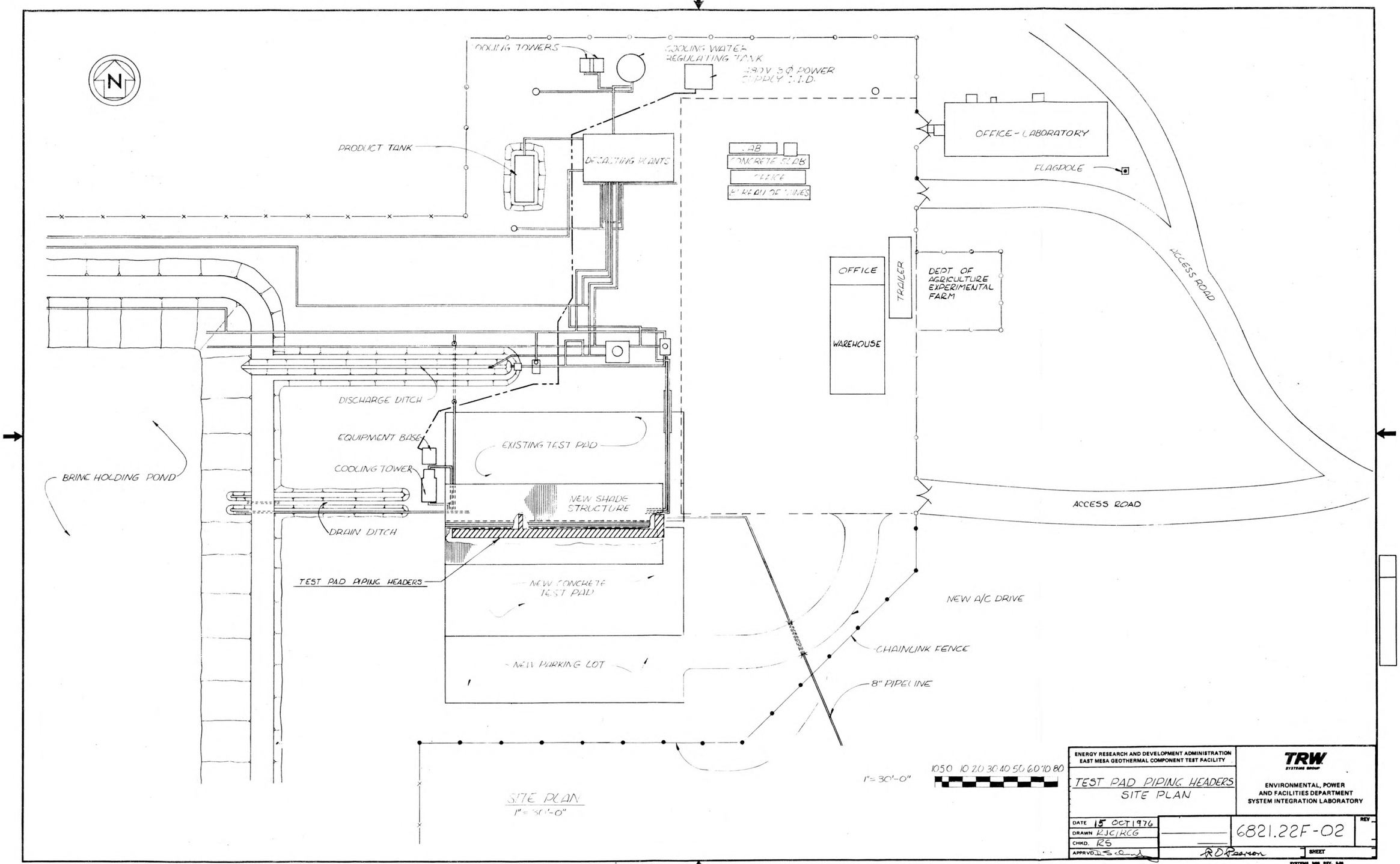
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

TEST PAD PIPING HEADERS
LOCATION PLAN

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 OCT 1976
DRAWN
CHKD RS
APPRVD.
APPRVD. – PROGRAM OFFICE RO Pearson

DWG. NO. 6821.22F-01



ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

TEST PAD PIPING HEADERS
SITE PLAN

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE	15 OCT 1976
DRAWN	RJC/RCG
CHKD.	RS
APPRVD	

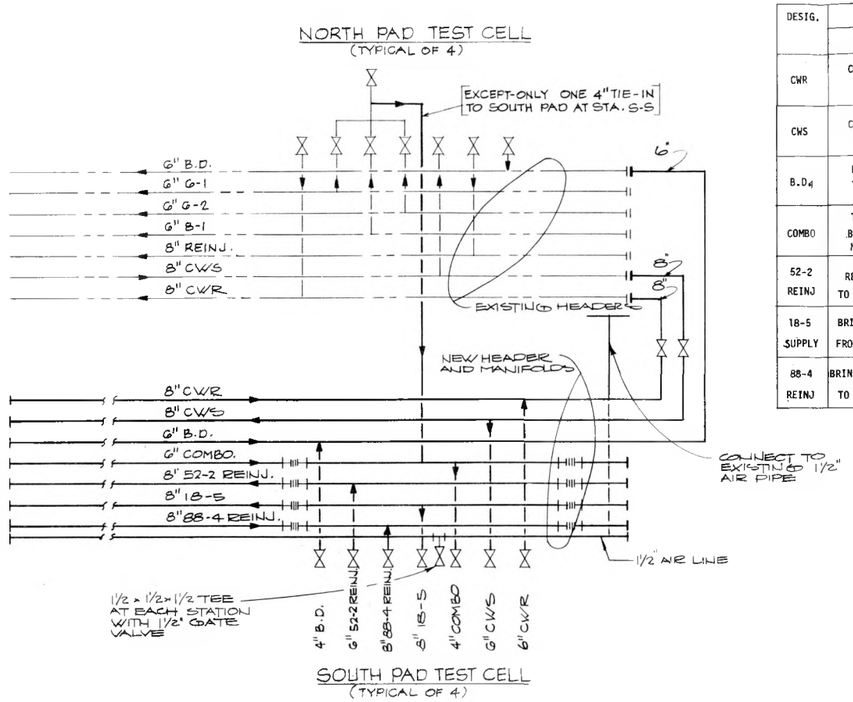
6821.22F-02

REV -

SHEET

DIETZGEN-POST CLEARPRINT 3688

SYSTEMS 3400 REV. 5-69



MECHANICAL FLOW DIAGRAM
NO SCALE

HEADER SCHEDULE

DESIG.	SERVICE			HEADER		BRANCH			REMARKS
	FUNCTION	TEMP	OPERATING PRESS.	SIZE	INSUL THK	SIZE	INSUL THK	TERMINATION	
CWR	COLD WATER RETURN	90°	70 PSIG	8"	NONE	6"	NONE	300# GATE VALVE	CROSS CONNECT WITH 8" TO NORTH HEADER
CWS	COLD WATER SUPPLY	90°	70 PSIG	8"	NONE	6"	NONE	300# GATE VALVE	CROSS CONNECT WITH 8" TO NORTH HEADER
B.D.	BLOWDOWN TO BRINE POND	350°	200 PSIG	6"	NONE	4"	1"	300# GATE VALVE	CROSS CONNECT WITH 6" TO NORTH HEADER
COMBO	TO SUPPLY BRINE FROM NORTH PAD	350°	200 PSIG	6"	2"	4"	2"	300# GATE VALVE	CROSS CONNECT WITH 4" TO NORTH HEADER
52-2 REINJ	BRINE REINJECTION TO WELL 52-2	350°	200 PSIG	8"	2"	6"	1"	300# GATE VALVE	
18-5 SUPPLY	BRINE SUPPLY FROM WELL 18-5	350°	200 PSIG	8"	2"	8"	2"	300# GATE VALVE	
88-4 REINJ	BRINE REINJECTION TO WELL 88-4	350°	200 PSIG	8"	2"	8"	2"	300# GATE VALVE	

LEGEND

CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
B.D.	BLOWDOWN
6-1	BRINE SUPPLY FROM WELL 6-1
6-2	BRINE SUPPLY FROM WELL 6-2
8-1	BRINE SUPPLY FROM WELL 8-1
18-5	BRINE SUPPLY FROM WELL 18-5
COMBO	BRINE SUPPLY FROM ADJACENT HEADER
	GATE VALVE
	COMPANION FLANGES
	EXPANSION JOINT
88-4 REINJ.	BRINE TO REINJECTION WELL 88-4
52-2 REINJ	BRINE TO REINJECTION WELL 52-2
REINJ	REINJECTION

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

TEST PAD PIPING HEADERS
PIPING AND
INSTRUMENTATION DIAGRAM

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER
AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 OCT 1976
DRAWN E.D.
CHKD. R.S.
APPRVD. R.S.C.

APPRVD. – PROGRAM OFFICE R.O. Pearson

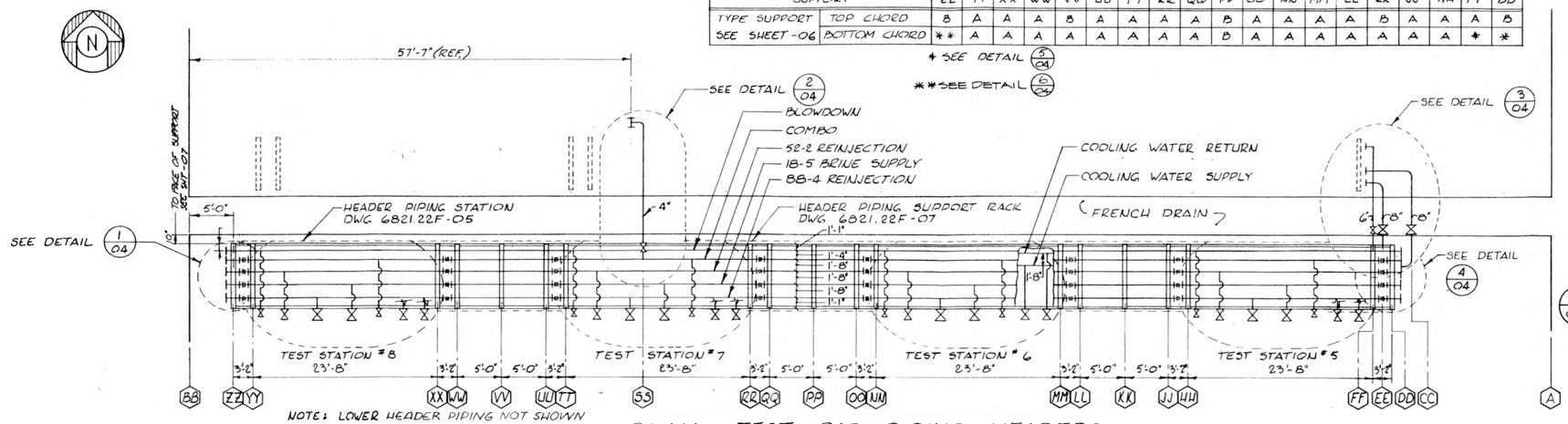
DWG. NO. 6821.22F-03

PIPE SUPPORT SCHEDULE

SUPPORT		ZZ	YY	XX	WW	VV	UU	TT	RR	QQ	PP	OO	NN	MM	LL	KK	JJ	HH	FF	DD
TYPE SUPPORT	TOP CHORD	B	A	A	A	B	A	A	A	A	B	A	A	A	A	B	A	A	A	B
SEE SHEET-06	BOTTOM CHORD	**	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A	A	*	*

* SEE DETAIL 5/04

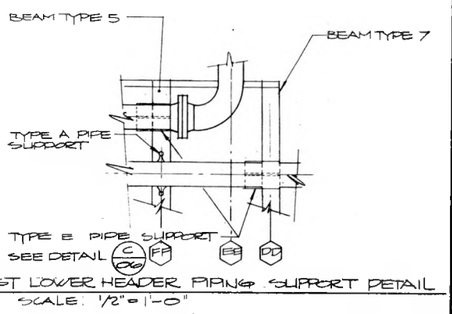
** SEE DETAIL 6/04



NOTE: LOWER HEADER PIPING NOT SHOWN

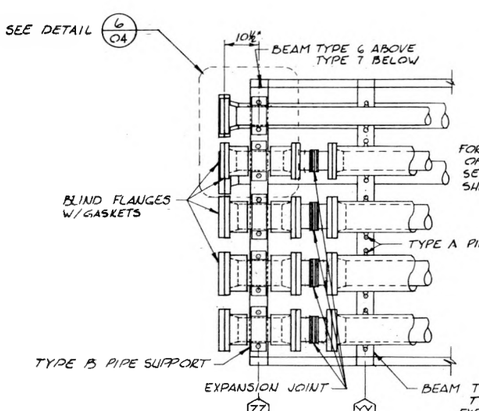
PLAN – TEST PAD PIPING HEADERS

SCALE: 1/8"=1'-0"



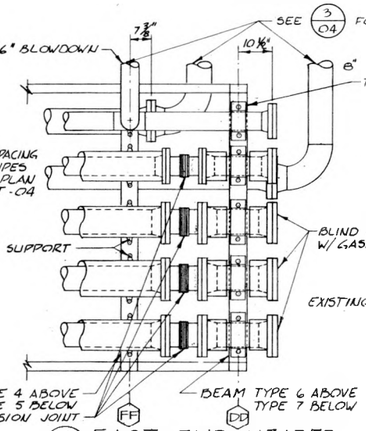
5/04 EAST LOWER HEADER PIPING SUPPORT DETAIL

SCALE: 1/2"=1'-0"



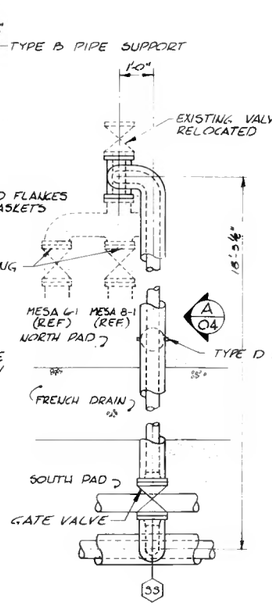
1/04 WEST END HEADER PIPING DETAIL

SCALE: 1/2"=1'-0"



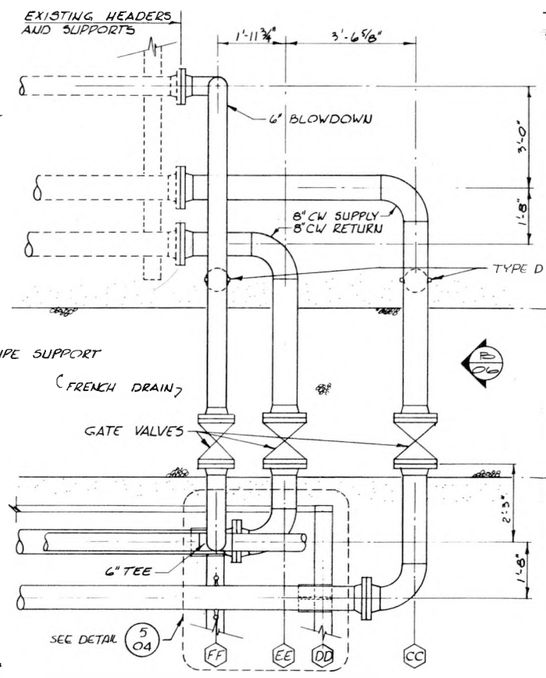
4/04 EAST END HEADER PIPING DETAIL

SCALE: 1/2"=1'-0"



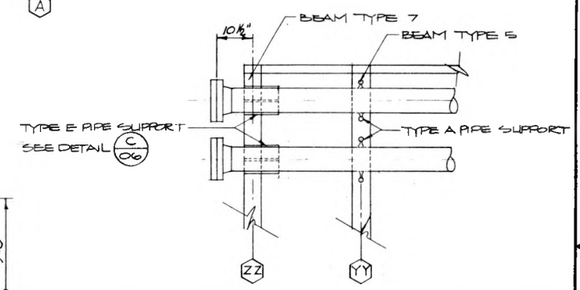
2/04 COMBINATION CROSSOVER DETAIL

SCALE 1/2"=1'-0"



3/04 EAST END HEADER PIPING DETAIL

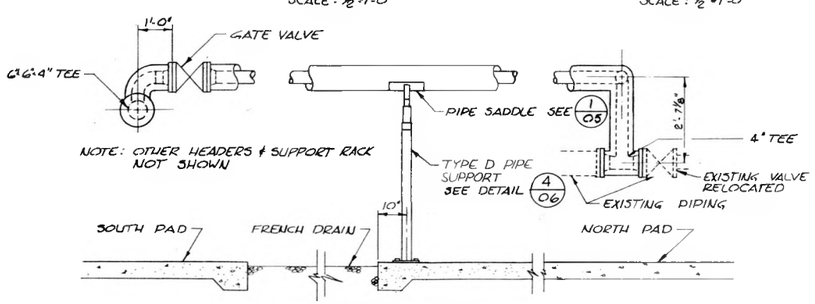
SCALE: 1/2"=1'-0"



6/04 WEST LOWER HEADER PIPING SUPPORT DETAIL

SCALE: 1/2"=1'-0"

NOTE: SEE SHEET 07 FOR PIPE SUPPORT DESIGNATIONS & DETAILS



A/04 COMBINATION CROSSOVER ELEVATION

SCALE: 1/2"=1'-0"

1/8"= 1'-0" 8' 6' 4' 2' 0 8 16 FEET

1/2" = 1'-0" 2' 1' 0 2 4 FEET

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

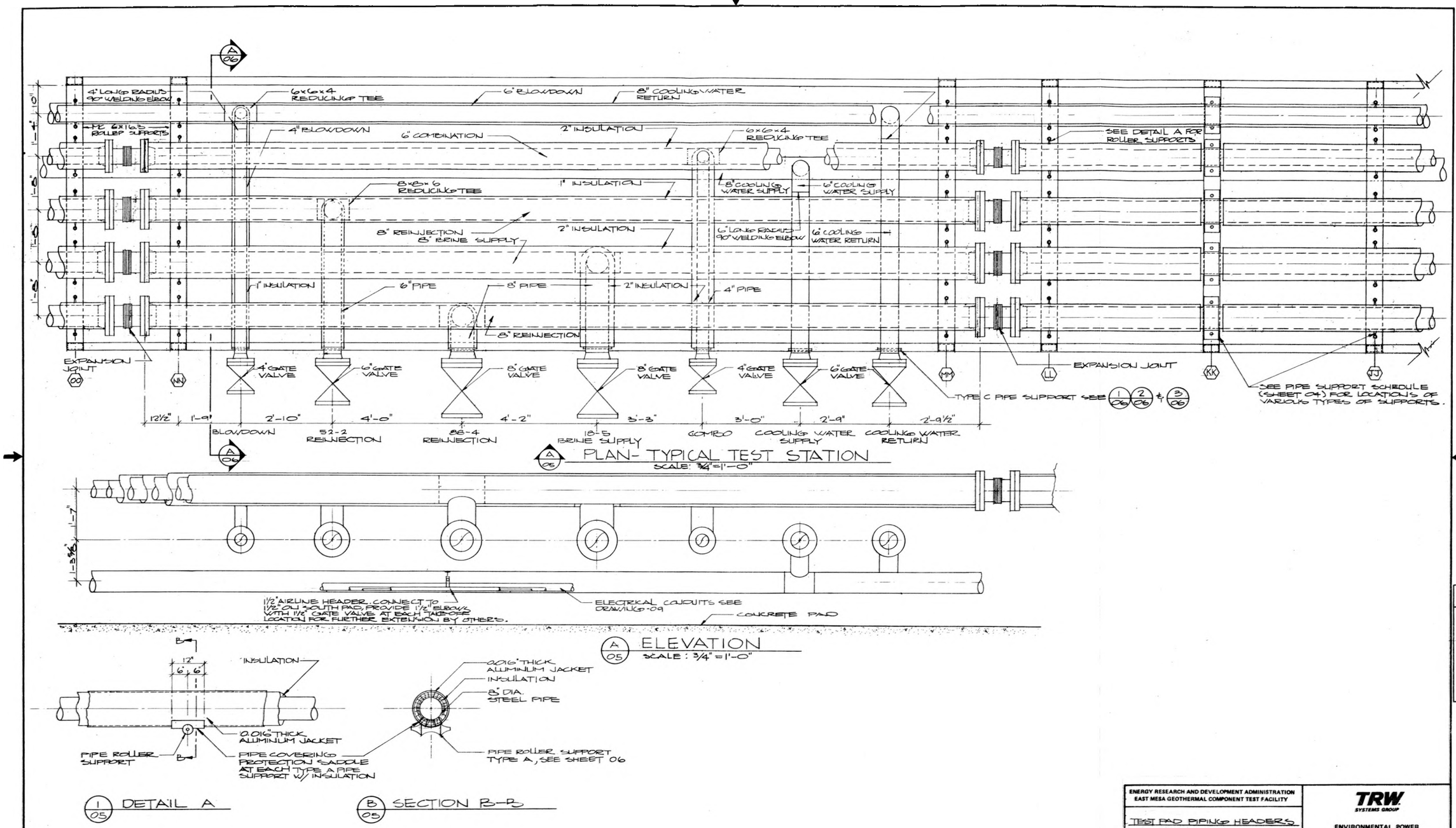
TEST PAD PIPING HEADERS
PIPING PLAN & DETAILS

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 OCT 1976
DRAWN R.V.C.
CHKD. RS
APPRVD. DS

DWG. NO. 6821.22F-04

APPRVD. – PROGRAM OFFICE RO Gagnon



ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

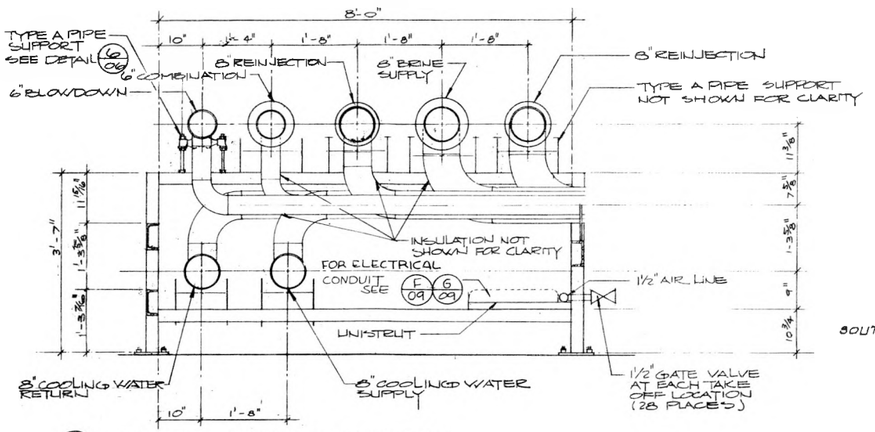
TEST PAD PIPING HEADERS
HEADER PIPING STATION AND DETAILS

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

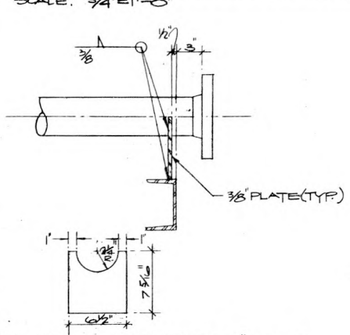
DATE 15 OCT 1976
DRAWN L. KEEVAY
CHKD. RS
APPRVD. R. Cook

APPRVD. – PROGRAM OFFICE R O Pearson

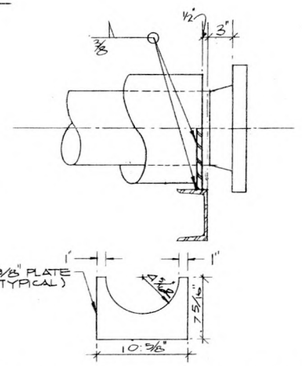
DWG. NO. 6821.22F-05



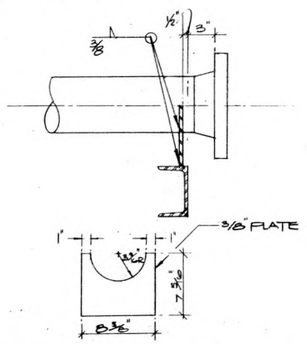
A/06 PIPING HEADER SECTION
SCALE: 3/4"=1'-0"



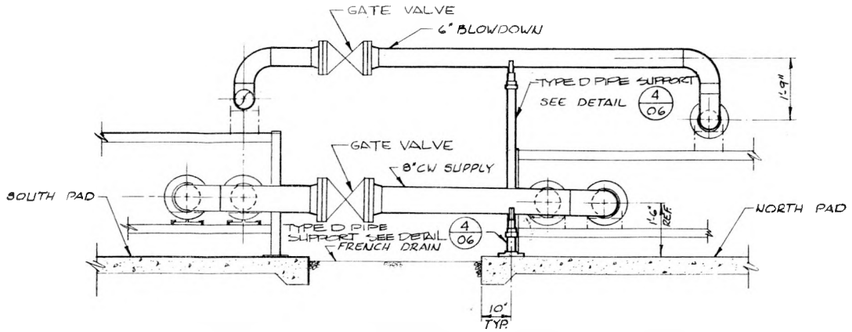
1/06 TYPE C PIPE SUPPORT-4" FIXED
SCALE: 1½"=1'-0"



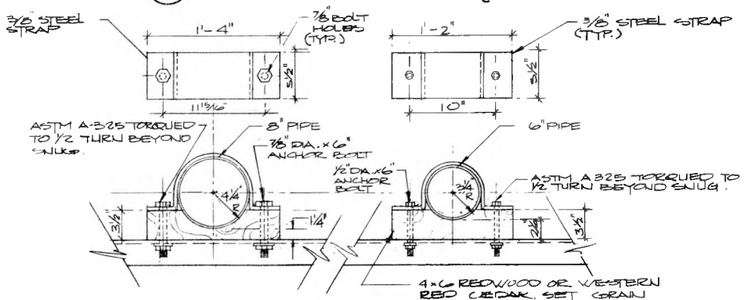
2/06 TYPE C PIPE SUPPORT-8" FIXED
SCALE: 1½"=1'-0"



3/06 TYPE C PIPE SUPPORT-6" FIXED
SCALE: 1½"=1'-0"

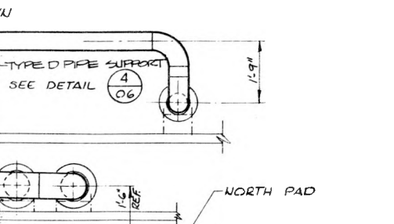


B/06 EAST END HEADER PIPING ELEVATION
SCALE: ½"=1'-0"

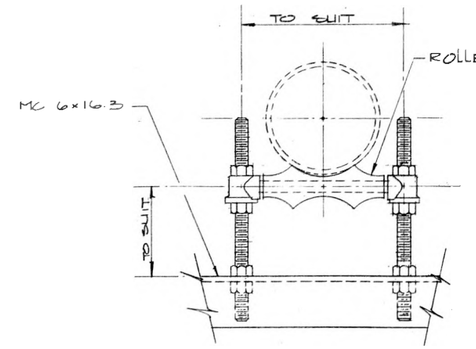


5/06 TYPE B PIPE SUPPORT-ANCHOR DETAILS
SCALE: 1½"=1'-0"

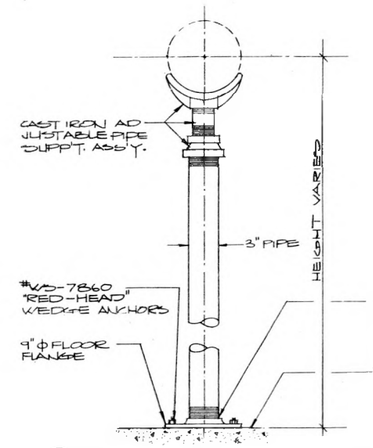
C/06 TYPE E PIPE SUPPORT-SLIDING ANCHOR
1½"=1'-0"



D/06 SECTION
SCALE: 1½"=1'-0"



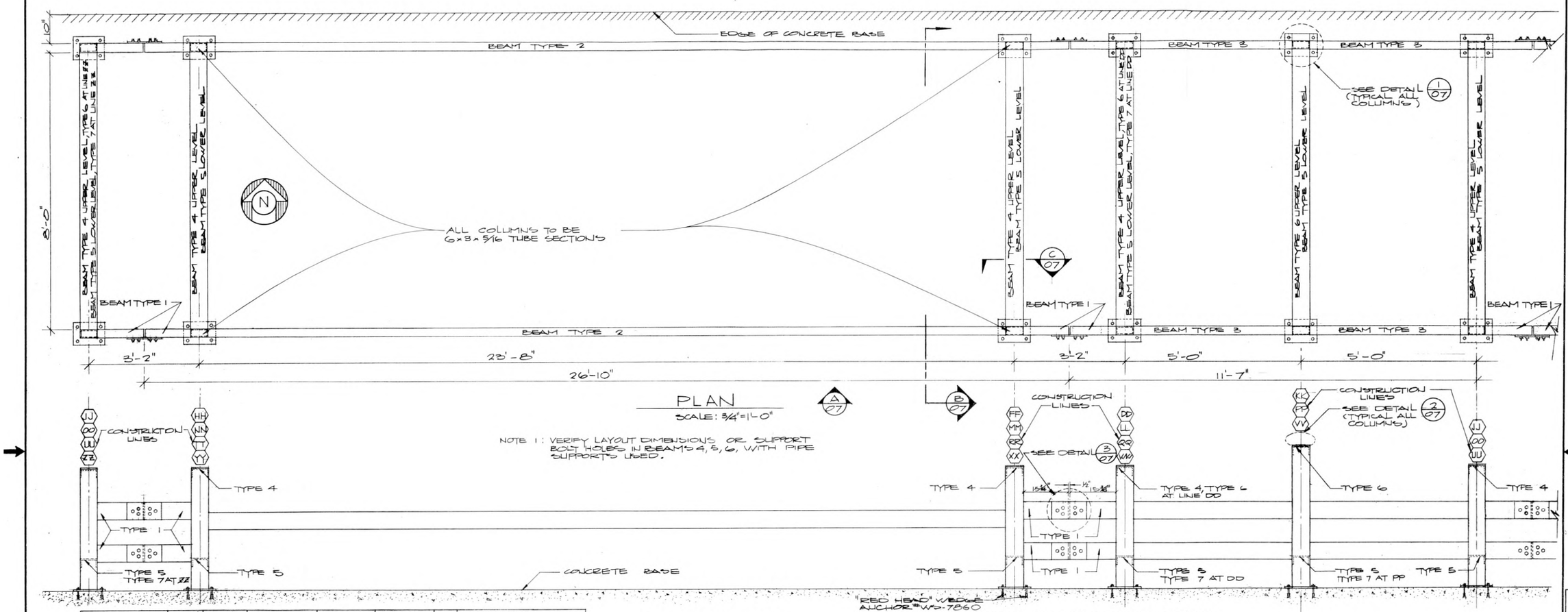
6/06 TYPE A PIPE SUPPORT-ROLLER
NO SCALE



4/06 TYPE D PIPE SUPPORT-ADJUSTABLE
SCALE: 1½"=1'-0"

1-1/2" = 1'-0" 1' 9" 6" 3" 0 1 2 FEET
3/4" = 1'-0" 1' 9" 6" 3" 0 1 2 3 4 5 FEET
1/2" = 1'-0" 2' 1' 0 2 4 FEET

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION · EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP
TEST PAD PIPING HEADERS PIPING HEADER SECTION AND MISC. DETAILS	ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
DATE 15 OCT 1976	DWG. NO. 6821.22F-06
DRAWN DKEVEY	
CHKD. RS	
APPRVD K Eck	APPRVD. - PROGRAM OFFICE RO Pearson

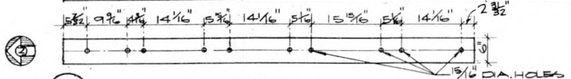


PLAN

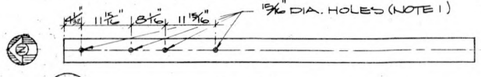
SCALE: 3/4"=1'-0"

NOTE 1: VERIFY LAYOUT DIMENSIONS OF SUPPORT BOLT HOLES IN BEAMS 4, 5, 6, WITH PIPE SUPPORTS USED.

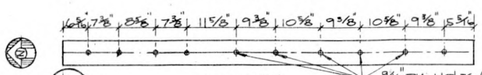
BEAM TYPE	NO REQD	SIZE	LENGTH	DRILLING	DETAIL	REMARKS
1	64	MC 6x16.3	1'-3 3/4"	YES	NONE	SEE DETAIL 3 FOR DRILLING
2	12	MC 6x16.3	23'-2"	NO	NONE	
3	24	MC 6x16.3	4'-6"	NO	NONE	
4	14	MC 6x16.3	8'-0"	YES	4	
5	17	MC 6x16.3	8'-0"	YES	5	
6	5	MC 6x16.3	8'-0"	YES	6	
7	3	MC 6x16.3	8'-0"	NO	NONE	



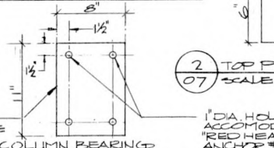
4/07 DETAIL
UPPER LEVEL ROLLER SUPPORT
SCALE: 3/4"=1'-0"



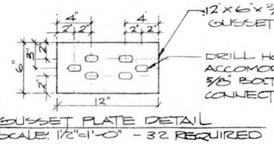
5/07 DETAIL
LOWER LEVEL ROLLER SUPPORT
SCALE: 3/4"=1'-0"



6/07 DETAIL
UPPER ANCHOR CHAIR SUPPORT
SCALE: 3/4"=1'-0"

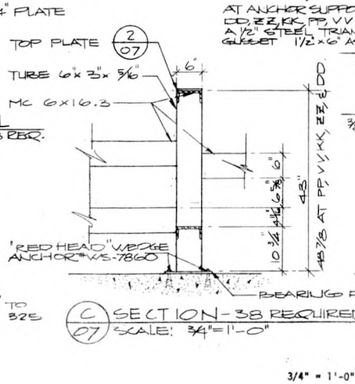


1/07 COLUMN BEARING PLATE DETAIL
SCALE: 1 1/2"=1'-0" - 38 REQ'D.

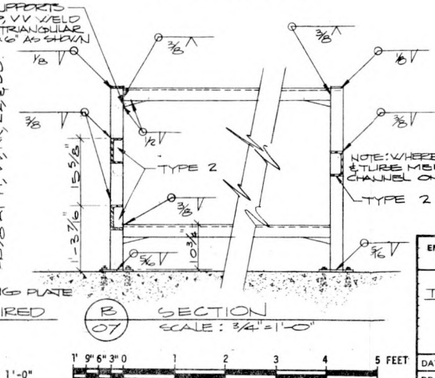


3/07 GUSSET PLATE DETAIL
SCALE: 1 1/2"=1'-0" - 32 REQUIRED

2/07 TOP PLATE DETAIL
SCALE: 1 1/2"=1'-0" - 38 REQ'D.



C/07 SECTION - 38 REQUIRED
SCALE: 3/4"=1'-0"



B/07 SECTION
SCALE: 3/4"=1'-0"

3/4" = 1'-0"
1-1/2" = 1'-0"

1' 9" 6" 3" 0 1 2 3 4 5 FEET
1' 9" 6" 3" 0 1 2 FEET

NOTE: ALL THREADED FASTENERS SHALL BE COMPLETE WITH LOCK WASHERS

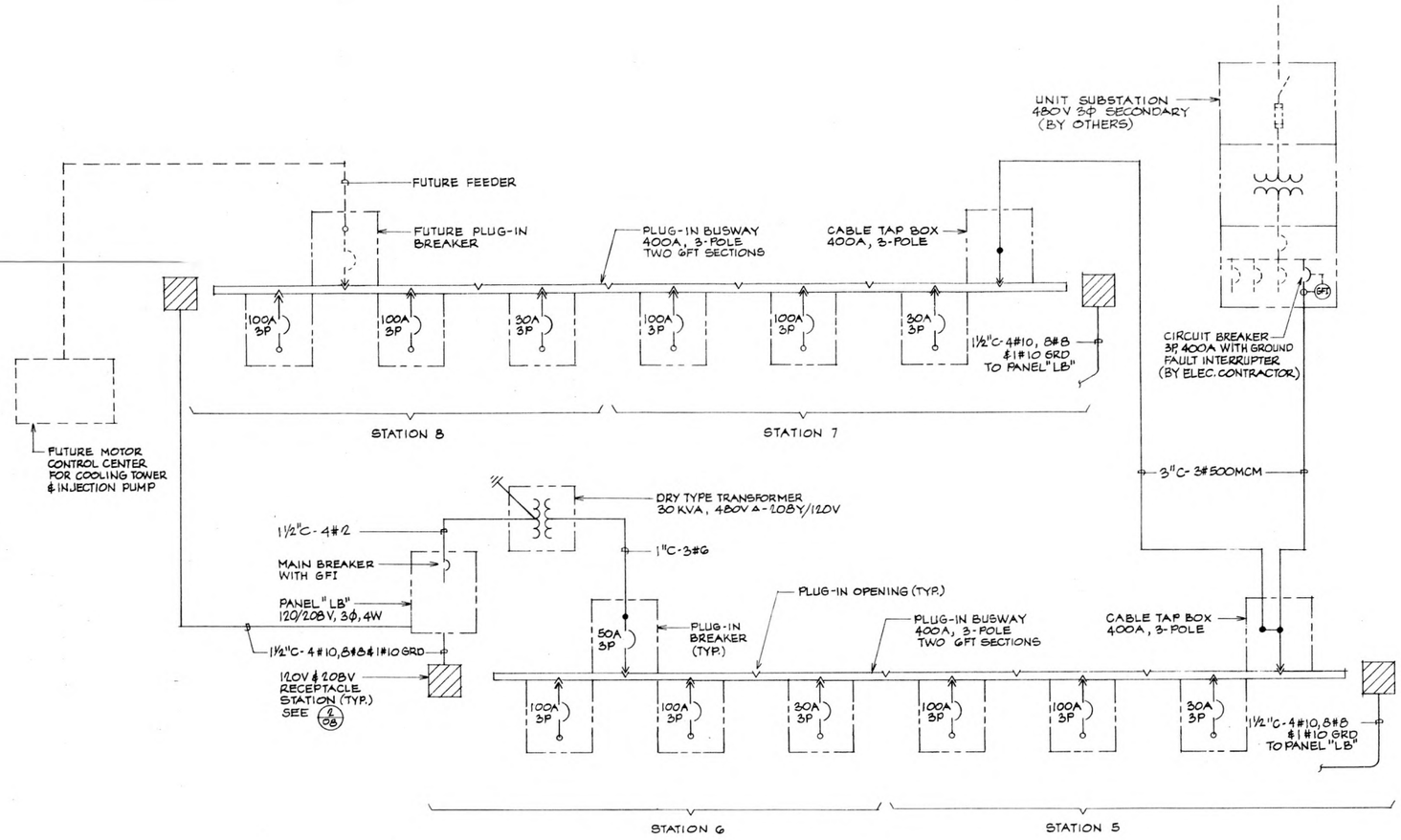
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

TEST PAD PIPING HEADERS
HEADER PIPING
SUPPORT RACKS

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 OCT 1976
DRAWN D.REVAY
CHKD. RS
APPRVD. R.S.C.
APPRVD. – PROGRAM OFFICE

DWG. NO. 6821.22F-07



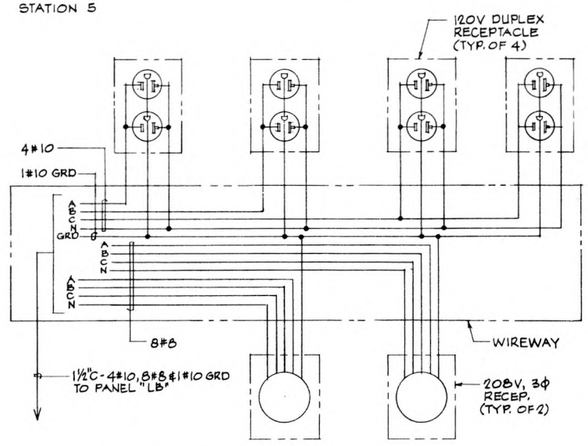
1/08 SINGLE LINE DIAGRAM

"LB" SOUTH PAD	120/208 225	3 ①3P,100A C.B.	4 SURFACE
—	1800		1800 —
RECEP. STA.5	1800	3 30	3 30 1800 RECEP. STA. 7
—	1800		1800 —
—	1800		1800 —
RECEP. STA.5	1800	3 30	3 30 1800 RECEP. STA 7
—	1800		1800 —
—	1800		1800 —
RECEP. STA.6	1800	3 30	3 30 1800 RECEP. STA.8
—	1800		1800 —
—	1800		1800 —
RECEP. STA.6	1800	3 30	5 30 1800 RECEP. STA.8
—	1800		1800 —
RECEP. STA.5	1200	① 1 20	1 20 ① 1200 RECEP. STA. 7
	1200	① 1 20	1 20 ① 1200 1200
	1200	① 1 20	1 20 ① 1200
STA.6	1200	① 1 20	1 20 ① 1200 STA. 8
	1200	① 1 20	1 20 ① 1200
	1200	① 1 20	1 20 ① 1200
SPARE		1 20	1 20 SPARE
		1 20	1 20
		1 20	1 20
	9600 9600 9600		9600 9600 9600
	19200	19200	19200 57600

D.L. - DEMAND LOAD
D.F. - DEMAND FACTOR

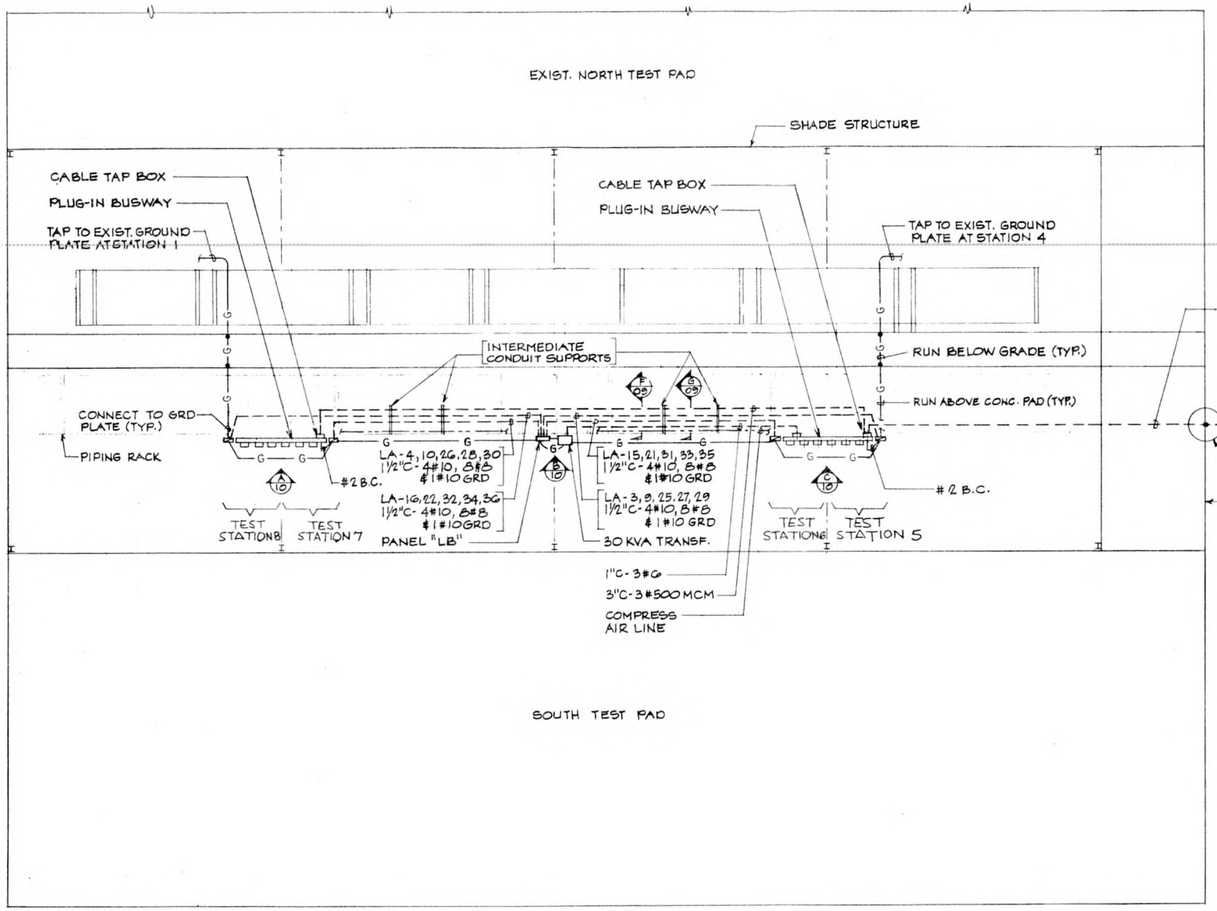
① BREAKER EQUIPPED WITH GROUND FAULT INTERRUPTER

D.L. @ 50% D.F. = 28800 VA
80 A



2/08 WIRING DIAGRAM
TYPICAL RECEPTACLE STATION

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
TEST PAD PIPING HEADERS ELECTRICAL SINGLE LINE DIAGRAM	
DATE 15 OCT 1976	DWG. NO. 6821.22F-08
DRAWN E.D.	
CHKD. RS	
APPRVD.	APPRVD. – PROGRAM OFFICE R O Pearson



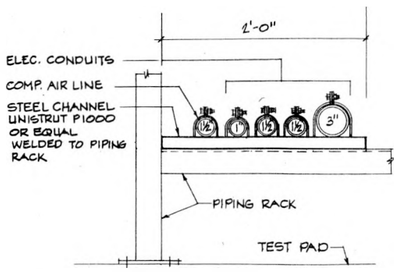
N

SYMBOLS

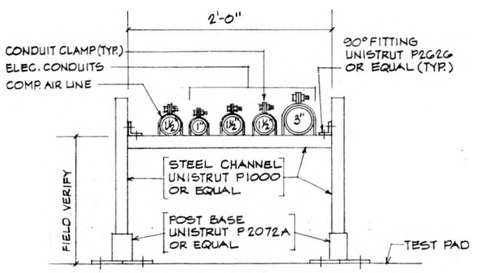
- WIRING IN CONDUIT RUN EXPOSED
- —G— GROUND WIRE, #2 BARE COPPER
- RECEPTACLE STATION; SEE DWG 6821.22F-10

(1/09) POWER AND GROUNDING PLAN

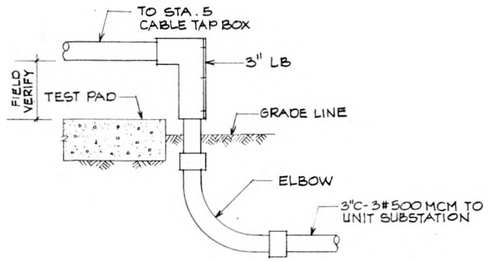
SCALE: 1"=10'-0"



(F/09) SECTION
NTS
TYPICAL CONDUIT SUPPORT ON PIPING RACK



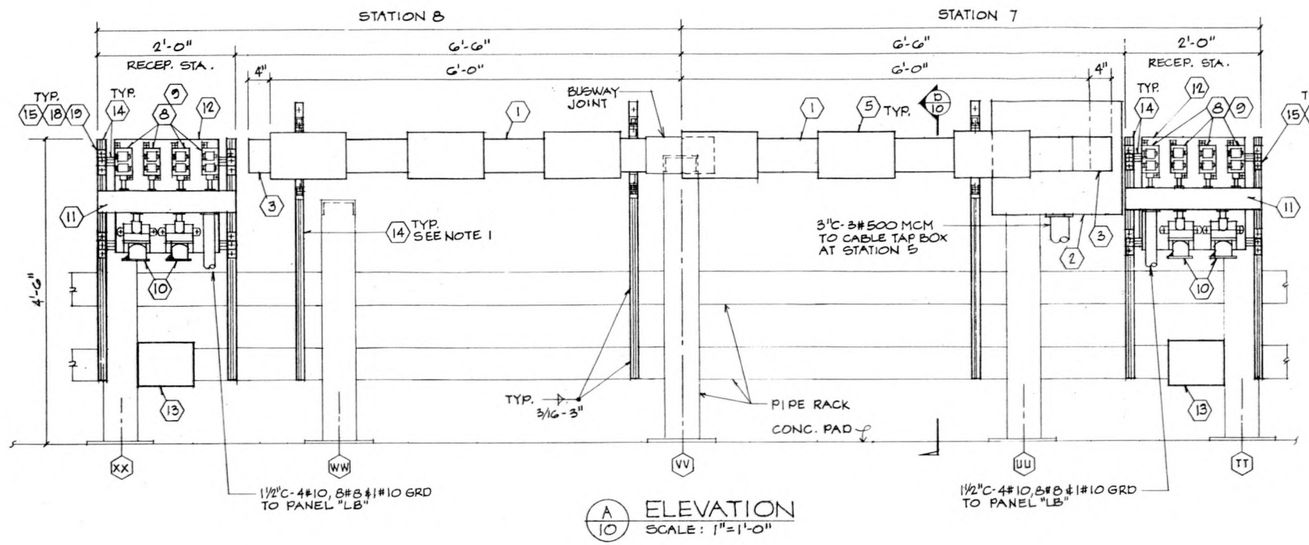
(G/09) SECTION
NTS
TYPICAL INTERMEDIATE CONDUIT SUPPORT



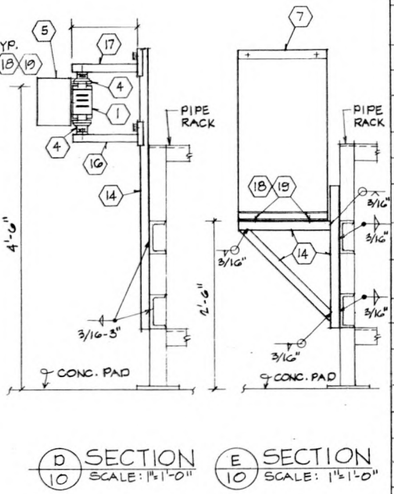
(2/09) DETAIL
NTS

10'8' 6' 4' 2' 0 10 20 30 FEET
1" = 10'-0"

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
TEST PAD PIPING HEADERS POWER AND GROUNDING PLAN	DWG. NO. 6821.22F-09
DATE 15 OCT 1976	
DRAWN E.O.	
CHKD. RS	
APPRVD. RS Conrad	APPRVD. – PROGRAM OFFICE RO Pearson



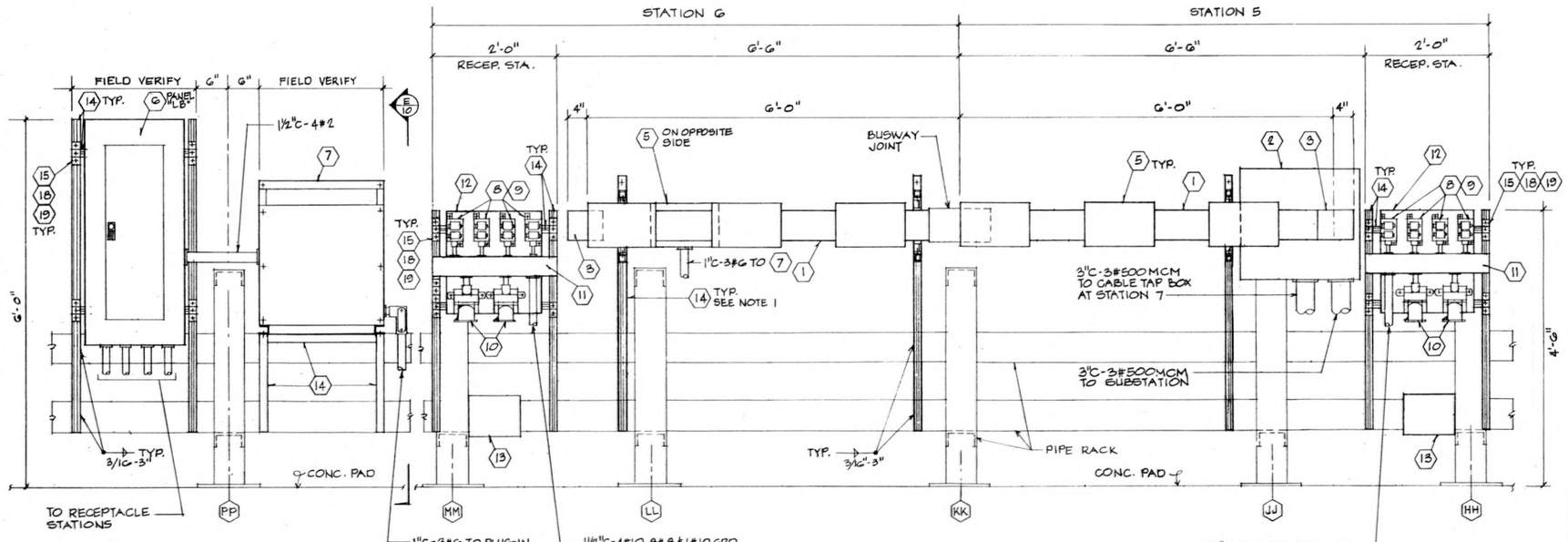
A/10 ELEVATION
SCALE: 1"=1'-0"



D/10 SECTION
SCALE: 1"=1'-0"

E/10 SECTION
SCALE: 1"=1'-0"

ITEM NO.	DESCRIPTION
1	PLUG-IN BUSWAY, 3-POLE, 400A, 600V, COPPER CONDUCTORS, 6FT LONG, SQUARE D CP-304-6 OR EQUAL
2	CABLE TAP BOX 3-POLE, 400A, 600V, SQUARE D PTB-304 OR EQUAL
3	END CLOSURE, SQUARE D ACP-3-EC OR EQUAL
4	HANGER, SQUARE D HP-3-F OR EQUAL
5	PLUG-IN CIRCUIT BREAKER UNIT, 3-POLE, 14,000 A.I.C. SYM. SQUARE D TYPE PFA OR EQUAL, TRIP RATING AS SHOWN DWG. GB21.22F-08
6	PANELBOARD, SEE SCHEDULE ON DWG GB21.22F-08
7	TRANSFORMER, DRY TYPE, 30 KVA
8	DUPLEX RECEPTACLE, NEMA 5-20R AND PLATE WITH GASKETED SPRING DOORS, CROUSE-HINDS DSGTG6-52
9	CAST BOX WITH MOUNTING LUGS, 1/2" HUB
10	RECEPTACLE, 4-POLE, 5-WIRE, 30A, 250V WITH GASKETED SPRING DOOR, CROUSE-HINDS ARE 3413 OR EQUAL
11	WIREWAY, 4" SQUARE, 2FT LONG
12	BACKPLATE, STEEL, 3/32" THICK
13	GROUND PLATE, COPPER, 8"x10"x1/4" THICK, PERFORATED WITH 1/4" HOLES @ 1½" O.C. BOTHWAYS
14	CHANNEL, 1⅝"x1⅝", 12 GA STEEL, UNISTRUT P1000 OR EQUAL
15	FITTING, UNISTRUT P1047 OR EQUAL
16	BRACKET, 12" LONG, UNISTRUT P2232 OR EQUAL
17	BRACKET, 12" LONG, UNISTRUT P2232A OR EQUAL
18	BOLT, HEX. HEAD, 3/8"x1", UNISTRUT H37HHCS100EG OR EQUAL
19	NUT WITH SPRING, 3/8-16, UNISTRUT P1008 OR EQUAL



B/10 ELEVATION
SCALE: 1"=1'-0"

C/10 ELEVATION
SCALE: 1"=1'-0"

NOTE

1. LOCATE ALL BUSWAY SUPPORT CHANNELS CLEAR OF FUTURE PLUG-IN UNITS.

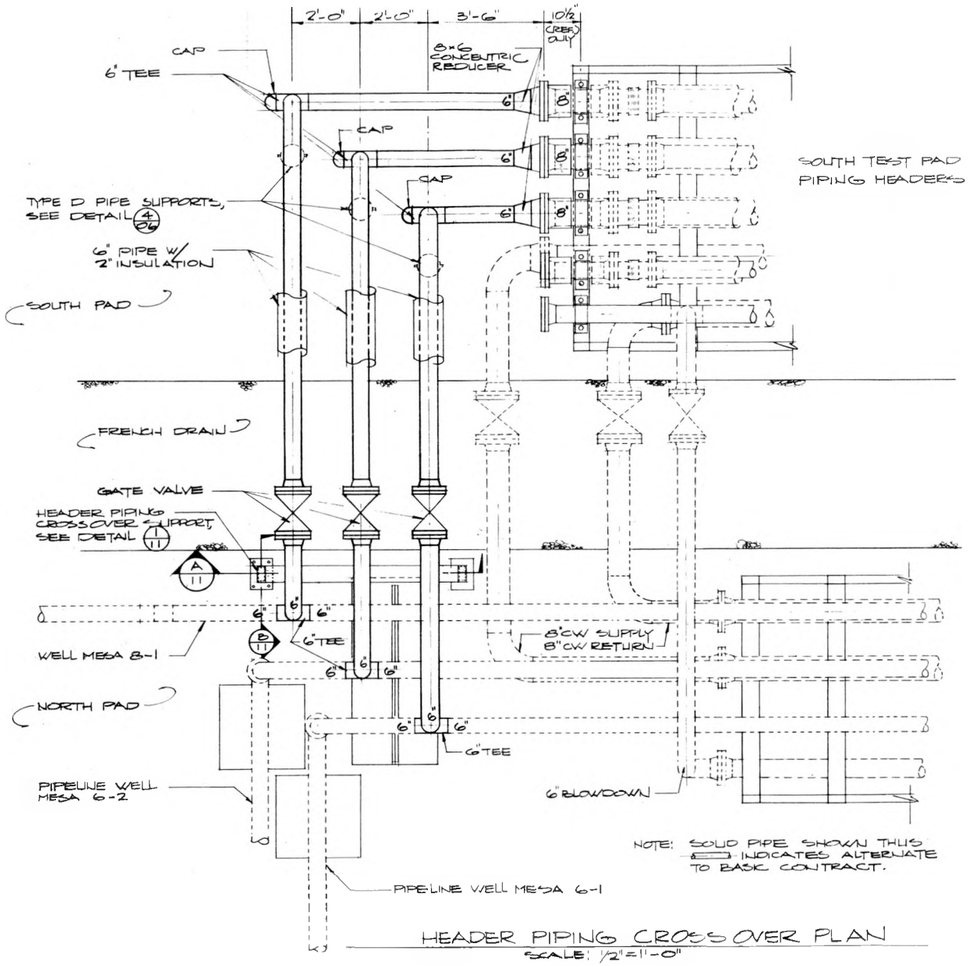
1' 9" 6" 3" 0 1 2 3 FEET
1" = 1'-0"

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

TEST PAD PIPING HEADERS POWER STATION DETAIL

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

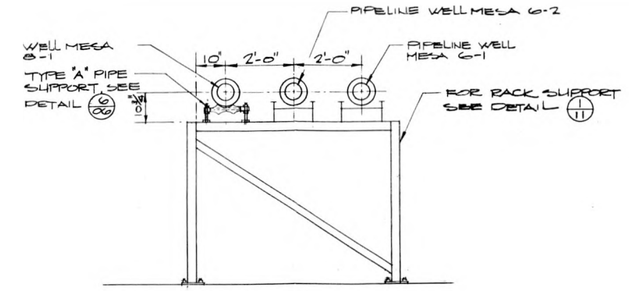
DATE	15 OCT 1976	DWG. NO. 6821.22F-10
DRAWN	E. D.	
CHKD.	RS	
APPRVD.		APPRVD. – PROGRAM OFFICE



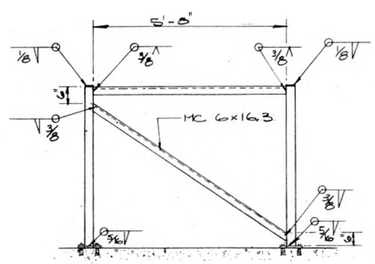
NORTH TEST PAD PIPING HEADERS

NOTE: SOLID PIPE SHOWN THUS ▭ INDICATES ALTERNATE TO BASIC CONTRACT.

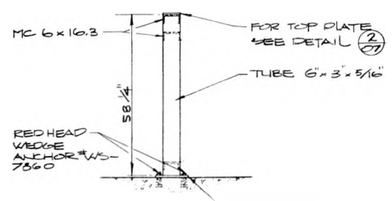
HEADER PIPING CROSS OVER PLAN
SCALE: 1/2"=1'-0"



A/11 SECTION
SCALE: 1/2" = 1'-0"



1/11 HEADER PIPING CROSS-OVER SUPPORT
SCALE: 1/2"=1'-0"



B/11 SECTION
SCALE: 1/2"=1'-0"

1/2" = 1'-0"

2' 1' 0 2 4 FEET

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
TEST PAD PIPING HEADERS HEADER PIPING CROSSOVER PLAN, SECTION, AND DETAILS	
DATE 5 OCT. 1976 DRAWN D REVAY CHKD. R.J.S. APPRVD.	DWG. NO. 6821.22F-11 APPRVD. – PROGRAM OFFICE G.O. Pearson

ALTERNATE BIDDING SCHEDULE FOR
SPECIFICATION No. 6821.22F-S

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Test Pad Piping Headers/West End Crossover

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
1	Furnishing, fabricating and erecting steel supports and frame	For the lump sum of		
2	Furnishing and installing steel pipe as follows:			
	6-inch diameter, Schedule 40	65 lin. ft.		
3	Furnishing and installing pipe insulation:			
	On 6-inch diameter pipe, fittings, valves and appurtenances	65 lin. ft.		
4	Furnishing and installing valves, including gaskets, as follows:			
	6-inch diameter gate valves, Class 300	3 ea.		
5	Furnishing and installing miscellaneous steel pipe fittings, including but not limited to: tapers, tees, elbows, crosses, flanges, and caps	650 lbs.		
6	Miscellaneous metalwork	50 lbs.		

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Contract No. E(04-3)-1140

TASKS 4.2.1 AND 4.2.2

PRODUCTION AND INJECTION WELLS

SPECIFICATION 6821.22H-S

Prepared by:

ENVIRONMENTAL, POWER
AND FACILITIES DEPARTMENT

TRW
SYSTEMS GROUP

F O R E W O R D

Work under these specifications consists of the drilling of one geothermal productionwell and two geothermal injection wells to a total vertical depth of 6500 feet.

The work is situated in the Mesa anomaly and in the vicinity of the Bureau of Reclamation's wells, Mesa 6-1 and Mesa 6-2, located approximately ten miles east of Holtville, California. The productionwell and one of the injection wells are to be directionally drilled, the former having 2000 feet of throw and the latter 4000 feet.

For these three geothermal wells, the contractorshall drill 26-inch holes to 60 feet, and furnish and set 20-inch casing, cemented to the surface. The contractor shalldrill 17 - 1/2-inch holes to 2000 feet, and furnish and set 13 - 3/8-inch casing, cemented to the surface. The contractor shall also drill 12 - 1/4-inch holes to a depth above the producing horizon, and furnish and set 9 - 5/8-inch casing cemented to the surface. This depth shall be determined by correlation with other logs in the area. The contractor shallthen drill 8 - 1/2-inch holes to a total vertical depth of 6500 feet, run screen with liner hanger, and gravel pack the entire open hole. At the completion of each interval of hole, the contractor shall furnish borehole geophysical logging. As drilling progresses, drill stem tests and coring shall be performed at depths as directed by the contracting officer.

The contractor shall furnish all equipment, materials, and services except a mud cooling tower which will be furnished by the Government.

Access roads will be provided by the Government.

Description of the Work

Drilling shall be performed by rotary drilling methods. The contractors work will consist of furnishing all personnel, equipment, facilities, materials, supplies, fuel and services, unless otherwise specified, to drill and complete three geothermal wells to a true vertical depth of 6500 feet. A general description of the work for each of the wells is as follows:

1. Prepare site for drilling operations.
2. Construct a reinforced concrete cellar.
3. Move in and rig up.
4. Drill 17 - 1/2-inch hole to 60 feet. Open hole to 26 inches.
5. Circulate hole clean. Make wiper trip. Pull out of the hole.
6. Run 20-inch casing and cement to surface.
7. Cut 20-inch casing and weld on 20-inch 2000 psi series 600 flange and nipple up 20-inch Hydril.
8. Drill out plug and shoe and cement with 17 - 1/2-inch bit and drill to 2000 feet.
9. Rig up mud logging unit.
10. Circulate hole clean. Make wiper trip into 20-inch casing. Go back to bottom and circulate bottoms up. Pull out of hole and run suite of logs. Go in hole and condition to run 13 - 3/8-inch casing. Pull out of hole running multishot.
11. Run 13 - 3/8-inch casing with float shoe and float collar. Place float collar on top of first (1st) joint. Use thread lock on shoe and collar. Strap shoe and collar. Cement using two plug method.
12. Nipple down 20-inch hydril. Cut 20-inch and 13 - 3/8-inch casing off. Install 13 - 3/8-inch weld on 12-inch 3000 W.P. flange. Test to 1000 psi. Nipple up 12-inch blow-out preventers. Install rotating head and super choke.
13. Install mud cooling tower.

Description of the Work (continued)

14. Pick up test plug. Run in and set in casing head. Test rams to 3000 psi-Hydril to 1500 psi. Lay down test plug.

15. Pick up bottom hole assembly. Go in hole. Drill float collar. Test 13 - 3/8-inch casing to 1700 psi. Drill float shoe.

16. Drill 12 - 1/4-inch hole to 5500 feet. Use stabilizers above second (2nd), fourth (4th), sixth (6th), eighth (8th), and tenth (10th) drill collars. If hole is directional, use B.H.A. designed by directional driller at well site.

17. Circulate hole clean; make wiper trip into surface casing; go back to bottom. Circulate bottoms up. Pull out of hole to log. Run sequence of logs.

18. Go in hole after logging. Circulate and condition hole. Make wiper trip. Go in hole. Circulate bottoms up. Pull out of hole to run 9 - 5/8-inch casing.

19. Run 9 - 5/8-inch casing and cement. Hang 9--5/8-inch casing in 13-3/8-inch surface casing with 200 foot overlap.

20. Go in hole with 12 - 1/4-inch bit and dress off top of liner. Circulate hole clean. Pull out of hole. Pick up 6-inch bottom hole assembly. Go in hole. Clean out 9 - 5/8-inch casing. Test 9 - 5/8-inch casing to 800 psi. Pull out of hole.

21. Pick up new bit. Go in hole. Drill 8 - 1/2-inch hole to true vertical depth of 6500 feet. Circulate hole clean; make wiper trip. Circulate bottoms up. Pull out of hole to log and perform logging.

22. Go in hole. Condition hole to run 7-inch gravel pack screen.

23. Pull out of hole. Pick up gravel packing screen assembly. Go in hole and hang 7-inch screen in 9 - 5/8-inch casing. Gravel pack.

24. Pull out of hole. Nipple down blow-out-preventers. Install guard valves. Go in hole. Displace mud with brine water. Test well.

SCHEDULE NO. 1

INJECTION WELL-ERDA US 52-2

(48° DIRECTIONAL)

ITEM	WORK OR MATERIALS	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
1	Site preparation	1 each		
2	Cellar construction	1 each		
3	Mobilization and demobilization	For the lump sum of		
4	Move (site to site)	1 each		
5	Conductor casing (20 inch)	60 lin. ft.		
6	Surface casing (13-3/8 inch)	2000 lin. ft.		
7	Intermediate casing (9-5/8 inch)	4400 lin. ft.		
8	Centralizers, shoe, collar	For the lump sum of		
9	Drilling fluid/solids separation equipment	For the lump sum of		
10	Drilling bits	For the lump sum of		
11	Directional drilling	For the lump sum of		
12	Mud logging services	For the lump sum of		
13	Borehole geophysical logging	8250 lin. ft.		
14	Casing head, spools and valves (injection type)	For the lump sum of		
15	Supervision	32 days		
16	Day work (RIG)	32 days		
17	Cementing	For the lump sum of		
18	Furnish and set packer assy and gravel pack	1000 lin. ft.		
19	Furnish and install BOP assy	For the lump sum of		

BIDDING SCHEDULE FOR
SPECIFICATION No. 6821.22H-S

SCHEDULE NO. 2
PRODUCTION WELL-ERDA US 18-5
(24° DIRECTIONAL)

ITEM	WORK OR MATERIALS	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
1	Site preparation	1 each		
2	Cellar construction	1 each		
3	Mobilization and demobilization	For the lump sum of		
4	Move (site to site)	1 each		
5	Conductor casing (20 inch)	60 lin. ft.		
6	Surface casing (13-3/8 inch)	2000 lin. ft.		
7	Intermediate casing (9-5/8 inch)	4290 lin. ft.		
8	Centralizers, shoe, collar	For the lump sum of		
9	Drilling fluid/solids separation equipment	For the lump sum of		
10	Drilling bits	For the lump sum of		
11	Directional drilling	For the lump sum of		
12	Mud logging services	For the lump sum of		
13	Borehole geophysical logging	7000 lin. ft.		
14	Casing head, spools and valves (production type)	For the lump sum of		
15	Supervision	27 days		
16	Day work (RIG)	27 days		
17	Cementing	For the lump sum of		
18	Furnish and set packer assy and gravel pack	1000 lin. ft.		
19	Furnish and install BOP assy	For the lump sum of		

SCHEDULE NO. 3

INVESTION WELL-ERDA US 88-4

(VERTICAL)

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
1	Site preparation	1 each		
2	Cellar construction	1 each		
3	Mobilization and demobilization	For the lump sum of		
4	Move (site to site)	1 each		
5	Conductor casing (20 inch)	60 lin. ft.		
6	Surface casing (13-3/8 inch)	2000 lin. ft.		
7	Intermediate casing (9-5/8 inch)	3700 lin. ft.		
8	Centralizers, shoe, collar	For the lump sum of		
9	Drilling fluid/solids separation equipment	For the lump sum of		
10	Drilling bits	For the lump sum of		
11	Directional drilling	For the lump sum of		
12	Mud logging services	For the lump sum of		
13	Borehole geophysical logging	6500 lin. ft.		
14	Casing head, spools and valves (injection type)	For the lump sum of		
15	Supervision	22 days		
16	Day work (RIG)	22 days		
17	Cementing	For the lump sum of		
18	Furnish and set packer assy and gravel pack	1000 lin. ft.		
19	Furnish and install BOP assy	For the lump sum of		

PRODUCTION AND INJECTION WELLS

GENERAL OUTLINE

DIVISION 2-- DRILLING WELLS

Section 2.1--SITE PREPARATION

- 2.1.1 Site Preparation
- 2.1.2 Construction of Cellar

Section 2.2--DRILLING WELLS

- 2.2.1 Drilling Wells, General
- 2.2.2 Mobilization and Demobilization
- 2.2.3 Moving from Well Site to Well Site
- 2.2.4 Drilling Methods and Practices
- 2.2.5 Responsibility for Loss of or Damage to the Equipment or the Hole
- 2.2.6 Conductor Casing
- 2.2.7 Casing
- 2.2.8 Casing Head Equipment
- 2.2.9 Cementing Operations
- 2.2.10 Borehole Geophysical Logging
- 2.2.11 Coring and Drill-Stem Formation Testing
- 2.2.12 Gravel Packing
- 2.2.13 Formations Difficult or Hazardous to Drill
- 2.2.14 Daywork
- 2.2.15 Reimbursable Contractor Costs
- 2.2.16 Work Stoppage
- 2.2.17 Cleanup
- 2.2.18 Plugging and Abandoment

DIVISION 3--DRAWINGS

Section 3.1--DRAWINGS

- 3.1.1 Drawings, General
- 3.1.2 List of Drawings

DIVISION 2--DRILLING WELLS

SECTION 2.1 -- SITE PREPARATION

2.1.1 Site Preparation

It will be the contractor's responsibility to clear and grade the area of each well site and perform such earthwork as necessary to accommodate his equipment and operations in drilling of the wells. Included in the site preparation will be the construction of pits for the disposal of drilling mud and drill cuttings. The contractor will need to prepare only enough area to conduct his well drilling operations. The layout and grading of the area, including location of drilling mud and mud disposal pits, shall be subject to the approval of the contracting officer.

Payment for preparing the well sites will be made at the lump sum price bid for site preparation in the schedule, which lump sum price shall include the cost of all labor and equipment at the well site to clear and grade the area to accommodate the contractor's drilling operations and to dig disposal pits for the drilling mud and drill cuttings.

2.1.2 Construction of Cellar

a. General--The contractor shall construct the cellar of reinforced concrete to the dimensions shown on Drawing 6821.22H-05, including excavation and backfill. The location of the cellar will be determined by the contracting officer. The elevation at which the cellar is set shall be subject to the approval of the contracting officer.

The contractor shall place and attach to the cellars all metal or other accessories necessary for its completion, as shown on the drawing.

b. Concrete--The contractor shall furnish all materials for use in concrete. The concrete shall be composed of cement, sand, coarse aggregate, air-entraining agent, and water, all well mixed and brought to the proper consistency.

Air-entraining agent and curing compound will be accepted on manufacturer's certification of compliance with specifications requirements: Provided, That the Government reserves the right to require submission of and to perform tests on samples of the agent and/or compound prior to shipment and use in the work.

Cement for concrete shall meet the requirements of Federal Specification SS-C-192G, including Interim Amendments, thereto, for Type V, low alkali, and shall meet the false-set limitation specified therein. The cement shall be free from lumps when used in concrete.

Sand and coarse aggregate shall be furnished from any approved source. The sand particles shall be clean, hard, dense, durable, uncoated rock fragments that will pass a screen having 3/16- or 1/4-inch square openings, shall be well graded from fine to coarse, and shall be free from injurious amounts of dirt, organic matter, or other deleterious substances. Coarse aggregate shall consist of clean, hard, dense, durable, uncoated rock fragments, shall be free of injurious amounts of thin pieces, organic matter, or other deleterious substances, shall be reasonably well graded from 3/16 or 1/4 of an inch to 1 and 1/2 inches, and shall be separated into two sizes by an intermediate screen having 3/4-inch-square openings. Screens having openings of other sizes and shapes may be used if equivalent results, as determined by the contracting officer, are obtained.

The air-entraining agent shall conform to ASTM Designation: C 260, except that the limitation and test in bleeding by concrete containing the agent and time of setting requirement shall not apply. Air-entraining agent shall be used in such amount as will effect the entrainment of 4 to 6 percent of air, by volume, of the concrete as discharged from the mixer.

The use of calcium chloride in concrete will not be permitted.

Water used in concrete shall be free from objectionalbe quantities of silt, organic matter, alkalies, salts, or other impurities. The water shall contain not more than 3,000 parts per million soluble sulphate.

Reinforcing bars shall confirm to Federal Specification QQ-S-632C, Type II, B60.

Curing compound if used for curing concrete shall be white-pigmented compound conforming to Bureau of Reclamation "Specifications for Wax-Base Curing Compound," dated May 1, 1973.

Sand and coarse aggregate shall be mixed in proportions as directed by the contracting officer. The concrete shall have a cement content of not less than 564 pounds per cubic yard for concrete containing 1 and 1/2-inch maximum size coarse aggregate and not less than 658 pounds per cubic yard for concrete containing 3/4-inch maximum size aggregate. The slump of the concrete shall not exceed 3 inches. The sand and coarse aggregate shall be weighed and shall be proportioned on the basis of integral bags of cement unless the cement is weighed. Weighing equipment of the beam type may be used. The mixing time shall be at least 1 and 1/2 minutes. The temperature of the concrete when it is being placed shall be not more than 90°F. and not less than 40°F. A truck mixer may be used provided the concrete produced meets the requirements of these specifications. Forms shall be used to shape the concrete to the required lines. Exposed unformed surfaces shall be brought to uniform surfaces and given a reasonably smooth wood-float or steel-trowel finish as directed.

The contractor shall protect all concrete against injury until final acceptance by the Government. The concrete shall be maintained at a temperature not lower than 50°F. for at least 72 hours after it is placed and shall be protected against freezing temperatures for 72 hours immediately following the 72 hours of protection at 50°F. Where artificial heat is employed, special care shall be taken to keep the concrete from drying.

The concrete shall be cured by water or membrane curing. If water cured, the concrete shall be kept continuously moist for at least 14 days after being placed by sprinkling or spraying or by other methods approved by the contracting officer.

Any concrete found to be damaged by reason of the contractor's operations at any time before completion and acceptance of the work shall be removed and replaced by the contractor with acceptable concrete at no cost to the Government.

Steel reinforcing bars shall be placed in the concrete where shown on the drawings. Before reinforcement is placed the surfaces shall be cleaned of heavy flaky rust, loose mill scale, dirt, grease, or other foreign substances. Reinforcement shall be accurately placed and secured in position so that it will not be displaced during the placing of concrete.

The cost of all labor and materials required for concrete under these specifications, including the cost of furnishing and placing reinforcing bars shall be included in the lump sum price bid in the schedule for constructing the cellar.

c. Payment--Payment for constructing the cellars will be made at the unit price bid therefor in the schedule which unit price shall include the cost of all materials, labor, and equipment to construct each cellar complete, including excavation and backfill.

SECTION 2.2 -- DRILLING WELLS

2.2.1 Drilling Wells, General

The purpose of the work required under these specifications is to drill one geothermal productionwell and two geothermal injection wells to a true vertical depth (T.V.D.) of 6500 feet at the locations indicated in Drawing 6821.22H-01. The producer well and one of the injection wells will be directionally drilled as follows:

Well	Type	Direction
ERDA US 18-5	Production Well	24° Directional
ERDA US 52-2	Injection Well	48° Directional
ERDA US 88-4	Injection Well	Vertical

The producer (18-5) will have 2000 feet of horizontal throw and the one injector (52-2) will have 4000 feet of horizontal throw as indicated on Drawing 6821.22H-05. Angles and build-up rates are listed in Paragraph 2.2.4 (Drilling Methods and Practices).

For these three geothermal wells, the contractorshall drill 26-inch holes to 60 feet, and furnish and set 20-inch casing, cemented to the surface. The contractor shalldrill 17-12/-inch holes to 2000 feet, and furnish and set 13-3/8-inch casing, cemented to the surface. The contractorshall also drill 12-1/4-inch holes to a depth above the producing horizon, and furnish and set 9-5/8-inch casing. This depth shall be determined by correlation with other logs in the area. Cementing of these strings shall be in accordance with Paragraph 2.2.9 (Cementing Operations). The contractorshall then drill 8-1/2-inch holes to a T.V.D. of 6500 feet, run screen with liner hanger, and gravel pack the entire open hole in accordance with Paragraph 2.2.12 (Gravel Packing). At the completion of each interval of hole, the contractor will furnish logging, as described in Paragraph 2.2.10 (Borehole Geophysical Logging). As drilling progresses, drill stem tests and coring shall be performed at depths as directed by the contracting officer.

The contractor shall furnish the casing and all equipment, materials, and services, except for those items to be furnished by the Government as listed below, to drill and complete the wells in accordance with these specifications:

a. Mud cooling tower with blower will be made available to the contractor for his use. The Government will deliver the tower to the contractor at the drill site. The tower has been used under a previous contract. The contractor shall accept the tower as his own and shall erect, make all connections, and perform all maintenance required to operate the cooling tower. Upon completion of the work, the contractor shall clean and dismantle the tower and deliver it to the Government at the site of the work in good condition and as received, usual wear excepted.

b. Access roads and maintenance of access roads shall be furnished by the Government.

Payment for all work to be performed under the contract in cementing, gravel packing or as otherwise required in the completion of the wells after setting of the surface casing will be made in accordance with the provisions of 2.2.14 (Daywork) and 2.2.15 (Reimbursible Contractor Costs).

2.2.2 Mobilization and Demobilization

In connection with the mobilization and demobilization of drilling equipment for the drilling of the wells as provided for in these specifications, the term "onto the site" shall refer to the moving onto any one of the well sites as selected for starting of the work and the "removing from the site" shall refer to the last site of the work or any of the well sites where equipment or materials may remain after use or completion of the work at that site.

Mobilization and demobilization for drilling shall include moving onto the site, assembling into working condition, disassembling, and removing from the site all machinery and equipment and supplies necessary to perform the required drilling operations. Payment for assembling all drilling machinery and

equipment and rigging up at the site preparatory to initiating the drilling described in these specifications and for disassembling and removing them from the site when the drilling program has been completed will be made at the lump sum price bid in the schedule for mobilization and demobilization.

The lump sum price bid in the schedule will be paid only once regardless of the number of times the equipment is moved and assembled or reassembled during the work, and shall be full payment for complete mobilization and demobilization, including the cost of moving onto the site during the progress of the work any additional equipment that may be required to perform the drilling operations. Seventy-five percent of the lump sum price bid in the schedule will be included in the estimate for progress payment for the month during which the mobilization and assembly is essentially complete and drilling the rathole and mousehole has commenced. The remaining twenty-five percent will be included in the estimate for progress payment for the month during which machinery and equipment are demobilized and removed from the site after completion of all drilling operations.

2.2.3 Moving from Well Site to Well Site

The item of the schedule for moving from well site to well site includes the cost of moving drill rig or rigs and all equipment, materials, and tools to each drill site; setting up of all equipment for drilling and other work as outlined in "Description of Work".

Payment for moving from well site to well site will be made at the unit price bid therefor in the bidding schedule for each move between the different drilling locations upon the starting of drilling operations at the new site.

2.2.4 Drilling Methods and Practices

The contractor shall drill a 17-1/2-inch hole for each 20-inch conductor casing, and open the hole to 26 inches. The contractor shall also drill a 17-1/2-inch hole for the surface casing, a 12-1/4-inch hole for the intermediate casing and a 8-1/2 hole to total depth, for each well, in accordance with these

specifications, with due diligence and care, in a good workmanlike manner, and in accordance with good drilling practices.

The contractor shall maintain well control equipment in good operating condition at all times and shall use all reasonable means to prevent fires and blowouts and to protect the hole. Blowout prevention equipment shall be installed and tested in accordance with good oil field practices and with reference to the pressures being encountered.

The contractor shall keep and furnish to the Government daily an accurate record of the work performed on an AAODC-API Dailing Drilling Report Form or a form acceptable to the Government. A legible copy of said form signed by the contractor's representative shall be furnished by the contractor to the contracting officer.

The contractor shall exercise due diligence and care to maintain a straight hole in accordance with these specifications, and all risk and expense of maintaining or restoring the hole to such specifications shall be borne by the contractor. The contractor shall make hole deviation surveys at intervals of not more than 300 feet between 0- and 1,000-foot depth and of not more than 500 feet between 1,000-foot and total depth. From 0- to 1,000-foot depth the maximum deviation gradient between surveys shall be one-half (1/2) degree per 100 feet with a maximum deviation from the vertical of three (3) degrees. From 1,000-foot depth to total depth the maximum deviation gradient between surveys shall be two (2) degrees per 500 feet with a maximum deviation from the vertical of six (6) degrees.

The kickoff point on both directionally drilled wells shall be immediately below the 13-3/8-inch casing. The build-up rate shall be 2° per 100 feet of measured depth (MD). The bearing of the directionally drilled holes shall be as shown on the drawings or directed by the contracting officer. Accumulated angles and throws for each of the wells shall be as follows, unless otherwise designated by the contracting officer:

a. Producer (ERDA US 18-5)

MD	TVD	Throw	Total Angle
2000	2000	0	0
2100	2099.93	3.49	2
2200	2199.68	10.46	4
2300	2299.14	20.91	6
2400	2398.17	34.83	8
2500	2496.65	52.50	10
2600	2594.46	72.99	12
2700	2691.49	97.18	14
2800	2787.62	124.74	16
2900	2882.72	155.64	18
3000	2976.69	189.84	20
3100	3069.41	227.30	22
3200	3160.76	267.97	24
	Maintain 24° angle to measured depth of 6961.71 - Total throw will be 2000 feet.		
6962	6500	2000	24

b. Injector (ERDA US 52-2)

MD	TVD	Throw	Total Angle
2000	2000	0	0
2100	2099.93	3.49	2
2200	2199.68	10.46	4
2300	2299.14	20.91	6
2400	2398.17	34.83	8
2500	2496.65	52.50	10

b. Injector (ERDA US 52-2) (Continued)

MD	TVD	Throw	Total Angle
2600	2595.46	72.99	12
2700	2691.49	97.18	14
2800	2787.62	124.74	16
2900	2882.72	155.64	18
3000	2976.69	189.84	20
3100	3069.41	227.50	22
3200	3160.76	267.97	24
3300	3250.64	311.81	26
3400	3338.93	358.76	28
3500	3425.54	408.76	30
3600	3510.34	461.75	32
3700	3593.25	517.67	34
3800	3674.15	576.45	36
3900	3752.95	638.02	38
4000	3829.55	702.30	40
4100	3903.87	769.21	42
4200	3975.80	838.68	44
4300	4045.27	910.61	46
4400	4112.18	984.92	48
	Maintain 48° angle to measured depth of 8246 feet - Total throw will be 4000 feet.		
8246	6500	4000	48

Drilling mud shall include a high temperature viscosifier thermo-gel or approved equal to reduce temperature flocculation, and shall be of suitable quality to remove drill cuttings and to maintain the well bore in a high temperature environment of approximately 400°F.

The rheological properties of the mud shall be controlled by the mud engineer to keep the drilling mud in laminar flow while circulating the well bore in order to minimize hole erosion. A hydraulic program shall be developed to aid in keeping a laminar fluid and still be able to clean the well bore. The reduction in hole erosion will afford less annular mud weight, thus reducing lost circulation problems and reducing cement requirements. A lubricant such as Magcolube, or approved equal, shall be added when drilling the directional wells to reduce drill string torque and drag.

Payment for rat-holing or other special work required in making drill-stem tests or coring, not covered by items of the schedule, will be paid for in accordance with Paragraphs 2.2.14 (Daywork) and 2.2.15 (Reimbursable Contractor Costs). No reduction will be made in the unit price per linear foot bid in the schedule for drilling under any specific item because of the existence of core-drill hole or rat-hole for drill-stem testing.

Payment for drilling of the 26-inch hole for the 20-inch conductor casing will be made in accordance with paragraph 2.2.6 (Conductor Casing). Measurement for payment, for footage drilled of 17 - 1/2-inch hole, 12 - 1/4-inch hole and 8 - 1/2-inch hole will be made by steel line tape of the drill string from ground elevation to the bottom of the respective hole for the length being determined or by other methods of measurement as determined by the contracting officer.

Payment for drilling of the 17-1/2-inch hole, 12-1/4-inch hole, and 8-1/2-inch hole will be made at the respective unit prices per linear foot bid therefor in the schedule, which unit prices shall include the cost of all labor, equipment, and materials, including drilling mud required for performance of the work.

2.2.5 Responsibility for Loss of or Damage to the Equipment or the Hole

a. Contractor's surface equipment--Contractor shall be liable at all times for damage to or destruction or loss of contractor's surface equipment including all drilling tools, machinery, and appliances for use above the surface, and for any other type of equipment, including in-hole equipment

when such in-hole equipment is above the ground surface regardless of when or how such damage or destruction occurs. The Government shall be under no liability to reimburse the contractor for any such loss except loss or damage thereto caused by the negligent acts or omissions of the Government or its agents, representatives, or employees.

b. Contractor's in-hole equipment--The contractor shall be liable at all times while work is being performed on other than a daywork basis for damage to or destruction or loss of the contractor's in-hole equipment, including but not limited to drill pipe, drill collars, bits, testing and logging tools, and tool joints. All tools and equipment lost in the hole, except on daywork basis, shall be fished out at the contractor's expense. The Government shall be under no liability to reimburse the contractor for any such loss except loss or damage thereto caused by negligent acts or omissions of the Government or its agents, representatives, or employees.

The Government will reimburse the contractor for his tools and equipment lost in the hole while the contractor is on daywork unless such loss is caused by the congractor's negligence. The basis of reimbursement shall be as follows:

1. Current stock-item costs for lost tools and equipment to be replaced by the Government, or
2. Replacement in kind by the Government for lost tools and equipment.

Reimbursement shall be subject to the written approval of the contracting officer.

c. Government's equipment--All machinery, tools, materials, and equipment furnished by the Government shall, at the completion or abandonment of the well, be returned to the Government in as good condition as when received by the contractor, ordinary wear and tear expected. The contractor shall be liable for any loss or damage to such equipment except that due to negligence of the Government, its agents, representatives, or employees.

d. The hole--Should the hole for any cause attributable to the contractor's operations be lost or damaged while the contractor is engaged in the performance of work, except on a daywork basis, all such loss or damage to the hole shall be borne by the contractor. If the hole should be lost and is not in condition to be carried to the contract depth or completed in accordance with these specifications due to the contracto's operations, the contractor shall properly plug and abandon the hole in accordance with Paragraphs 2.2.18 (Plugging and Abandonment) and 2.2.17 (Cleanup), and shall remove and dispose of the cellar, dispose of all drilling mud and cuttings, and backfill all disposal pits, and if requested by the Government shall move to a new well site without delay, at the contractor's expense. Provided That the contractor may remove and reuse the cellar or any casing that can be pulled without damage and is approved for reuse by the contracting officer. Any casing that is pulled for reuse shall be inspected in accordance with standard casing inspection methods as may be required by the contracting officer and such inspection shall be at the expense of the contractor. The drilling of the new hole shall be conducted under the terms and conditions of the specifications and as shown on Drawing 6821.22H-05 in the same manner as though it were the hole that had been lost or damaged. In such case, the contractor shall not be entitled to any payment or compensation for expenditures made or incurred by the contractor or in connection with the abandoned hole.

2.2.6 Conductor Casing

a. General--The contractor shall furnish and set to a depth of 60 feet in the 26-inch hole a 20-inch conductor casing, and cement the casing to surface. The contractor may drill a larger hole and install a casing of a larger size, as approved by the contracting officer to facilitate his operations. If the contractor elects to furnish conductor casing of a larger size than the 20-inch-diameter, no additional payment will be made by the Government for the larger size casing, hole, cementing, or any other additional cost to the contractor due to the use of the larger size casing.

b. Materials.--The conductor casing shall be steel pipe having a minimum 20-inch outside diameter with a minimum weight of 90 pounds per linear foot. Cementing of the conductor casing shall be in accordance with the requirements set forth in Paragraph 2.2.9. (Cementing Operations).

c. Installation.--The contractor shall have the option of joining the casing by either butt welding or by threading. If the contractor elects to joing the casing by threading, he shall furnish steel pipe with threads and the necessary couplings. After the casing has been cemented to the surface the contractor shall allow a waiting period of 12 hours for the cement to set before drilling out from under the 20-inch-conductor casing.

d. Measurement and payment.--Measurement, for payment, for drilling the 26-inch hole, furnishing and setting 20-inch conductor casing, and cementing to surface will be made only of the length of casing actually set. Payment will be made at the unit price per linear foot bid therefor in the schedule which unit price shall include the furnishing of cement and cementing operations.

2.2.7 Casing

a. General.--The contractor shall furnish and set to depth required all surface and production casings and couplings. All casing shall be new steel pipe in accordance with API Standard 5A, "Casing, Tubing, and Drill Pipe." Casing shall be properly identified and the contractor shall keep thread protectors on the casing. The contractor shall use quick-release thread protectors while running casing and apply fresh high-temperature thread compound in making up joints. The surface casings shall be cemented to surface.

b. Casing couplings.--Casing couplings shall be ordered handling-tight to facilitate removal of couplings for cleaning, inspecting and applying fresh high-temperature thread compound.

Casing couplings may be ordered from the manufacturer with the high-temperature thread compound applied at the factory and the couplings mill tightened. The type of compound shall be subject to the approval of the contracting officer prior to application. The threads, application of the high-temperature thread compound, and the tightening of the couplings shall be subject to inspection at the mill.

c. Surface Casing (All Three Wells)

Depth	O.D.	Weight #/ft.	Grade	Range	Thread
0-2000	13-3/8	61	K-55	3	Buttress

d. Intermediate Casing - Straight Hole

Depth	O.D.	Weight #/ft.	Grade	Range	Thread
1800-2500	9-5/8	36	K-55	3	Buttress
2500-3500	9-5/8	40	K-55	3	Buttress
3500-4500	9-5/8	40	N-80	3	Buttress
4500-5500	9-5/8	40	S-95	3	Buttress

e. Intermediate Casing - Low Angle Hole (24°)

Depth	O.D.	Weight #/ft.	Grade	Range	Thread
1800-2500	9-5/8	36	K-55	3	Buttesss
2500-3500	9-5/8	40	K-55	3	Buttress
3500-4500	9-5/8	40	N-80	3	Buttress
4500-6000*	9-5/8	40	S-95	3	Buttress

f. Intermediate Casing - High Angle Hole (48°)

Depth	O.D.	Weight #/ft.	Grade	Range	Thread
1800-4000	9-5/8	36	K-55	3	Buttress
4000-5000	9-5-8	40	K-55	3	Buttress
5000-6000	9-5/8	40	N-80	3	Buttress
6000-7000*	9-5/8	40	S-95	3	Buttress

* Depths are measured depths, not T.V.D.

g. Centralizers--Two centralizers shall be installed on the bottom joint and immediate joint above it and one centralizer per joint to top of each string. A float collar and shoe are to be used on the 13-3/8-inch and 9-5/8-inch strings with D.V.collars on the 9-5/8-inch string for cementing purposes as described in Paragraph 2.2.9 (Cementing Operations). Liner hanger for 9-5/8-inch string should be equivalent to Brown Oil Tool's CMC multiple cone with swivel underneath, landing collar, V shoe, and double back pressure valve.

h. Inspection and cleaning of casing--Prior to running, all casing shall be inspected for defects with Tuboscope, or equal, new casing shall be inspected by the following methods consisting of combination mechanical-optical and magnetic particle inspection for the full length and API drift for the full length and shall be accepted by the Government prior to installation. The exterior of all blank casing requiring cementing shall be cleaned thoroughly to remove all scale, dirt, loose rust, and coatings.

Extreme care shall be taken to keep threads and thread compound free of sand. Copies of inspection reports shall be furnished to the contracting officer prior to installation.

i. Pressure testing--Prior to drilling the plug after cementing the 13-3/8-inch casing, the blowout prevention equipment shall be pressure tested with water for 15 minutes at 1,000 p.s.i. If the pressure declines more than 5 percent in the 15 minutes or if there is any other indication of leakage, corrective measures shall be taken until a satisfactory test is obtained.

j. Measurement and Payment--

(1) Measurement of casing, for payment, will be made of the actual length of casing set plus the balance of the length of casing cut off after the casing is run in the hole.

(2) Payment for furnishing and setting 13-3/8-inch surface casing and cementing to surface will be made at the unit price bid therefor in the schedule.

(3) Payment for furnishing and setting the 9-5/8-inch casing string will be made at the unit price bid therefor in the schedule. The cementing of the 9-5/8-inch blank casing string will be paid for as provided in Paragraph 2.2.14 (Daywork) and Paragraph 2.2.15 (Reimbursable Contractor Costs).

(4) The cost for pressure testing of the 13-3/8-inch casing and blowout preventor shall be included in the price bid for furnishing and installing casing head equipment as provided in Paragraph 2.2.8 (Casing Head Equipment).

2.2.8 Casing Head Equipment

a. General--The contractor shall furnish the casing head equipment as shown on Drawing 6821.22H-03 and in accordance with these specifications and shall install the casing head on the 20-inch conductor casing of each

of the three wells. Materials for the fittings and valve components exposed to streamflow shall be suitable designed to withstand the corrosive action of geothermal steam and saline water. The casing head shall have 3-inch minimum ports for cementing, testing, or other operations and may be either threaded or flanged. Flanges shall be API Type 6B with ring-joint facing. The flanges, fittings, studbots, and ring-gaskets shall conform to the requirements of the latest API Standard 6A. The contractor shall also furnish and install casing head equipment consisting of the adaptor spools for the master and the production valves as shown on Drawing 6821.22H-03.

b. Installation--The contractor shall cut off the 20-inch conductor and 13-3/8-inch surface casing and install the casing head so that the bottom of the master valve (top of expansion spool) will be at the same elevation as the top of the concrete cellar. The slip-on weld female bottom shall be fastened with a full fillet weld by a certified welder who has had experience in this type of work. Prior to the completion of the work under the contract the adapter spools, the master valve, the guard valves, and production valves shall be installed by the contractor on the casing heads furnished and installed by the contractor as shown on Drawing 6821.22H-03.

c. Payment--Payment for furnishing and installing casing head equipment will be made at the lump sum prices bid therefor in the schedule for the following:

(1.) Furnishing and installing casing head.
(2.) Furnishing and installing 12-inch master valve.
(3.) Furnishing and installing 20- to 12-inch expansion spool.
(4.) Furnishing and installing 12- to 8-inch adapter spool.
(5.) Furnishing and installing 8-inch guard valve.
(6.) Furnishing and installing 8-inch production valve.

The lump sum price bid shall include all labor, materials and equipment required for the complete installation.

The payment for furnishing and installing the casing head shall include the cost of pressure testing the 13-3/8-inch casing, with casing head and blowout preventor attached as provided in Paragraph 2.2.7 (Casing).

2.2.9 Cementing Operations

a. General--After the contractor has drilled to casing depth, the hole shall be thoroughly circulated to condition it for running and landing the casing. The casing shall be cemented as required in Paragraph 2.2.7 (Casing).

b. Materials--The slurry constituents shall be as follows based on cement content; 1:1 perlite ratio, 0.6 of 1 percent cement friction reducer, 1 percent retarder, 2 percent gel, 0.75 to 1 percent low water loss, and 40 percent silica flour. The cement shall be API Class G. The contractor shall allow a waiting period of 12 hours for the cement to set before continuing drilling or gravel packing operations.

The contractor shall have on hand at the beginning of cementing operations, cement and other materials in an amount of not less than 150 percent of that theoretically required for cementing of the annulus around the casing.

All cement and additives shall be in accordance with API Standards 10A "0.1 - Well Cements and Cement Additives." The following information shall be plainly marked on each bag of cement and on each shipping invoice covering a shipment of bulk cement:

1. Manufacturer's name.
2. API monogram.
3. Class of cement.
4. The word "RETARDED" if the cement contains a retarder other than or in addition to calcium sulfate.
5. The words "MODERATE SULFATE RESISTANCE (MSR)" or "HIGH SULFATE RESISTANCE (HSR)" if the cement complies with the respective requirements for sulfate resistance.

c. Cementing Operations--Cementing shall be in accordance with good oil well cementing practice and shall be by the displacement method from the bottom. The 9-5/8-inch intermediate casing shall be cemented by stages. Mixing equipment and pumps shall be of adequate size to provide good circulation of the cement around the casing and to complete the cementing operation in the relatively high temperatures encountered without detrimental effects due to hydration of the cement.

d. Cementing Summary--

1. Conductor casing program (60 feet of 20-inch casing in 26-inch hole)-- This casing shall be cemented by the one plug method. Each of the joints of casing shall be equpped with a centralizer. (API Class G cement premixed with 30 percent Silica Flour mixed at 117 lbs/cubic feet slurry with 0.85 cu.ft. water/sack of cement to yield 1.50 cubic feet of slurry/sack). The theoretical slurry volume required is 90 cubic feet and at least 100 percent excess cement (90 cubic feet) shall be allowed for a total slurry volume of 180 cubic feet.

2. Surface casing program (2000 feet of 13-3/8-inch casing in 17-1/2-inch hole)-- This casing shall be cemented by the conventional two-plug method. The casing shall be equipped with a differential fill float collar one joint above a differential fill float shoe and with centralizers as specified in Paragraph 2.2.7 (Casing). The cement shall be preceded by 2000 gallons of Mud Flush or approved equal, mud removal solution and a bottom cementing plug and followed by a top cementing plug. Cement with API Class G with 1 cubic feet Perlite/sack, 40 percent Silica flour, 2 percent Gel and retarder mixed with 1.62 cubic feet water/sack at a density of 92 lbs/cubic feet with an absolute yield of 2.65 cubic feet of slurry/sack. The theoretical slurry volume required is 1320 cubic feet. The amount of excess cement used shall be 50 percent (660 cubic feet) minimum.

3. Intermediate casing program (3700 feet of 9-5/8-inch casing in 12-1/4-inch hole)--This string shall be cemented by the displacement plug method. Casing shall be equipped with differential fill float collar and shoe and with centralizers as specified in Paragraph 2.2.7 (Casing). Production strings shall be cemented in three stages by using DV cementer port collars at approximately 3700 and 2700 feet TVD respectively. Each stage shall be preceded by 1000 gallons of Mud Flush, or approved equal. Assuming 50 percent excess cement, the bottom stage will require 845 cubic feet of slurry and the second stage will require 465 cubic feet. The top stage will require 798 cubic feet. The recommended slurry shall be the same as for the surface casing program.

4. Outside jobs--Outside jobs, if required, shall be done with the same slurry recommended for the conductor casing program. A friction reducer such as D-19 can be added to increase placement rate.

e. Payment--The cost of cementing the 20-inch conductor casing shall be included in the unit price per linear foot bid in the schedule for drilling the 26-inch hole, furnishing and setting 20-inch conductor casing, and cementing to surface as provided in Paragraph 2.2.6 (Conductor Casing).

The cost of cementing the 13-3/8-inch surface casing shall be included in the unit price per linear foot bid in the schedule for setting 13-3/8-inch casing and cementing to surface as provided in Paragraph 2.2.7 (Casing).

Payment for cementing of the 9-5/8-inch intermediate casing will be made on the basis of daywork for the contractor's manned drilling rig and by reimbursable contractor costs for the cementing operation, including therewith the cost of all cement and cementing materials and special equipment for the cementing operation which will be left in the well.

2.2.10 Borehole Geophysical Logging

a. General--The contractor shall provide Dresser Atlas, or approved equal, borehole logs described as follows:

1. 0 to 2,000 feet
   (a) Gamma ray log

2. 2,000 to 6,500 feet T.V.D.
   (a) Dual induction-laterolog
   (b) Compensated formation density log/gamma ray
   (c) Compensated neutron porosity log/gamma ray
   (d) Acoustic/Caliper log
   (e) Dipmeter 4 arm

The contractor shall provide the contracting officer, on equipment scale, 5 field prints of each log immediately upon completion of logging and 20 copies of final prints at the same scale within 15 days. The contractor shall also provide 10 copies of a "Epilog" log of permeabilities and porosities as compiled by the "Epilog Process" by Dresser Atlas together with 10 portfolios of a computer printout of the data within 15 days after logging operations are completed.

The geophysical logging shall be performed by a qualified subcontractor regularly performing this type of work.

b. Measurement and payment--Measurement, for payment, for borehole geophysical logging will be made only for the length of hole actually logged. Payment will be made for borehole geophysical logging at the unit price per linear foot bid therefor in the schedule, which unit price shall include the cost of the manned drill rig and all labor, materials, and equipment required for performance of the work and the furnishing of data as required in Subparagraph a., hereof.

2.2.11 Coring and Drill-Stem Formation Testing

a. General--The contractor shall provide coring and open hole drill stem formation testing if directed by the contracting officer at depths as required. A rathole will be drilled for making drill-stem tests. All drill-stem formation tests shall utilize a double packer assembly, a reverse circulating sub, and the necessary instruments to measure and record the formation pressure, hydrostatic pressure, flowing pressure during test, and the maximum temperature at the depth being tested.

b. Payment--Payment for coring and drill-stem formation testing will be made in accordance with Paragraphs 2.2.14 (Daywork) and 2.2.15 (Reimbursable Contractor Costs).

2.2.12 Gravel Packing

The 8-1/2-inch hole from approximately 5500 to 6500 feet T.V.D., in each well, shall be gravel packed. An all welded 0.012 gage, heavy duty 7-inch screen, Howard Smith or approved equal, shall be run in with a 9-5/8-inch by 7-inch Burns liner hanger and port collar or approved equal. The hole will be packed using Dresser Guiberson "Kleen Screen", 0.015-0.03 or 0.012-0.020 gage packing material. Total amount of gravel pack material shall be determined after caliper logs are run.

The contractor shall furnish all materials, special fittings, equipment, and labor to gravel pack the well.

Payment for gravel packing of the well will be made in accordance with the provisions of Paragraphs 2.2.15 (Daywork) and 2.2.16 Reimbursable Contractor Costs).

2.2.13 Formations Difficult or Hazardous to Drill

If loss of circulation occurs while drilling operations are in process, the contractor shall notify the Government of such loss and shall use all reasonable means to restore the same, without compensation for the first 24 hours after the loss. If the Government concurs that such a condition exists, operations to restore circulation after said 24-hour period shall be performed on a daywork basis until normal circulation is restored: Provided, however, That the Government shall not be responsible for any fishing job or sticking of drill pipe, or other difficulty which occurs during or prior to the said 24-hour period unless said difficulty is a direct result of said loss of circulation, and the contractor shall bear all expenses in connection therewith without compensation until said difficulty is overcome. Subject to the foregoing, in the event that during the drilling of the well the allowed time in the aggregate exceeds 24 hours, all operations thereafter by the contractor in attempting to restore circulation shall be on a daywork basis and the Government will reimburse

the contractor in accordance with these specifications for actual cost of such materials, services, and articles necessary to restore circulation. The actual cost shall include any cash discounts to which the contractor may be entitled. Payment to the contractor for materials, services,and articles necessary to restore circulation will be made in accordance with the General Provisions. The percentage to be allowed to cover the contractor's administration, overhead, and profit shall be fifteen (15) percent.

If the contractor should encounter hard formations, such as chert, pyrite, quartzite, fresh granite, igneous rock, or highly metamorphosed rock, during normal drilling operations, the contractor shall notify the Government of such conditions. If the Government concurs that such conditions exist and if, solely because of such conditions, by continuous and diligent drilling the contractor fails within a twenty-four (24) hour period to drill footage which multiplied by the footage rate (applicable unit price per linear foot bid in the schedule for drilling) does not equal payment by the daywork rate bid in the schedule plus cost of bits, the Government shall compensate the contractor at the daywork rate and reimburse the contractor for the cost of all rock bits used while on the daywork rate. Continuous and diligent drilling shall mean only time during which the bit is actually being rotated on the bottom and the time consumed in making round trips to change bits.

When drilling operations have returned to normal, payment on a daywork basis will be discontinued and payment at the applicable unit price bid in the schedule per linear foot for the respective work will again be resumed.

2.2.14 Daywork

a. General--Daywork as used in these specifications refers to the hourly rate at which the contractor performs work in the providing of manned drilling rig services for coring and drill-stem formation testing or for other special conditions as set forth in Paragraph 2.2.13 (Formations Difficult or Hazardous to Drill). The daywork rate will be based on the use of the contractor's manned drilling rig furnished complete with all necessary personnel and laborers, machinery, equipment, materials, and supplies as required for proper operation and maintenance of drilling rig in the performance of the above specified work, except for the services in connection therewith as provided for in Paragraph 2.2.15 (Reimbursable Contractor Costs).

In determining the amount of daywork time for which the contractor is to be paid in connection with the loss of circulation of encountering of hard formations, the daywork time shall begin when the contractor is ordered by the contracting officer to suspend normal drilling operations and shall include the time required to restore the hole to the same normal drilling conditions which existed prior to the time operations were suspended.

b. Maintenance of drilling rig--In the event it is necessary to shut down the contractor's drilling rig for repairs or maintenance while the contractor is performing work on a daywork basis, the contractor will be allowed compensation at daywork rate as follows: The number of hours for which the contractor is to be compensated under this provision shall be limited to (1) 4 hours for any one repair job and (2) 12 hours in the aggregate for each well.

c. Supervision of work by the Government--The contracting officer shall have the right, as required, to direct and supervise all of the work at well sites being performed on a daywork basis, including the manner and mode in which the work is done. The actual performance of the contractor's employees and superintendence of drilling or other well work operations under daywork shall be by the contractor.

d. Measurement and payment--Measurement, for payment, for daywork will be made of the number of hours actually expended in daywork from the time that the contractor has completed work as provided for under the schedule on a unit or lump sum price payment basis or to special conditions due to which he has been notified to proceed on a daywork basis by the contracting officer. The work shall continue on a daywork basis until the specified daywork operations have been completed and/or the contractor is ordered to proceed with the normal sequence of other work and in accordance with the provisions made for payment thereof. Payment for daywork will be made at the unit price per hour bid therefor in the schedule, which unit price shall include all costs involved in providing labor, materials, and equipment as provided in this paragraph to be furnished by the contractor.

Payment for materials and equipment required as a part of the work being performed when the drilling rig is on a daywork basis will be made in accordance with Paragraph 2.2.15 (Reimbursable Contractor Costs).

2.2.15 Reimbursable Contractor Costs

The contractor will be reimbursed by the Government for the costs of all materials, services, and articles required in connection with daywork under the supervision of the Government, except those items of work or materials for which payment is specifically provided in the schedule on a unit or lump sum price basis.

The major materials, services, and articles covered by this paragraph are as follows:

1. Coring and drill-stem formation testing.

2. Drill bits, drilling mud, and special materials, equipment, or services required while the drilling rig is on a daywork basis under the supervision of the Government. Payment will be made only for additional drilling mud required during the daywork period over and above that which has been in use in the existing system.

The Government payment to the contractor will be for the actual cost of such materials, services, and articles, and shall be less any cash discounts thereon to which the contractor may be entitled. The contractor shall furnish the Government copies of supplier's, vendor's, or third party invoices and their current posted price schedule covering such materials, services, and articles.

Materials and services furnished under this paragraph shall be subject to the written approval of the contracting officer.

The cost for billing of the Government for reimbursable contractor costs and related overhead shall be included in the prices bid in the schedule for other items of work.

2.2.16 Work Stoppage

The Government shall have the right to direct the stoppage of work at any time prior to reaching the contract depth specified. The Government shall have the further right to require the well to be completed in accordance with these specifications or abandoned at any depth as set forth in Paragraph 2.2.18 (Plugging and Abandonment). Immediately upon receipt of instructions from the contracting officer, the contractor shall discontinue the drilling of the well and, plug and abandon or complete the well, as the contracting officer may direct. The contractor will be paid for the actual work completed at the respective prices bid therefor in the Bidding Schedule.

In case of work stoppage, the contractor will be reimbursed for costs incurred, in accordance with the General Provisions.

In the event of unreasonably slow progress, carelessness, inattention, or incompetency on the part of the contractor in the performance of the work under daywork, the Government shall notify the contractor of the dissatisfaction and the provisions and the provisions of the General Provisions shall apply.

2.2.17 Cleanup

After the Government has accepted the work, the contractor shall remove from the vicinity of the work, all equipment, supplies, rubbish, unused materials, and other like material, belonging to him or used under his direction during construction. In the event of his failure to do so the same may be removed by the Government at the expense of the contractor.

The contractor will not be required to dispose of the drilling mud and cuttings nor to backfill the disposal pits. The contractor shall leave the cellar in place at the well head if the well is completed as specified, but should the well be ordered plugged or abandoned by the contracting officer the contractor shall remove and dispose of the cellar. The cost of cleanup shall be included in the prices bid in the schedule for the other items of work.

2.2.18 Plugging and Abandonment

In the event the contracting officer orders the hole to be plugged and abandoned, the contractor shall plug and abandon the hole in a manner and method prescribed by the contracting officer and shall clean up the drill site location as set forth in Paragraph 2.2.17 (Cleanup).

If the contractor voluntarily stops work before a well is completed to a total vertical depth of 6,500 feet or less as ordered by the contracting officer or it does not satisfy alinement requirements as set forth in Paragraph 2.2.4 (Drilling Methods and Practices) or the hole is lost or damaged due to the contractor's operations as set forth in Paragraph 2.2.5 (Responsibility for Loss of or Damage to the Equipment or Hole), the well will be rejected by the contracting officer and abandoned. No payment will be made by the Government for abandonment due to the fault of the contractor.

Payment for plugging and abandonment of a well due to the operations or responsibility of the Government will be made in accordance with the "General Provisions".

It is the intent that the wells will be drilled to a depth of 6,500 feet; however, if conditions are encountered requiring the termination of drilling at lesser depths for a well as determined by the contracting officer, payment for the work accomplished will be made to the contractor in accordance with the provisions of Paragraph 2.2.16 (Work Stoppage).

DIVISION 3 -- DRAWINGS

SECTION 3.1 -- DRAWINGS

3.1.1 Drawings, General

Schematic drawings of the well section and casing head are furnished for the contractor's general information. Final dimensions determined, depending upon field conditions and equipment as supplied, will be furnished by the contracting officer. The contractor shall check all drawings carefully and shall advise the contracting officer of any errors.

Additional drawings will be furnished to the contractor for construction purposes, where necessary, as determined by the contracting officer.

The contractor will be furnished such additional copies of the specifications and drawings as may be required for carrying out the work. Full-size contact prints of the original drawings from which the attached reproductions were made will be furnished to the contractor for construction purposes upon request.

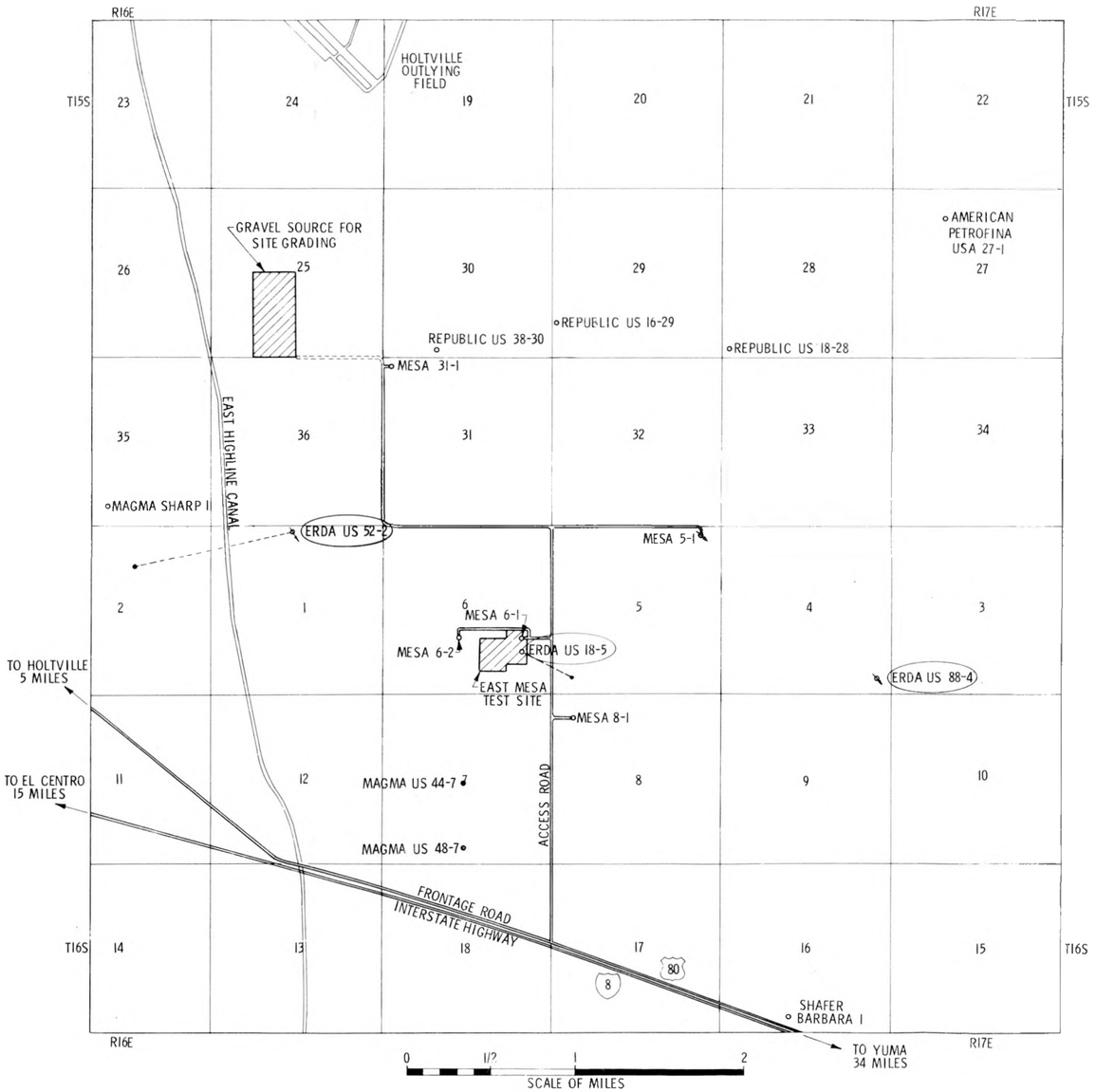
3.1.2 List of Drawings

The following drawings are made a part of these specifications:

PRODUCTION AND INJECTION WELLS
EAST MESA TEST SITE

Construction Design Drawings

6821.22H-01	Location Plan
6821.22H-02	Site Plan
6821.22H-03	Casing Head Equipment
6821.22H-04	Concrete Cellar
6821.22H-05	Schematic Well Section



LOCATION MAP
EAST MESA TEST SITE

NEW WELL LOCATIONS

INJECTOR WELL: ERDA US 52-2

SURFACE LOCATION: 150' SOUTH, 2500' EAST OF NORTHWEST CORNER SECTION 1, T16S, R16E

BOTTOM LOCATION: 1200' SOUTH, 2400' WEST OF NORTHEAST CORNER SECTION 2, T16S, R16E

PRODUCER/INJECTOR PAIR

PRODUCER: ERDA US 18-5

SURFACE LOCATION: 1225' NORTH, 700' WEST OF SOUTHEAST CORNER SECTION 6, T16S, R17E

BOTTOM LOCATION: 500' NORTH, 500' EAST OF SOUTHWEST CORNER SECTION 5, T16S, R17E

INJECTOR: ERDA US 88-4

LOCATION: 500' NORTH, 500' WEST OF SOUTHEAST CORNER SECTION 4, T16S, R17E

PRODUCTION AND INJECTION WELLS

DRAWING INDEX

DRAWING NO.	DRAWING TITLE
6821.22H-01	LOCATION PLAN
6821.22H-02	CASING HEAD EQUIPMENT
6821.22H-03	CONCRETE CELLAR
6821.22H-04	SCHEMATIC WELL SECTION

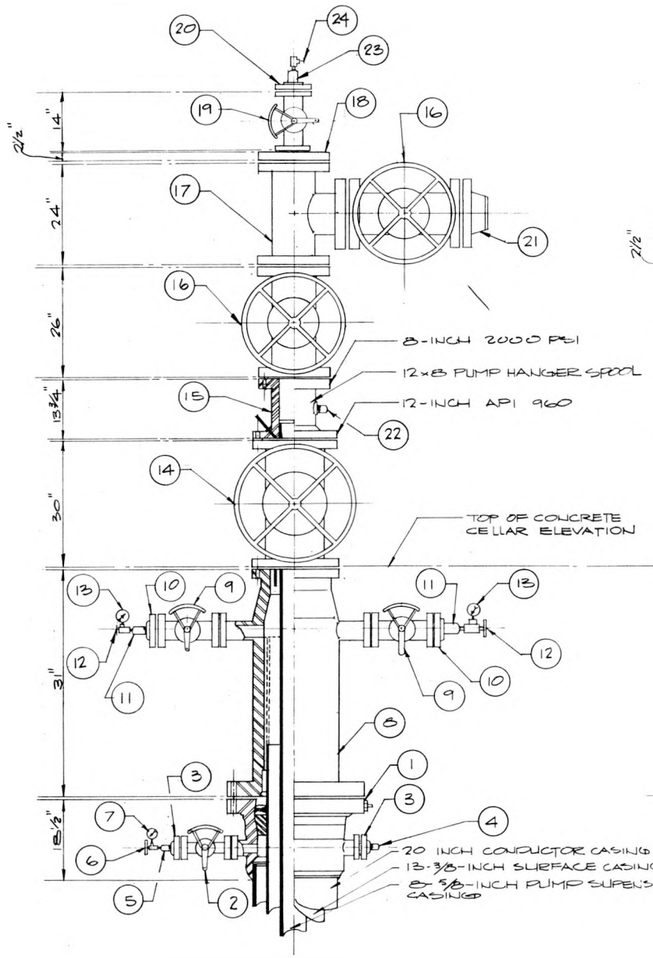
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

PRODUCTION & INJECTION WELLS
LOCATION PLAN

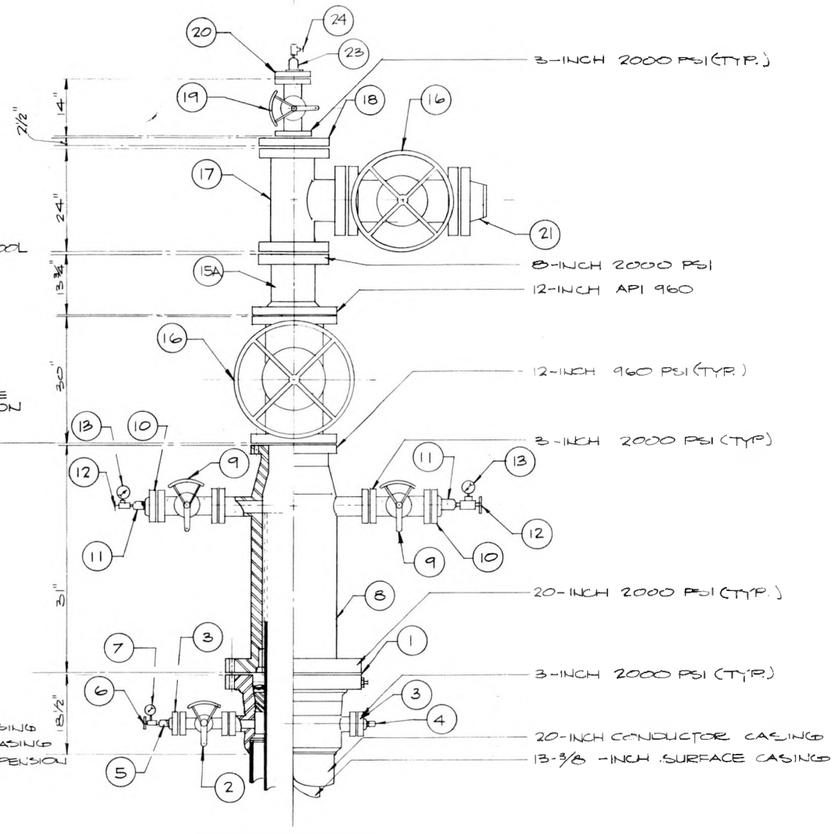
TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 OCT 1976
DRAWN R EVAY
CHKD V COREY
APPRVD. – PROJECT ENGR.
APPRVD. – PROGRAM OFFICE R O Pearson

DWG. NO. 6821.22H-01



PRODUCTION WELL
CASING HEAD EQUIPMENT
(TYP. ERDA US 18-5



INJECTION WELL
CASING HEAD EQUIPMENT
(TYP. ERDA US 52-2
& ERDA US. 88-4)

NOTE:
DIMENSIONS DO NOT INCLUDE RING GASKET

LIST OF PARTS

ITEM	W-K-M PART NUMBER	DESCRIPTION	NO. REQ'D PER WELL 18-5	52-2	88-4
1	430070	AP - Csg. Hd., G.T. 20 - 2M x 20 S.O.W. w/2 3-2M F.O.	1	1	1
2	203479	Valve, W-K-M 3-2M W.P. F x F GT Trim Pow-R-Seal	1	1	1
3	201649	Flange, Companion, 3-2M x 3" L.P. Thd.	2	2	2
4	188042	Bull Plug, 3" L.P. Plain	1	1	1
5	188073	Bull Plug, 3" L.P. Tap 1/2 N.P.T.	1	1	1
6	203250	Valve, Needle, 1/2 N.P.T. Angle	1	1	1
7	203269	1/2" Gauge, 0-2000# Reading 4 1/2 Face	1	1	1
8	430078	AP-Spool Expansion, Pack-Off 20 - 2M x 12 - 960 GT w/2 3-2M F.O.	1	1	1
9	203479	Valve, W-K-M 3-2M W.P. F x F GT Trim Pow-R-Seal	2	2	2
10	201649	Flange, Companion, 3-2M x 3 L.P. Thd.	2	2	2
11	188073	Bull Plug, 3" L.P. Tapped 1/2 N.P.T.	2	2	2
12	203250	Valve, Angle Needle 1/2 N.P.T.	2	2	2
13	203269	1/2" Gauge, 0-2000# Reading 4 1/2 Face	2	2	2
14	203479	Valve, W-K-M Pow-R-Seal F x F GT Trim 12 ANSI 400 W.P.	1	1	1
15	430072	Spool, Hanger G.T. 12 API 960 x 8 - 2M @/8-5/8 L. Casing Thds.	1	-	-
15A		Spool Adapter - 12 API 960 x 8 - 2M	-	1	1
16		Valve, W-K-M Pow-R-Seal, 8" - 600 ANSI with G.T. Trim	2	1	1
17	070225	Tee, Flange 8-2M Run w/8 - 2M Side Outlet	1	1	1
18	076924	Flange, Adapter G.T. 8-2M Drilled x 3-2M Studded	1	1	1
19	203479	Valve, W-K-M Pow-R-Seal 3-2M GT Trim F x F	1	1	1
20	201649	Flange, Companion, 3-2M x 3" L.P. Thds.	1	1	1
21	201662	Flange, Weld Neck 8 ANSI 600 x SCH 40 Bore	1	1	1
22	188040	Bull Plug, 2" L.P. Plain	1	1	1
23	188073	Bull Plug, 3" L.P. w/Tapped 1/2 N.P.T.	1	1	1
24	203251	Valve Needle M x F 1/2 N.P.T.	1	1	1

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

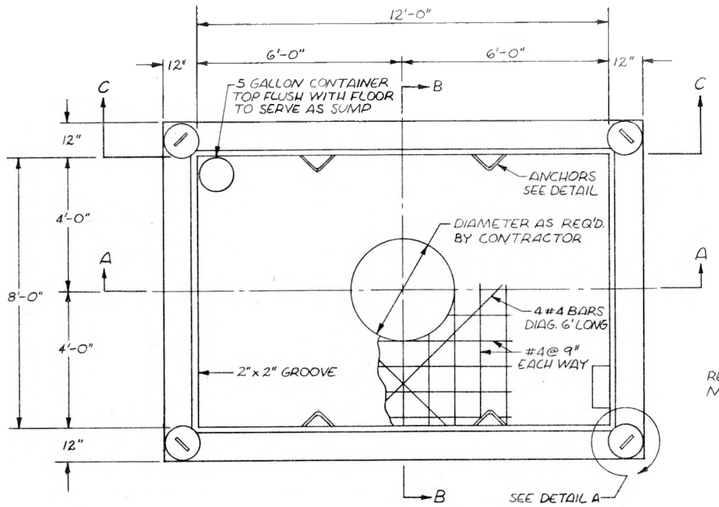
PRODUCTION & INJECTION WELLS
CASING HEAD EQUIPMENT

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

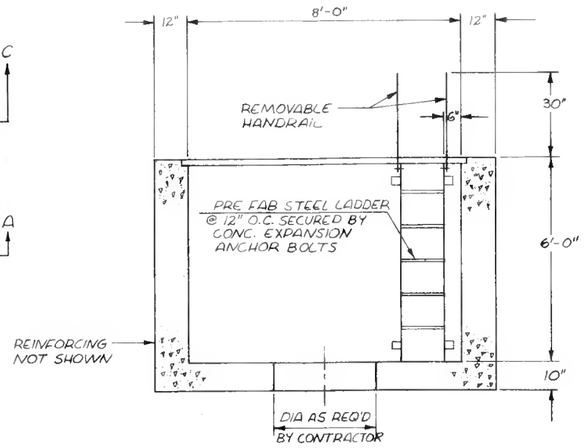
DATE 15 OCT 1976
DRAWN R. REMAY
CHKD. R. COREY
APPRVD.

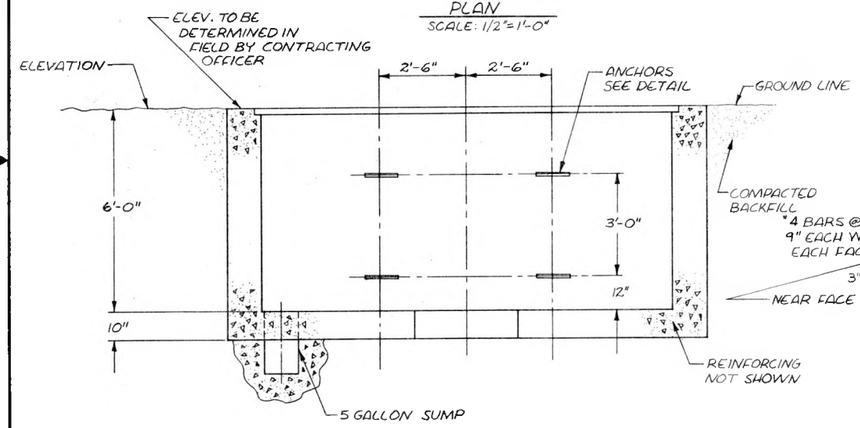
APPRVD. – PROGRAM OFFICE

DWG. NO. 6821.22H-02



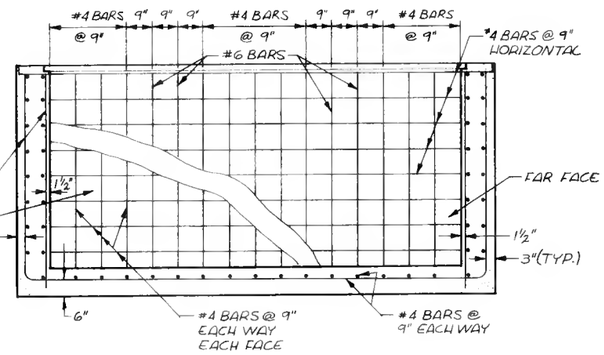
PLAN
SCALE: 1/2"=1'-0"





SECTION A-A
SCALE: 1/2"=1'-0"

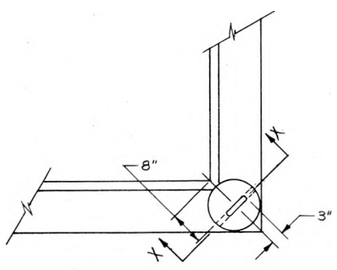
SECTION B-B
SCALE: 1/2"=1'-0"



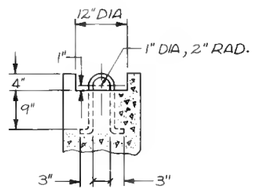
SECTION C-C
SCALE: ½"=1'-0"

NOTES:

CONCRETE SHALL HAVE A 28 DAY COMPRESSIVE STRENGTH OF 3750 PSI.
REINFORCEMENT SHALL BE LAPPED A MINIMUM OF 24 BAR DIAMETERS AT SPLICES
IF THE REINFORCED CONCRETE CELLAR IS TO BE PRECAST AND MOVED TO ITS PERMANENT SITE, THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING ANY REQUIRED ADDITIONAL REINFORCEMENT, LIFTING EYES, OR OTHER APPURTENANCES THAT MAY BE REQUIRED, AT NO ADDITIONAL COST TO THE GOVERNMENT.
CONTRACTOR MAY DESIGN OPENINGS IN CELLAR FLOOR FOR RAT HOLES & MOUSE HOLES AS NECESSARY.

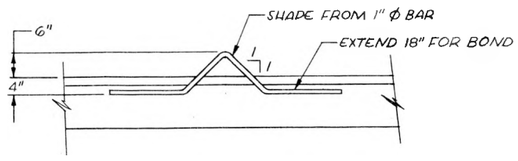


DETAIL A
SCALE: 3/4"=1'-0"



SECTION X-X
SCALE: 3/4"=1'-0"

CORNER TIE DOWN ANCHORS
(4 REQUIRED)



DETAIL ANCHORS
(8 REQUIRED)
SCALE: 3/4"=1'-0"

1/2" = 1'-0"
2' 1' 0 2 4 FEET

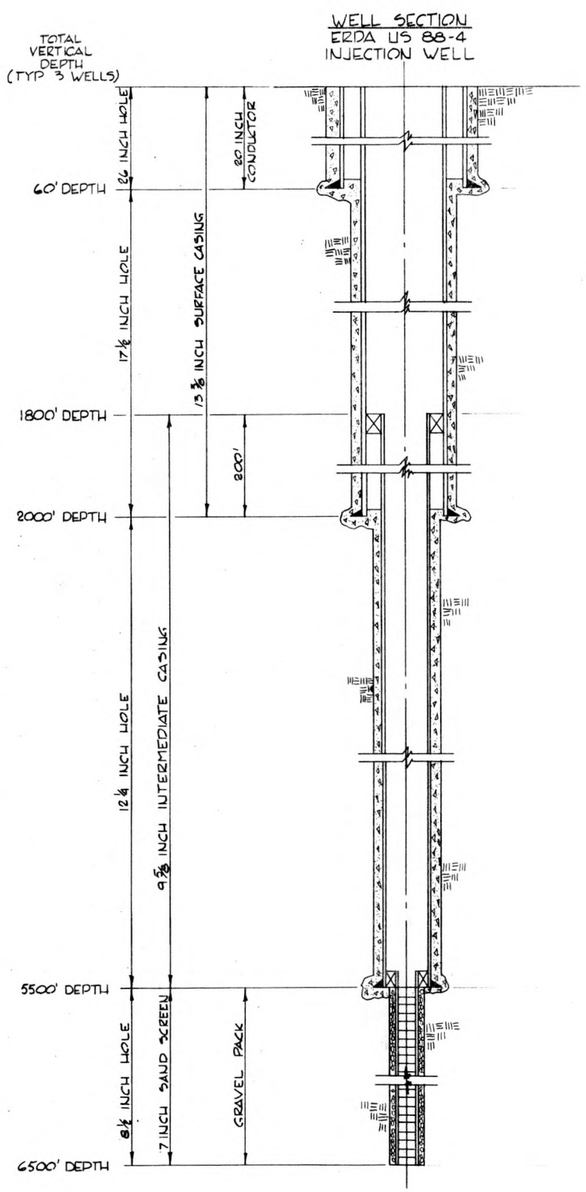
3/4" = 1'-0"
1' 9" 6" 3" 0 1 2 3 4 5 FEET

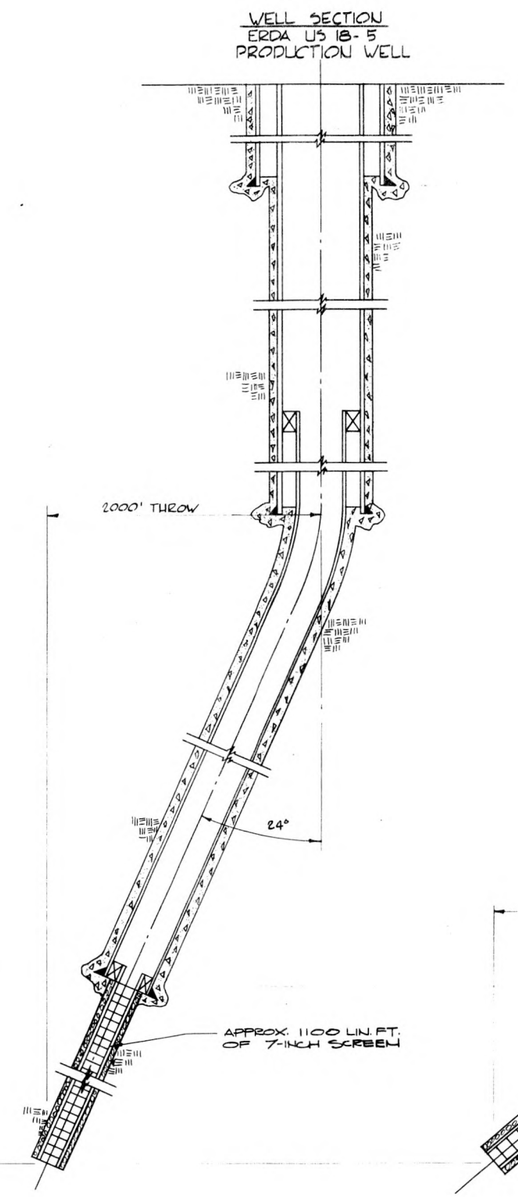
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

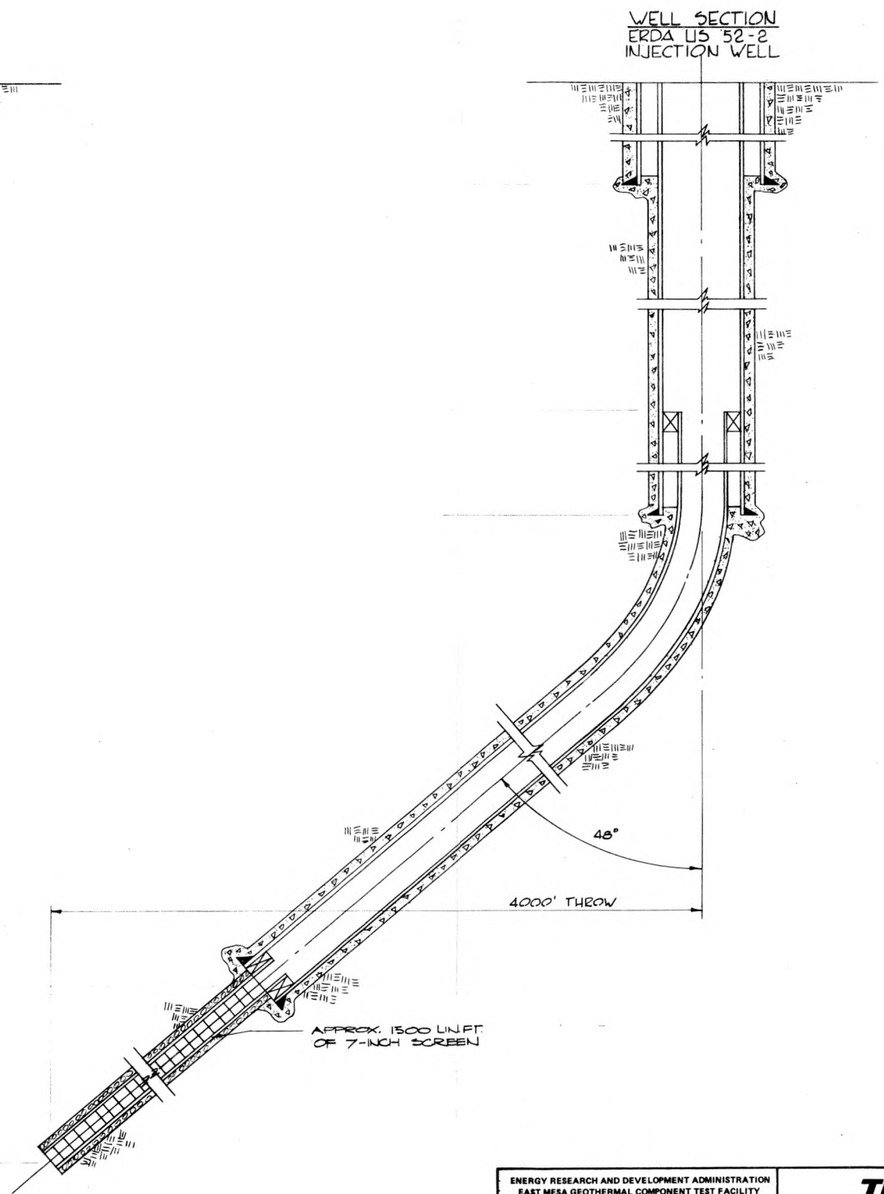
PRODUCTION & INJECTION WELLS
CONCRETE CELLAR

TRW SYSTEMS GROUP
ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT
SYSTEM INTEGRATION LABORATORY

DATE 15 OCT 1976		DWG. NO. 6821.224-03
DRAWN R.C.GUERRERO		
CHKD. R. COREY		
APPRVD.	APPRVD. – PROGRAM OFFICE	







ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
PRODUCTION & INJECTION WELLS SCHEMATIC WELL SECTIONS	
DATE 15 OCT 1976	DWG. NO. 6821.22H-04
DRAWN RG & RC	
CHKD. R. COREY	
APPRVD.	APPRVD. – PROGRAM OFFICE RO Pearson

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Contract No. E(04-3) - 1140

TASK 4.3.1

MESA 5-1 MODIFICATION

SPECIFICATION 6821.22K-S

Prepared by:

Environmental, Power and Facilities Department

TRW
SYSTEMS GROUP

FOREWORD

The work is situated approximately 10 miles east of Holtville, California. Work under this service contract consists of IN-HOLE Perforation Services to be performed at the well Mesa 5-1 located adjacent to the ERDA East Mesa Geothermal Component Test Facility.

This firm fixed-price service contract is to be negotiated without formal advertising, pursuant to authority contained in U.S. Code 252 (c)(2) Section 302 (c)(2), required in connection with the Geothermal Well Program, near Holtville, California.

SCHEDULE

IN-HOLE Perforation Services shall be performed at the well Mesa 5-1, Geothermal Well Site, approximately 10 miles east of Holtville, California. All in accordance with the following. Work to be performed the week of _____.

This perforation job will be required to open casing opposite permeable sand horizons in well Mesa 5-1. A total of 4568 1/2-inch shots over a total interval of 571 feet (8 shots per foot) will be required. It will be necessary for the contractor to supply a mast to gain access to the wells as well as a lubricator for standby safety purposes. A depth control log will be required; this will consist of a gamma radiation and collar location log.

Access to the well 5-1 is as follows:

Top of an 8"x8"x8"x8" - 300 psi cross fitting approximately 7 feet above ground line.

The schedule of intervals is to be as follows:

Perforation Intervals	Bed Thickness (Feet)
4061-4090	29
4095-4118	23
4138-4158	20
4163-4190	27
4217-4226	9
4250-4276	26
4310-4322	12
4326-4329	3
4347-4409	62
4443-4476	83
4615-4633	18
4674-4702	28
4726-4791	65
4811-4837	26
4856-4870	14
4942-4957	17
4972-5000	28
5023-5050	27
5054-6064	10
5072-5079	7
5123-5139	16
5147-5153	6
5156-5171	15
5182-5197	15
5237-5253	16
5257-5276	19
TOTAL	571

6821.22K-S

SPECIAL PROVISIONS

1. Requirement: It is required that there be completed, in accordance with this contract, In-Hole Perforation Services to be performed at the well Mesa 5-1 located approximately 10 miles east of Holtville, California.

2. Delivery Point: Offer shall be on the basis of delivery f.o.b. at the destination stated in the Schedule.

3. Delivery: Completed services from the shipping point or points is desired within the number of calendar days after receipt by the contractor of notice of award of contract as specified in the Schedule.

4. Payments: Lump-sum payment will be paid within 30 calendar days after receipt by the Bureau of Reclamation paying office, indicated on Standard Form 26, of proper invoices, properly receipted, covering completion of Schedule, and copies of shot data records required by the Contracting Officer (see Special Provisions, Paragraph 6).

5. Standards: The in-hole perforation will be made in accordance to the procedures as outlined in API-RP 43: "Standard Procedure for Evaluation of Well Perforators" (Nov. 1971), copy available upon request.

6. Shot Record: Individual data sheets, showing shot records and certification that the shots were made in accordance with API standards, will be furnished to the Contracting Officer after completion of the in-hole perforation service.

CONDITIONS

1. Casing is 7-7/8" OD.

2. Contractor will furnish service personnel.

3. Contractor will furnish derrick truck or mast.

4. Temperature range with the well in equilibrium is less than 250°F. Cooling operations will be provided by the Government. Therefore, down-hole temperatures will be no more than 250°F.

5. Contractor will be required to run a minimum of two temperature surveys, the first immediately prior to running first perforation gun.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Contract No. E(04-3)-1140

TASK 4.3.2

MESA 8-1 DOWN-HOLE PUMP

SPECIFICATION 6821.22L-S

Prepared by:

Environmental, Power and Facilities Department

TRW
SYSTEMS GROUP

FOREWORD

The work is situated approximately 10 miles east of Holtville, California. Work under this contract consists of providing installing and checking out a down-hole pump in the Well MESA 8-1 to provide the production indicated in the performance specification.

Potential suppliers include Reda Pump Company and Peerless Pump Division of FMC.

MESA 8-1 DOWN-HOLE PUMP
PERFORMANCE SPECIFICATION

WELL DESCRIPTION

Name	---	MESA 8-1
County	---	Imperial
State	---	California
Total Depth	---	6000 Ft.
Casing	---	7-5/8 inch O.D. 6-3/4 inch I.D.

RESERVOIR DATA

Fluid Temperature	---	350 ± 10%F
Fluid Specific Gravity	---	0.89
Permeability	---	20 Millidarcies
Drawdoen Water Level (400 GPM)	---	550 Ft.

PRODUCTION DATA

Flow	---	400 GPM
Well Head Discharge Pressure	---	185 psig
Pump Intake Setting Depth	---	950 Ft.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Contract No. E(04-3)-1140

TASK 4.3.3

MESA 6-1 DOWN-HOLE PUMP

SPECIFICATION 6821.22M-S

Prepared by:
Environmental, Power and Facilities Department

TRW
SYSTEMS GROUP

FOREWORD

The work is situated approximately 10 miles east of Holtville, California. Work under this contract consists of providing installing and checking out a down-hole pump in the well MESA 6-1 to provide the production indicated in the performance specification.

Potential suppliers include Reda, Peerless, Sundstrand, Lear and Sperry.

MESA 6-1 DOWN-HOLE PUMP

PERFORMANCE SPECIFICATION

WELL DESCRIPTION

Name	---	MESA 6-1
County	---	Imperial
State	---	California
Total Depth	---	8000 Ft.
Casing	---	9-5/8 inch O.D. 8-3/4 inch I.D.

RESERVOIR DATA

Fluid Temperature	---	350 ± 10°F
Fluid Specific Gravity	---	0.89
Permeability	---	20 Millidarcies
Drawdown Water Level (500 GPM)	---	500 Ft

PRODUCTION DATA

Flow	---	500 GPM
Well Head Discharge Pressure	---	185 psig
Pump Intake Setting Depth	---	890 Ft.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

EAST MESA GEOTHERMAL COMPONENT TEST FACILITY

Contract No. E(04-3) - 1140

TASK 2.5.4
WELL 8-1 BOOSTER PUMP
SPECIFICATION 6821.22N-S

Prepared by:

Environmental, Power and Facilities Department

TRW

FOREWORD

The work is situated approximately 10 miles east of Holtville, California, in Imperial County, and is accessible by primary and secondary roads. Work to be performed consists of furnishing and installing a booster pump to pump brines from the well Mesa 8-1 to the ERDA test facility.

Features of the work include clearing, excavation and placing concrete for pump slab and pipe supports, and furnishing and installing a pump with ancillaries including valves, pipe manifolds, and electrical service.

DESCRIPTION OF THE WORK

The work required under these specifications consists of furnishing and installing a booster pump to pump geothermal brines from the well Mesa 8-1 at the ERDA component test facility.

Principal components of the work to be performed under these specifications include the following:

a. Clearing, excavation and compaction of earth for pump slab.

b. Furnishing and placing reinforced concrete for pump slab.

c. Furnishing and installing manifold piping consisting of 8-, and 3-inch diameter Schedule 40 insulated pipe complete with pipe supports, pipe rollers, pipe expansion joints, control and isolation valves, and miscellaneous fittings.

d. Furnishing and installing centrifugal booster pump.

e. Provision of electrical service to the pump from a distribution transformer.

f. Furnishing and installing temperature and pressure indicators.

BIDDING SCHEDULE FOR
SPECIFICATION NO. 6821.22N-S

WELL 8-1 BOOSTER PUMP

Bids will be considered on the following schedule, but no bid will be considered for only part of the schedule

S C H E D U L E

ITEM	WORK OR MATERIAL	QUANTITY AND UNIT	UNIT PRICE	AMOUNT
1	Excavation for structure	0.8 cu. yd.	$_____	$_____
2	Compacting for structure	0.1 cu. yd.	_____	_____
3	Furnishing and placing reinforcement	63 lb.	_____	_____
4	Furnishing and placing concrete	0.7 cu. yd.	_____	_____
5	Furnishing and installing Pump	FOR THE LUMP SUM OF --		
6	Furnishing and installing instrumentation	FOR THE LUMP SUM OF --		
7	Furnishing and installing steel pipe and fittings for the complete pipe manifolding and pump installations complete with cutting 8" line, installation of 8" fittings, and 3" and 3/4" pipe, fittings, valves, and necessary appurtenances	FOR THE LUMP SUM OF --		
8	Furnish and install pipe insulation on 8-inch pipe fittings and 3-inch pipe and fittings	FOR THE LUMP SUM OF --		
9	Miscellaneous metalwork	240 lb.	_____	_____
10	Furnishing and installing all electrical equipment, conduit and wiring	FOR THE LUMP SUM OF --		

INJECTION PUMP SYSTEM
GENERAL OUTLINE

DIVISION 2 -- EARTHWORK

Section 2.1 -- EARTHWORK

- 2.1.1 Classification of Excavation
- 2.1.2 Site Grading
- 2.1.3 Excavation for Structures
- 2.1.4 Backfill About Structures
- 2.1.5 Compacting Backfill About Structures
- 2.1.6 Excavation and Backfill for Trenches
- 2.1.7 Disposal of Excavated Materials
- 2.1.8 Gravel Fills
- 2.1.9 Compacting Earth Materials

DIVISION 3 -- CONCRETE

Section 3.1 -- CONCRETE

- 3.1.1 Concrete, General
- 3.1.2 Materials
- 3.1.3 Composition
- 3.1.4 Batching and Mixing
- 3.1.5 Forms, Preparation for Placing, and Placing
- 3.1.6 Protection and Curing
- 3.1.7 Repair of Concrete
- 3.1.8 Reinforcement
- 3.1.9 Measurement and Payment
- 3.1.10 Concrete Floor Hardener
- 3.1.11 Grouting Mortar for Metalwork

DIVISION 4 -- PIPE MANIFOLDS

Section 4.1 -- PIPE MANIFOLDS

- 4.1.1 Pipe Manifolds
- 4.1.2 Testing the Pipe Manifold
- 4.1.3 Guarantee
- 4.1.4 Steel Pipe and Fittings

DIVISION 5 -- MISCELLANEOUS METALWORK

Section 5.1 -- MISCELLANEOUS METALWORK

- 5.1.1 Miscellaneous Metalwork

DIVISION 6 -- INSTRUMENTATION

Section 6.1 -- INSTRUMENTATION

6.1.1 General
6.1.2 Testing
6.1.3 Cleaning
6.1.4 Materials
6.1.5 Instruments
6.1.6 Instrument and Control Calibration and Adjustment
6.1.7 Nameplates
6.1.8 Payment

DIVISION 7 -- PUMP

Section 7.1 -- PUMP

7.1.1 Pump

DIVISION 8 -- ELECTRICAL SYSTEM

Section 8. 1 -- ELECTRICAL SYSTEM

8.1.1 General
8.1.2 Acceptance of Electrical System
8.1.3 Drawings and Data to be Furnished by the Contractor
8.1.4 Grounding
8.1.5 Electrical Conduit System
8.1.6 Insulated Electrical Wires and Cables
8.1.7 Motor Starter
8.1.8 Circuit Breaker
8.1.9 Motor Control
8.1.10 Payment

DIVISION 9 -- PAINTING

Section 9.1 -- PAINTING

9.1.1 Painting
9.1.2 Painting Tabulation
9.1.3 Color Schedule for Painting

DIVISION 10 -- DRAWINGS

Section 10.1 -- DRAWINGS

10.1.1 Drawings, General
10.1.2 List of Drawings

DIVISION 2 -- EARTHWORK

SECTION 2.1--EARTHWORK

2.1.1 Classification of Excavation

a. General--Bidders and the contractor must assume all responsibility for deductions and conclusions as to the nature of the materials to be excavated and the difficulties of making and maintaining the required excavations.

b. Clearing--Any brush, plant growth, or other unsuitable material shall be removed and disposed of. The cost of all clearing shall be included in the prices bid in the schedule for various items of work.

2.1.2 Site Grading

a. General--The contractor shall perform all excavation for site grading to the subgrade for final elevations as shown on the drawings or established by the contracting officer. The contractor shall use materials removed in excavation for constructing fills. Fills shall be constructed and compacted in accordance with provisions of **Paragraph 2.1.9** hereof. Any extra or unsuitable excavated material from site grading shall be disposed of in waste areas as directed by the contracting officer.

b. Costs--The cost of site grading shall be included in the prices bid in the schedule for various items of work, which prices shall include the cost of all labor, equipment, and incidentals required to perform the site grading as herein specified.

2.1.3 Excavation for Structures

a. Measurement for payment--Excavation for structures will be measured for payment to excavation pay lines shown on the drawings, or if not shown on the drawings to pay lines in accordance with the provisions of this paragraph. Regardless of quantities removed, measurement for payment will be made to the prescribed pay lines: Except, That for purposes of safety or other practicable reasons in connection with individual structures the Government reserves the right to require the contractor to excavate to the prescribed pay lines. No payment will be made for excavation or removal of material which is outside of the prescribed pay lines.

Measurement of excavation will be in accordance with the following:

Pump slab--Measurement of excavation for structure will include all required excavation for the structure below the original ground surface and between vertical planes at the ends of the structure or combination of adjoining structures. Such measurement will also include any excavation for the structure outside of these vertical planes which may be required below the original ground surface and outside of the pay lines for excavation for the concrete footings. Measurement of excavation will be made to dimensions one foot outside of the foundations of the structure and to slopes of 1:1 to ground surface.

b. Foundations for structures--Excavation for the foundation of structures shall be to the elevations shown on the drawings or established by the contracting officer. The contractor shall prepare the foundations at structure sites by methods which will provide firm foundations for the structures. The bottom and side slopes of common excavation, upon or against which the structure is to be placed, shall be finished to the prescribed dimensions, and the surfaces so prepared shall be moistened and tamped with suitable tools to form firm foundations upon or against which to place the structure.

Where rock or other unsuitable material is encountered in the foundation for a structure, the contracting officer will direct additional excavation to remove the unsuitable material. This additional excavation shall be made to provide a minimum clearance between the undisturbed foundation and the underside of the structure and the additional excavation shall be refilled with compacted backfill to provide a firm foundation for the structure. Measurement and payment for excavation, backfill, and compacting backfill will be made to depths and dimensions prescribed by the contracting officer.

If at any point in excavation the foundation material is excavated beyond the lines required to receive the structure, the overexcavation shall be filled with suitable materials and compacted in accordance with Paragraph 2.1.9 (Compacting Earth Materials). If at any point in excavation, the natural foundation material is disturbed or loosened during the excavation process or otherwise, it shall be compacted in place or, where directed, it shall be removed and replaced with suitable material and compacted in accordance with Paragraph 2.1.9 (Compacting Earth Materials). Any and all excess excavation or overexcavation performed by the contractor for any purposes or reason except for additional excavation as may be prescribed by the contracting officer and whether or not due to the fault of the contractor, shall be at the expense of the contractor. Fill and compacting of fill for such excess excavation or over excavation shall be at the expense of the contractor.

c. Payment--Insofar as practicable, the material moved in excavation for structures shall be used for backfill and embankments, otherwise it shall be wasted as directed by the contracting officer. Payment for excavation for structures will be made at the unit price per cubic yard bid in the schedule. The unit price bid in the schedule for excavation for structures shall include the cost of all labor and materials, of all other work necessary to maintain the excavations in good order during construction, and shall include the cost of disposal of the excavated material.

2.1.4 Backfill About Structures

a. General--Backfill about structures shall be placed to the lines shown on the drawings, as prescribed in this paragraph, or as directed. The type of material used for backfill, the amount thereof, and the manner of depositing the material shall be subject to approval. Insofar as practicable, backfill material shall be obtained from material moved in excavating for structures, but when sufficient suitable material is not available from this source or from adjacent canal excavation, additional material shall be obtained from approved borrow pits. Except as otherwise provided in Paragraph 2.1.5 (Compacting Backfill About Structures), special compaction of the backfill will not be required.

b. Structures on fill--Where the original ground surface is below the base of a structure or below the bottom of a structure, all fill required for the structure foundation and all fill up to the bottom of a structure shall be placed as embankment. All fill about the structures above the original ground surface and outside of the above described backfill shall be placed as embankment.

c. Measurement and payment--Excavation refill required to be placed about structures that is within the payline limits for excavation for the structures will be measured in place for payment as backfill about structures. Fill about the structures above the orignal ground surface and within the slopes of excavation pay lines for such structures as extended to intersect the finished surfaces of adjacent earthwork will be measured for payment as backfill about structures: Except, That above the original ground surface the excavation pay lines will be extended to intersect the finished surfaces at slopes of one to one. Where the original ground surface is below the base of a structure, measurement, for payment, of backfill will be made above the structure base and within the lines prescribed in Subparagraph b. for backfill.

Measurement, for payment, of backfill about structures will be made only for the quantities actually placed within the limits of the established pay lines.

Payment for backfill about structures will be made at the unit price per cubic yard bid in the schedule, which unit price shall include the cost of all work connected therewith, including the excavation and haul of the necessary material.

Refill of excavation performed outside of the established pay lines for excavation for structures shall be placed in the same manner as specified for the adjacent backfill, and such refill shall be placed at the expense of the contractor.

2.1.5 Compacting Backfill About Structures

a. General--Unless otherwise shown on the drawings, backfill about structures shall be compacted as prescribed in this paragraph or as directed.

To provide adequate protection for compacted backfill about a structure, the Government reserves the right to direct the contractor to place a sufficient amount of backfill or embankment material over the compacted backfill within 72 hours after compacting of the backfill has been completed.

The 1:1 slopes specified below shall extend from the top of the concrete walls to their intersection with the surfaces of the excavation or embankment as the case may be.

b. Location of compacted backfill--

(1) Backfill about the pump and tank slab and pipe support base shall be compacted to slopes of 1:1 from the concrete bases to the ground surface: Provided, That where the structure is located in compacted embankment, the backfill shall be compacted to the elevation prescribed for the adjacent compacted embankment.

c. Material and compacting--The material used for backfill to be compacted shall be selected material, containing no stones larger than 3 inches in diameter, approved by the contracting officer, and obtained from required excavation or approved borrow pits. To prevent unequal loadings and displacement of structures, the backfill shall be placed and compacted in layers having essentially the same top elevation on each side of the structure. All materials in backfill to be compacted shall be placed, moistened, and compacted as provided in Paragraph 2.1.9 (Compacting Earth Materials).

d. Measurement and payment--Measurement for payment for compacting backfill about structures will be made in place to the lines shown on the drawings, as prescribed in this paragraph, or as directed by the contracting officer and will be made only for the quantities actually compacted within the limits of the established pay lines for backfill about structures, and the compacting or refill outside of excavation pay lines shall be performed at the expense of the contractor. Payment for compacting backfill about structures will be made at the unit price per cubic yard bid therefor in the schedule and will be in addition to the payment made for backfill about structures. The unit price bid in the schedule for compacting backfill about structures shall include the costs of furnishing water and moistening the materials.

2.1.6 Excavation and Backfill for Trenches

a. General--Excavation, backfill, and compacting backfill for trenches include all excavation, backfill, and compacting backfill required for trenches for electrical cable, conduits, and grounding cables.

b. Excavation--All excavation for trenches shall be made to the lines, depths, and grades shown on the drawings or directed by the contracting officer. The bottom of the trench shall be finished accurately to the lines and grades shown on the drawings or established by the contracting officer and in a manner suitable

and as provided for the facility to be placed in the trench. The bottom of the trenches shall be prepared so as to provide a firm, even, and unyielding foundation. Trenches for conduit, or cable, may be excavated by trencher but the backfill shall be compacted as provided for in this paragraph.

If at any point in excavation the material is excavated beyond the lines required, the overexcavation shall be filled with suitable materials and compacted in accordance with Paragraph 2.1.9 (Compacting Earth Materials). If at any point in excavation the natural foundation material is disturbed or loosened during the excavation process or otherwise, it shall be compacted in place, or where directed, it shall be removed and replaced with suitable material and compacted in accordance with Paragraph 2.1.9 (Compacting Earth Materials). Any and all excess excavation or overexcavation performed by the contractor for any purposes or reason, except for such additional excavation as may be prescribed by the contracting officer and, whether or not due to the fault of the contractor, shall be at the expense of the contractor. Fill and compaction of fill for such excess excavation or overexcavation shall be at the expense of the contractor.

c. Backfill--All backfill shall be placed carefully to give the conduit, or cable, a continuous even bearing on the bottom and sides. Backfill shall not be dropped directly on the conduit or cable. Rocks and clods, larger than 3 inches in maximum dimensions, shall not be placed within 6 inches of the conduit or cable.

d. Compacting backfill--All backfill in trenches under paving, structures, and where otherwise directed by the contracting officer, shall be compacted. All backfill shall be placed, moistened, and compacted in accordance with the applicable provisions of Paragraph 2.1.9 (Compacting Earth Materials). The backfill shall be compacted in layers having the same elevation on both sides of the pipe or cable to prevent unequal loading and displacement.

e. Costs--The cost of excavation for trenches, backfill for trenches, and compacting backfill for trenches shall be included in the prices bid in the schedule for other items of work, which prices shall include the cost of all labor and equipment required to perform the excavation, backfill and compacting backfill for the various trenches.

2.1.7 Disposal of Excavated Materials

All suitable material from required excavations, or as much thereof as may be needed, as determined by the contracting officer, shall be used for backfill, construction of fills, and for other required earthwork, as directed by the contracting officer. Material removed in excavation and not suitable for backfill or other required earthwork shall be wasted on right-of-way owned by the Government at such points as may be approved by the contracting officer. Unless otherwise directed, no material shall be wasted in drainage channels. Waste banks shall be left with reasonably even and regular surfaces as approved by the contracting officer. The cost of all work described in this program for the disposal of excavated materials shall be included in the prices bid in the schedule for other items of work. Waste asphalt, concrete, or other than natural earth materials shall be wasted at special nearby disposal areas, as designated by the contracting officer, where such materials will not be exposed to public view or present an unsightly appearance from public roadways or regular places of travel.

2.1.8 Gravel Fills

a. General--The contractor shall be responsible for furnishing all materials and performing all work for placing gravel fills under the pump slab. Gravel fills under the slab shall be covered with sheet polyethylene. The contractor shall furnish all gravel for gravel fills and the sheet polyethylene.

b. Materials--

(1) Gravel--The material for gravel fills shall be composed of hard, dense, durable rock particles, obtained from any approved source and shall range from 3/16 to 3/4 of an inch in size.

(2) Sheet polyethylene--The sheet polyethylene material shall be equal to 0.006 inch thick "Visqueen," as manufactured by the Visking Company, 6733 West 65th Street, Chicago, Illinois 60638.

c. Placing gravel fills--Before gravel is placed, the subgrades shall be leveled to a uniform cross section, free from depressions and soft spots. All gravel shall be placed to the lines and grades shown on the drawings or as directed.

Gravel fills under the concrete pad shall be deposited and compacted as specified in Paragraph 2.1.9 (Compacting Earth Materials) and shall be covered with sheet polyethylene. Before the sheet polyethylene is placed, the surfaces of the gravel fills shall be prepared by any suitable means satisfactory to the contracting officer which will prevent protrusions that may cause damage to the sheet polyethylene. The sheet polyethylene shall be lapped 6 inches at all ends and edges with the top lap in the direction of the spreading of the concrete. The contractor shall exercise care in placing materials and in his operations so as not to damage the sheet polyethylene covering.

d. Payment--Payment for furnishing and placing gravel fills under concrete will be made at the unit price bid therefor in the schedule, which price shall include the cost of furnishing and placing gravel and sheet polyethylene, of all work required for loading, hauling, placing, spreading, and compacting the gravel; and the cost of preparing, shaping, and compacting the subgrade surface as necessary for a satisfactory base for the gravel fill.

2.1.9 Compacting Earth Materials

a. General--Where compacting of earth materials is required, the materials shall be deposited in horizontal layers and compacted as specified in this paragraph. The excavation, placing, moistening, and compacting operations shall be such that the material will be uniformly compacted throughout the required section and will be homogeneous, free from lenses, pockets, streaks, laminations, or other imperfections.

b. Compacting clayey and silty materials--Where compaction of earth materials containing appreciable amounts of clay or silt is required, the materials shall be deposited in horizontal layers. The thickness of each horizontal layer after compaction shall be not more than 6 inches. The excavation and placing operations shall be such that the materials when compacted will be blended sufficiently to secure the highest practicable unit weight and best impermeability and stability.

Prior to and during compaction operations, the materials shall have a moisture content of not greater than 2 percent wet or less than 2 percent dry of optimum moisture, as determined by the contracting officer and the moisture content shall be uniform throughout each layer.

Insofar as practicable, as determined by the contracting officer, moistening of the material shall be performed at the site of excavation but such moistening shall be supplemented by sprinkling at the site of compaction, if necessary. If the moisture content is less than optimum for compaction by more than 2 percentage points or is greater than optimum for compaction by more than 2 percentage points, the compaction operations shall not proceed, except with the specific approval of the contracting officer, until the material has been wetted or allowed to dry out, as may be required, to obtain optimum moisture content within the tolerances permitted above, and no adjustment in price will be made on account of any operations of the contractor in wetting or drying the materials or on account of any delays occasioned thereby.

When the material has been conditioned as hereinbefore specified, it shall be compacted by rollers or by hand or power tampers. Where hand or power tampers are used to compact soils in confined areas such as under pipe, they shall be equipped with suitably shaped heads to obtain the required density.

The density (dry) of the soil fraction in the compacted material shall not be less than 95 percent of the laboratory standard maximum soil density (dry) as determined by the Bureau of Reclamation Proctor Compaction Tests for the materials being compacted.

(1) Compaction test--The compaction tests will be made by the Government. The standard maximum soil density is the dry weight per cubic foot of the soil compacted at optimum moisture content of laboratory procedure. The compaction test is the same as ASTM designation: D 698, Method A, except that a 1/20-cubic-foot compaction mold is used and the rammer is dropped from a height of 18 inches, resulting in the same energy of compaction per unit volume.

c. Compacting cohesionless materials--

(1) Compacting cohesionless free-draining materials--Where compaction of cohesionless free-draining materials, such as sands and gravels, is required, the materials shall be deposited in horizontal layers and compacted to the relative density specified below. The excavating and placing operations shall be such that the materials, when compacted, will be blended sufficiently to secure the highest practicable unit weight and best stability. Water shall be added to the materials as may be required to obtain the specified density by method of compaction being used.

The thickness of the horizontal layers after compaction shall not be more than 6 inches if compaction is performed by tampers or rollers; not more than 12 inches if compaction is performed by treads of crawler-type tractors, surface vibrators, or similar equipment; and not more than the penetrating depth of the vibrator if compaction is performed by internal vibrators.

The relative density of the compacted materials shall be not less than 70 percent as determined by the standard Bureau of Reclamation relative density tests for cohesionless free-draining soils.

(a) Relative density test--The relative density tests will be made by the Government. The relative density of a cohesionless free-draining soil, expressed as a percentage, is defined as its state of compactness with respect to the loosest and most compact states at which it can be placed by laboratory procedures. The

relative density will be based on the following formula, wherein the maximum density is the highest unit weight of the soil, minimum density is the lowest unit weight of the soil, and in-place density is the unit weight of the soil in place. Tests for moisture content are made on the materials and the unit weights are expressed in terms of ovendry weights.

$$\text{Rel. Den. } (\%) = \frac{\text{max.den. x (in-place den. - min. den.)}}{\text{in-place den. x max. den. - min. den.)}} \times 100$$

(2) Compacting cohesionless materials containing some clay and silt--Cohesionless materials containing clay and silt may not be free-draining. When compaction of cohesionless materials containing sufficient clay and silt as to impede free drainage is required, the material shall be placed and compacted in accordance with the provisions of c.(1) above. These materials shall be compacted to a dry density in accordance with either of the following control tests whichever shows the higher dry unit weight.

(a) Ninety-five percent of the laboratory standard maximum soil density (dry) as determined by the Bureau of Reclamation Proctor Compaction Test as prescribed in b.(1) above, or

(b) The dry density of the material at 70 percent relative density as determined by the relative density test as prescribed in c.(1)(a) above.

d. Costs--The costs of compacting earth materials as described in this paragraph shall be included in the prices bid in the schedule for other items of work.

DIVISION 3 -- CONCRETE

Section 3.1 -- Concrete

3.1.1 Concrete, General

The contractor shall construct the reinforced pump slab as shown on the drawings and herein specified.

All concrete construction shall conform to Paragraphs 3.1.1 (Concrete, General) to 3.1.9 (Measurement and Payment) inclusive. Concrete finishes shall conform to Paragraph 3.1.5 (Forms, Preparation for Placing, and Placing) and shall be as noted on the drawings.

All structures shall be built to the prescribed lines, grades and dimensions. The contractor shall place and attach to the structure all metal, or other accessories necessary for its completion as shown on the drawings. The cost of such work, for which specific prices are not provided in the schedule, shall be included in the respective unit price per cubic yard bid in the schedule for furnishing and placing concrete.

3.1.2 Materials

The contractor shall furnish all materials for use in concrete, including cement, water, sand and coarse aggregate, and air-entraining agent, and shall furnish all reinforcing bars and materials for curing concrete. Air-entraining agent and curing compound will be accepted on manufacturer's certification of compliance with specification requirements: Provided, That the Government reserves the right to require submission of and to perform tests on samples of the agent and/or compound prior to shipment and use in the work.

Except as hereinafter provided, cement shall be obtained from a commercial (non-Government tested) bin and shipped on manufacturer's certificate of

compliance with specification requirements, the certification to be accompanied by mill test report. If the cement company does not have a commercial bin of cement meeting the specified requirements and which they can certify, Government tested and approved cement may be shipped, if available at the cement plant concerned, in which case certification by the manufacturer will not be necessary. If cement is shipped under the foregoing conditions from a Government-tested bin, the contractor will be charged by deduction from payments due for the cost of testing of all such cement he obtains in excess of the quantity used in work under these specifications, which charge, including Government overhead, will be at the rate of 3.5 cents per cwt (hundredweight).

Permission to ship on manufacturer's certification shall in no way relieve the contractor of the responsibility for furnishing materials meeting specification requirements. The contractor shall be responsible for the accuracy and completeness of certifications and mill test reports furnished.

a. Cement.--Cement shall meet the requirements of Federal Specification SS-C-192G, including Amendment -3 thereto, for Type II low alkali, and shall meet the false-set limitation specified therein. The cement shall be free from lumps and damaged cement when used in concrete.

b. Water.--Water shall be free from objectionable quantities of silt, organic matter, alkalies, salts, or other impurities.

c. Sand and coarse aggregate.--Sand and coarse aggregate shall be furnished from any approved source. The sand particles shall be clean, hard, dense, durable, uncoated rock fragments that will pass a screen having 3/16- or 1/4-inch-square openings. The sand shall be well graded from fine to coarse and shall be free from injurious amounts of dirt, organic matter, and other deleterious substances. The coarse aggregate shall consist of clean, hard, dense, durable, uncoated rock fragments, shall be free from injurious amounts of thin pieces, organic matter, or other deleterious substances, shall be reasonably well graded from 3/16 of an inch to 1 and 1/2 inches, and shall be separated into two sizes by an intermediate screen having 3/4-inch-square openings. Screens having openings of other sizes and shapes may be used, if the Government reserves the right to test the sand and coarse aggregate

and if required, the contractor shall submit, for preliminary tests and approval, representative samples of the sand and coarse aggregate proposed for use in the concrete work.

d. Air-entraining agent.--The air-entraining agent shall conform to ASTM Designation: C 260, except that the limitation and test on bleeding by concrete containing the agent and time of setting requirement shall not apply.

e. Reinforcing bars.--Reinforcing bars shall conform to ASTM Designation: A 615, Grade 60, or ASTM Designation: A 617, Grade 60.

f. Wax-base curing compound.--Wax-base curing compound shall be white-pigmented compound confroming to Bureau of Reclamation "Specifications for Wax-Base Curing Compound," dated May 1, 1973.

3.1.3 Composition

Sand and coarse aggregate shall be mixed in proportions as directed by the contracting officer. One and one-half-inch-maximum-size coarse aggregate shall be used where practicable from the standpoint of satisfactory placing and consolidation of the concrete. Concrete which contains 1 and 1/2-inch-maximum-size aggregate shall have a cement content of not less than 517 pounds per cubic yard, and concrete which contains 3/4-inch-maximum-size aggregate shall have a cement content of not less than 611 pounds per cubic yard. The net water-cement ratio of the concrete (exclusive of water absorbed by the aggregates) shall not exceed 0.47 by weight. The concrete shall develop a minimum compressive strength of 3,000 lb/in^2 at 28 days as determined by standard specimens. The compressive strength of the concrete will be determined by the Government through the medium of tests of 6- by 12-inch cylinders made and tested in accordance with Designations 29 to 33, inclusive, of the Seventh Edition of the Bureau of Reclamation Concrete Manual.

The use of calcium chloride in concrete will not be permitted.

Air-entraining agent shall be used in such amount as will effect the entrainment of from 4 to 6 percent of air, by volume, of the concrete as discharged from the mixer.

The slump of the concrete shall not exceed 2 inches for slabs, and 3 inches for all other concrete.

3.1.4 Batching and Mixing

The sand and coarse aggregate shall be weighed and shall be proportioned on the basis of integral bags of cement unless the cement is weighed. Weighing equipment of the beam type may be used. The contractor shall provide equipment and shall maintain and operate the equipment as required to accurately determine and control the amount of each separate ingredient entering the concrete. Batching shall be such that combined inaccuracies in feeding and measuring the materials will not exceed 1 and 1/2 percent for water and weighed cement and 2 percent for sand and each size of coarse aggregate. The concrete shall be uniform in composition and consistency throughout the mixed batch, and from batch to batch, except where changes in composition or consistency are directed. The mixing time shall be at least 1 and 1/2 minutes. Excessive overmixing requiring the addition of water to preserve the required consistency will not be permitted. The temperature of the concrete when it is being placed shall be not more than $90^{o}F$ and not less than $40^{o}F$ in moderate weather or $50^{o}F$ when the mean daily temperature drops below $40^{o}F$. Truck mixers will be permitted only when the mixers and their operation are such that the concrete throughout the mixed batch and from batch to batch is uniform with respect to consistency and grading. Any concrete retained in truck mixers so long as to require additional water to permit satisfactory placing shall be wasted.

3.1.5 Forms, Preparation for Placing, and Placing

Forms shall be sufficiently tight to prevent loss of mortar from the concrete and shall be maintained rigidly in position until the concrete has hardened sufficiently to prevent damage by form removal. All surfaces of foundations upon or against which concrete is to be placed shall be free from standing water, mud, and debris. The surfaces of absorptive foundations against which concrete is to be placed shall be moistened thoroughly so that moisture will not be drawn from the freshly placed concrete. The surfaces of construction joints shall be clean, rough, and surface dry when covered with

fresh concrete. Cleaning shall consist of the removal of all laitance, loose or defective concrete, coatings, sand, curing compound if used, and other foreign material.

The methods and equipment used for transporting concrete, and the time that elapses during transportation shall be such as will not cause appreciable segregation of coarse aggregate or slump loss in excess of 1 inch in the concrete as it is delivered into the work. Retempering of concrete will not be permitted. Any concrete which has become so stiff that proper placing cannot be assured shall be wasted. Formed concrete shall be placed in continuous approximately horizontal layers, the depths of which generally shall not exceed 20 inches. Concrete shall be vibrated until it has been consolidated to the maximum practicable density, is free from rock pockets of coarse aggregate, and closes snugly against all surfaces of forms and embedded materials.

Exposed unformed surfaces of concrete shall be brought to uniform surfaces and worked with suitable tools to a reasonably smooth wood-float or steel-trowel finish as directed.

3.1.6. Protection and Curing

The contractor shall protect all concrete against injury until final acceptance by the Government. The concrete shall be cured by water curing or by application of wax-base curing compound. If concrete is cured by water curing, the concrete shall be kept continuously moist for at least 14 days after being placed by sprinkling or spraying or by other methods approved by the contracting officer. If concrete is to be cured by application of curing compounds, the application of the curing compound shall be in accordance with the procedures contained in the Seventh Edition of the Bureau of Reclamation Concrete Manual for curing with sealing compounds.

3.1.7. Repair of Concrete

Any concrete that is damaged or defective from any cause; concrete that is honeycombed, fractured, or otherwise defective; and concrete which, because of excessive surface depressions, must be excavated and built up to bring the surfaces to the prescribed lines; shall be removed and replaced; and any imperfections and irregularities on concrete surfaces shall be corrected.

The removal and replacement of damaged or defective concrete, and the correction of surface imperfections and irregularities shall be made with concrete, dry pack, or mortar (portland cement mortar); or, at the option of the contractor, with epoxy-bonded concrete, or epoxy-bonded epoxy mortar; where as applicable for the type of repair involved, in accordance with Bureau of Reclamation "Standard Specifications for Repair of Concrete" dated November 15, 1970. The cost of all materials, labor, and equipment required in the repair of concrete and the correction of surface imperfections and irregularities shall be borne by the contractor.

3.1.8. Reinforcement

Steel reinforcing bars shall be placed in the concrete where shown on the drawings. Before reinforcement is placed, the surfaces shall be cleaned of heavy flaky rust, loose mill scale, dirt, grease, or other foreign substances. Reinforcement shall be accurately placed and secured in position so that it will not be displaced during the placing of the concrete. Welding or tack-welding of Grade 60 reinforcing bars will not be permitted except at locations shown on the drawings.

Unless otherwise shown on the drawings, the reinforcement shall be placed so that there will be a clear distance of at least 1 inch between the reinforcement and any anchor bolts, form ties, or other embedded metalwork.

The Government will not furnish supplemental bar-placing diagrams, bar lists, and bar-bending diagrams. Any such additional diagrams and bar lists of this type which the contractor may require to facilitate the fabrication and placement of reinforcement shall be provided by the contractor. The cost of preparing such additional diagrams and bar lists, if provided, shall be included in the lump sum price bid in the schedule for furnishing and placing reinforcement. Reinforcement will be inspected for compliance with requirements as to size, shape, length, splicing, position, and amount after it has been placed.

159

3.1.9. Measurement and Payment

Measurement, for payment, of reinforcement will be made only of the weight of the reinforcement placed in the concrete, in accordance with the drawings or as directed. Payment for furnishing and placing reinforcement will be made at the unit price per pound bid therefor in the schedule, which unit price shall include the sort of furnishing and attaching wire ties and metal or other approved supports, if used, and of cutting, bending, cleaning, and securing and maintaining in position all reinforcement as shown on the drawings or as directed.

Cement will be paid for on the basis of the cwt (hundredweight) of cement used in the work covered by these specifications. One bag of cement shall be considered as 0.94 cwt of cement. Measurement, for payment, of cement will be on the basis of the number of bags of cement used at the mixer, except that no payment will be made for cement used in wasted concrete, cement used in damaged or defective concrete, or cement used in concrete required as a result of careless excavation, or excavation intentionally performed by the contractor to facilitate his operations, as determined by the contracting officer. Payment for furnishing and handling cement will be made at the unit price per cwt bid therefor in the schedule.

Measurement, for payment, of furnishing and placing concrete will be on the basis of cubic yards of concrete having the dimensions shown on the drawings or prescribed by the contracting officer. Payment for furnishing and placing concrete will be made at the unit price per cubic yard bid in the schedule therefor, which unit price shall include the cost of all labor and materials except that payment for furnishing and handling cement, and payment for furnishing and placing reinforcement will be made at the respective unit price bid therefor in the schedule.

3.1.10 Concrete Floor Hardener

a. General--The contractor shall furnish and apply a liquid floor hardener to the surfaces of the pump slab.

b. Materials--Fluosilicate crystals shall be used for floor hardener and shall be magnesium fluosilicate or zinc fluosilicate or a combination of both.

c. Applying liquid floor hardener--Two coats of liquid floor hardener shall be applied to the slab in a manner approved by the contracting officer. After the slab has been cured thoroughly and at such time as directed by the contracting officer, the surface shall be cleaned thoroughly of all dirt, grease, laitance, or other foreign matter and shall be allowed to dry, immediately after which the floor hardener shall be applied. The contractor shall prepare the hardener solution by dissolving fluosilicate crystals in the proportion of one-half pound of crystals per gallon of water for the first coat and 2 pounds of crystals per gallon of water for the second coat. The hardener solution shall be applied at a maximum coverage of 100-square-feet-per-gallon per coat. The solution shall be applied liberally by means of floor mops. Each coat shall be spread uniformly, and the presence of pools of the hardener solution shall be avoided. The first coat shall be allowed to dry thoroughly before the second coat is applied. After the second coat has dried, the floors shall be brushed and washed with water to remove any crystals which may have formed on the surface.

The contractor's cost for furnishing and applying liquid floor hardener and any work connected therewith shall be included in prices bid in the schedule for other items of work.

3.1.11 Grouting Mortar for Metalwork

a. General--Grouting mortar required to be placed under the baseplate of the pump shall be in accordance with this paragraph. The contractor shall furnish all materials.

b. Grouting mortar--Grouting mortar shall be composed of cement, water and sand. Cement, water and sand shall be in accordance with paragraph 3.1.2 (Materials), except that sand passing a No. 16 screen shall be used when clearances are such that the specified grading for sand is not suitable. Grouting mortar shall be mixed in the proportion of 1 part of portland cement to 2 and 1/2 parts of sand, by weight, and to the consistency prescribed by the contracting officer.

c. Preparation for placing, and placing--Before placing the grouting mortar, the surfaces of base concrete to which the mortar will be bonded shall be roughened and shall be cleaned of all laitance, loose or defective concrete, coatings, and other foreign material by effective means, followed by thorough washing with water. If any delay occurs between the washing of the concrete and placing of the mortar, the surfaces of the concrete shall be lubricated by washing with water immediately prior to placing of the mortar. Forms shall be used, where required, to confine the grouting mortar. The mortar shall be placed so as to completely fill spaces adjacent to equipment and metalwork as shown on the drawings.

d. Curing--The exposed surfaces of mortar shall be cured for 72 hours by keeping them covered with moist burlap, damp sand, or by other effective means approved by the contracting officer.

e. Cost--The costs of all work in connection with the grouting mortar operations and the cost of the cement, water and sand for mortar shall be included in the prices bid in the schedule for the items of work for which the mortar is required.

DIVISION 4 -- PIPE MANIFOLDS

SECTION 4.1--PIPE MANIFOLDS

4.1.1 Pipe Manifolds

a. General--The contractor shall furnish pipe appurtenances and fittings and construct the pipe manifolds as shown on the drawings and as herein specified.

During manufacturing, transporting, storing, and installing pipe and pipe fittings, the pipe and pipe fittings shall not be dropped or subjected to any unnecessary impact or other treatment that could damage the pipe.

Pipe shall not be stored in the yard or on the jobsite under conditions which would cause damage. Any length of pipe that, in the opinion of the contracting officer, is damaged beyond repair by the contractor by hauling, handling, unloading, storing or otherwise, shall be removed from the worksite and replaced by and at the expense of the contractor with another length of pipe of equal or greater strength.

b. Pipe--The contractor shall furnish and install steel pipe and fittings as specified in Paragraph 4.1.4 (Steel Pipe and Fittings).

Gaskets furnished with flanged fittings shall be suitable to withstand temperatures of 500°F.

c. Measurement and payment for pipe--Payment for furnishing and installing 3/4-inch and 3-inch manifolds and 8-inch modifications will be made at a lump sum unit price bid.

4.1.2 Testing the Pipe Manifold

a. Pressure test--After the pipe manifold has been installed and all joints completed, the contractor shall subject the pipe to a hydrostatic pressure of 350 lb/in^2 for a period of not less than one hour. No leakage will be allowed and any and all leaks shall promptly be made watertight.

The contractor shall furnish all pumping equipment, labor, tools, pressure gages, and other equipment, and water required for making the tests.

All exposed piping, fittings, and joints shall be carefully examined during the test. Any cracked or defective piping or fittings discovered during the pressure test shall be removed and replaced by the contractor with sound material and the test repeated as required, all at the expense of the contractor.

All testing shall be done in the presence of a duly authorized representative of the contracting officer.

b. Cost--The entire cost of testing the pipe manifold and of furnishing all equipment, labor, and materials for making the tests shall be included in the respective unit price bid in the schedule for furnishing and installing 8-, 3-, and 3/4-inch pipe manifolds.

4.1.3 Guarantee

The contractor shall furnish a guarantee against leakage of the pipeline for a period of one year from date of acceptance. Any leaks shall be corrected by the contractor, on notice from the contracting officer and at no cost to the Government. Any repairs to the pipeline shall be made in an acceptable manner as approved by the contracting officer.

In lieu of such guarantee the contractor may hydrostatically test the pipeline at 150 percent of the specifiied test pressure of the pipeline at the lowest point in the line. Any visible leaks shall be repaired. The installation will be considred acceptable when the specified test pressure has been maintained without loss for a period of not less than 2 hours or no leaks are observed during that period of time or such time as necessary for completing inspection of all joints along the pipeline.

4.1.4 Steel Pipe and Fittings

a. General--The contractor shall furnish, install, and insulate the steel piping, valves, appurtenances, and fittings for the pipe manifold complete with accessories in accordance with the requirements of these specifications and as shown on the drawings.

b. Materials--Materials shall be in accordance with the following requirements:

(1) 3-c, and 8-inch steel pipe--ASTM, Type E or S, Class A53A (Schedule 40), plain end.

(2) 3/4-inch steel pipe--ASTM A120 Type S (Schedule 40) galvanized.

(3) Flange gaskets--flat, asbestos, metallic reinforced.

(4) Bolts and nuts--Bolts - FF-B-575C, Grade II, Type II, or stud bolts; Nuts - FF-H-336D, Type II (Hexagon), Style 4; VNC coarse thread series.

(5) Steel welding flanges--ASTM Designation A181, Grade 1, 300# Class, raised face.

(6) Steel fittings--ASTM Designation A234, Schedule 40,long radius welding type, except where designated on the drawings. Fittings for 3/4-inch and smaller shall be Class 300 Malleable iron, screwed end.

(7) Insulation--Insulation for all brine steel pipe, fittings, valves, and appurtenances and tank, shall be equal to Johns-Manville "Metal-ON" aluminum-jacketed, calcium silicate insulation in nominal 1" thickness on the 3-inch piping, and 2-inch thickness on the 8-inch pipe and fittings, as furnished by Johns-Manville, 22 East 40th Street, New York, New York, 10016, and shall comply with the requirements of

Federal Specification HH-1-523c, Type II, Class C. Insulation shall be installed in accordance with the manufacturer's recommendations. Pump need not be insulated.

(8) Bellows type stainless steel expansion joints--Expansion joints shall have a traverse of one inch. Expansion joints shall be of the multi-ply, laminated, corrugated bellows construction; constructed of type 347 stainless steel. Each expansion joint shall be provided with ends consisting of rigid joint shall be provided with ends consisting of rigid flanges with elongated bolt holes. Self-equalizing stainless steel contour rings shall be provided in each corrugation. Each expansion joint shall be so constructed as to require not more than one hundred pounds to compress through its full rated traverse. Expansion joints shall be designed for 300 pounds working pressure and provided with self-guiding internal liners or guides. Expansion joints when installed shall be protected against both end loading and torsional stresses. Expansion joints shall be type 308-1230 supplied by Keflex, Inc., General Offices, San Francisco, California, 94111, or approved equal.

(9) Ball valves--3 inch and 8 inch ball valves shall be McCannaseal Model S301-CS-R-S6 Ball Valves, ANSI Class 300/ Flanged Ends/CS body stainless steel trim, reinforced teflon seats, top entry or approved equal.

(10) Miscellaneous materials -- Where materials are required but are not specified herein, the contractor shall furnish standard commercial quality material suitable for the intended use.

c. Fabrication--The steel pipe shall be fabricated in accordance with these specifications, the drawings and the requirements of the American Water Works Association Standard C201. Where provisions of the AWWA Standards conflict with provisions of these specifications and/or drawings, the provisions of these specifications and/or drawings shall govern. The requirements of Section 5.1 to 5.4 inclusive of the AWWA Standard C201 are not a part of these specifications.

d. Installation--The steel pipe and fittings shall be assembled and erected in place as shown on the drawings. The contractor shall furnish and install such temporary supports and bracing as may be required to hold the pipe in place and prevent distortion during welding; however, the embedment of timber supports or the welding of temporary supports to the pipe shell will not be permitted. Expansion joints and pipe insulation shall be installed in accordance with the manufacturer's instructions.

e. Cleaning--Finished manifold shall be thoroughly cleaned and flushed with water or blown with steam or air to clear the pipe of dirt, mill scale, filings and other debris. Cleaning or flushing shall continue until no trash is evident in the exhaust or a clean stream of water is obtained at the outlet.

f. Measurement and payment--Measurement for payment and payment for furnishing and installing steel pipe, valves, expansion joints, and miscellaneous pipe fittings will be made as provided in Subparagraph 4.1.1c (Measurement and Payment for Pipe).

Measurement, for payment, for furnishing and installing the 3-inch and 8-inch pipe insulation will be made at a lump sum unit price bid.

DIVISION 5 -- MISCELLANEOUS METALWORK

SECTION 5.1 -- MISCELLANEOUS METALWORK

5.1.1 Miscellaneous Metalwork

a. General--The contractor shall furnish and install the shims, hangers, pipe supports, pipe roller chairs, and protection saddles, as shown on drawings as miscellaneous metalwork.

b. Materials--Materials shall conform to the following requirements:

(1) Structural steel--Structural shapes, plates, and bars shall conform to Federal Specification QQ-S-741D, ASTM Designation: A36.

(2) Steel pipe--ASTM A120, seamless black steel.

(3) Bolts and nuts--Bolts shall conform to Federal Specification FF-B-575C, Type I or II; Nuts - FF-B-836D, Type I or II, Style 1 or 4.

(4) Pipe roller chairs--Pipe roller supports for Type A pipe supports shall be equal to No. 175 as offered by the ITT Grinnell Corp.(Catalog PH-76).

(5) Protection saddles--Saddles for the protection of the pipe insulation at pipe supports shall be ITT Grinnell Corp. (Catalog PH-76). No. 162 protection saddle for 2- and 1-inch insulation, or approved equal.

(6) Materials for miscellaneous metalwork not specifically covered herein by detailed specifications shall be of good commercial quality approved by the contracting officer.

c. Fabrication--Metalwork shall be fabricated in accordance with the drawings and with the applicable provisions of the "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction.

d. Welding--Welding shall conform with the requirements of the American Welding Society Code AWS D1.0.

e. Measurement and payment--Measurement, for payment, for miscellaneous metalwork shall be made in pounds of metalwork incorporated into the work.

Payment for supports, pipe anchor chairs, and pipe protection saddles will be made at the unit price per pound bid therefor in the schedule, which price shall include the cost of all labor, materials, fabricating, installing and any incidentals associated therewith.

Payment for furnishing and installing all other metalwork for which unit prices are not provided in the schedule will be made as miscellaneous metalwork at the unit price per pound bid therefor in the schedule, which price shall include the cost of all labor, materials and incidentals associated therewith.

DIVISION 6 -- INSTRUMENTATION

SECTION 6.1--INSTRUMENTATION

6.1.1 General

The contractor shall furnish all plant, labor, equipment, appliances and materials and perform all operations in connection with the installation of instrumentation in accordance with this section and Drawing No. 6821.22N-02.

All materials furnished shall be as specified herein. No departures shall be made without written approval. All workmanship shall be of the highest quality.

All installation shall be performed in accordance with information in this specification, Instrument Society of America Recommended Practices, or as indicated on the drawings.

Clamps, brackets, supports, etc., shall not be welded to process piping, electrical conduit, vessels or equipment. "U" bolts or other types of approved clamps shall be used.

6.1.2 Instruments

a. Temperature indicators--T-1 Brine Service, Bi-metal 5" dial adjustable thermometer, 304 ss case and stem - 2-1/2" long, 0-500°F RN, 1/2" NPT male conn., with 1/2" x 3/4" NPT thermowell. Rochester R-1849 or approved equal.

b. Pressure Indicators--P-1 Brine Service, 316 ss Bourdon tube and case, 4-1/2" Dial, 0-400 psi range, 1/4" NPT bottom conn. Marshal Model E 5460 type 100-3SS-MS or approved equal.

6.1.3 Nameplates

The contractor shall supply and install permanent nameplates on all locally mounted instruments, and control valves.

All instruments and valves shall be tagged with corresponding numbers as indicated on Drawing No. 6821.22N-02.

6.1.4 Payment

Contractor shall bid cost of appropriate instrumentation as lump sum.

DIVISION 7 -- PUMP

SECTION 7.1--PUMP

7.1.1 Pump

a. General--The contractor shall furnish and install the pump in accordance with these specifications and as shown on Drawing No. 6821.22N-02.

b. Performance--The pump shall deliver 150 GPM of 350°F geothermal brine, at 0.89 specific gravity, with a suction pressure of 145 psig and a discharge pressure of 195 psig.

c. Materials--Pump shall be equal to Buffalo, Kinematic pump, H-254-2013 Type HCR, hermetically sealed Can-O-Matic, and 10 HP, 3 phase, 60 Hz, 460 V, 1750 RPM, TEFC Motor.

d. Payment--Payment for furnishing and installing the pump will be made at the unit price bid therefor in the schedule.

DIVISION 8 -- ELECTRICAL SYSTEM

SECTION 8.1--ELECTRICAL SYSTEM

8.1.1 General

a. General--The contractor shall furnish and install all electrical equipment and materials to complete and make ready for service the electrical service to booster.

The contractor shall place accurately in position, level and plumb, connect, adjust, and make ready for service the motor starter, grounding system, conduit system, insulated electrical wires and cables, and all other equipment and materials required by these specifications. All installations, assembly operations, and adjustments shall be in accordance with the following, and in the event of conflicting requirements, precedence is established by the order of the following:

(1) The latest edition of "National Electrical Code", the National Electrical Safety Code, and the adopted electrical code of the county and state in which the construction will be performed.
(2) Manufacturer's instruction data furnished with the equipment.
(3) These specifications and the drawings included herein or as directed by the contracting officer.
(4) The Bureau of Reclamation Design Standards No. 5, "Field Procedures for Electrical Installation", a copy of which will be furnished to the contractor upon request.

The electrical system shall be maintained and protected by the contractor in a satisfactory condition until final acceptance by the Government. Defective materials and equipment damaged in the course of installation or testing shall be replaced or repaired by and at the expense of the contractor in a manner meeting the approval of the contracting officer.

Temporary lighting equipment, if required or necessary to accommodate and facilitate the contractor's work operations, shall be provided, installed, and removed by and at the expense of the contractor.

b. Earthwork--The excavation of trenches, backfill and compacting of backfill in trenches for conduit shall be performed in accordance with the provisions of Paragraph 2.1.6 (Excavation and Backfill for Trenches). Conduits shall be buried to a minimum depth of 18 inches unless otherwise shown on the drawings or directed by the contracting officer. Suitable select backfill shall be placed around all conduit and all backfill compacted as provided in Paragraph 2.1.6 (Excavation and Backfill for Trenches). Timber protection above the low voltage distribution direct burial cable will not be required. No direct payment will be made for earthwork for burying conduit and cable but the cost thereof shall be included in the prices bid in the schedule for related items of work.

c. Payment--Payment will be made in accordance with Paragraph 8.1.9 (Payment).

8.1.2 Acceptance of Electrical Systems

After the work required under these specifications has been completed, the systems will be tested and operated, by and at the expense of the Government. These acceptance tests are exclusive of the operational tests covered under other paragrahss of these speicfications. The tests may be witnessed by the contractor or his representative. Final payment under the contract will not be made until each item is completed and accepted in its entirety, these tests are completed, and the contracting officer has determined that the requirements of these specifications have been fulfilled: Except, that if the Government, through no fault of the contractor or of the materials furnished by the contractor is delayed in making the acceptance tests beyond a period of 30 days from the date of final completion of the installation of all equipment, payment of the balance due under the contract will be made at the end of the 30 day period.

8.1.3 Drawings and Data to be Furnished by the Contractor

a. Approval drawings and data--Within fortyfive (45) calendar days after date or receipt of notice to proceed and before proceeding with procurement of materials, the contractor shall submit to the Government five sets of drawings and data for approval. The drawings and data shall include:

(1) Manufacturer's detailed drawings, data, and description of the motor starter.

(2) Manufacturer's data and description of circuit breaker.

Any material shipped before approval of drawings and data will be at the contractor's risk. The Government shall have the right to require the contractor to make any changes in the equipment design and installation details which may be necessary to make the equipment conform to the requirements and intent of these specifications without additional cost to the Government. Approval of drawings and data by the Government shall not be held to relieve the contractor of any part of the contractor's obligation to meet all of the requirements of these specifications nor of the responsibility for the correctness of the drawings and data submitted.

The submittal of data required under this paragraph shall be complete, shall be made at one time, and shall include all data required to be submitted under the provisions of this paragraph. Three copies of all data required above shall be forwarded by the contractor and not by subcontractors, to the Construction Engineer, Yuma Projects Office, P.O. Bin 5569, Yuma, Arizona 85364. The contractor shall forward a copy of his transmittal letter with the other two copies to the Regional Director, Lower Colorado Region, P.O. Box 427, Boulder City, Nevada 89005.

b. Cost--The cost of submitting drawings and data to the Government shall be included in the lump sum price bid in the schedule for furnishing and installing electrical systems.

8.1.4 Grounding

a. General--The grounding system shall be in accordance with Drawing No. 6821.22N-01 and as specified herein.

The contractor shall furnish and install the grounding system, consisting of bare stranded copper cables, and accessories. Accessories shall include cable clamps, connectors, and other incidentals.

b. Materials--

(1) Ground cables--All ground cables shall be annealed, bare copper cable, concentric stranded, and in accordance with ASTM Designation: B 8, Class B. The solid wires used in forming the cables shall be in accordance with ASTM Designation: B 3.

(2) Cable fittings, lugs, and connectors--All cable fittings shall be of the solderless type and shall have current-carrying capacity equal to that of the copper cable with which they are used. All cable fittings, lugs, connectors, together with the bolts, nuts, and washers used therewith and the bolts, nuts, and washers which are used to make the connection to the equipment, shall be of copper alloy, containing not more than 4 percent zinc.

c. Installation--

The contractor shall make all necessary connections for the complete grounding system. Motor frames and metallic enclosures of all electrical equipment shall be connected to the ground rod at the base of the transformer pole.

Grounding conductors shall be embedded, buried or concealed insofar as possible. All paint, scale, and enamel shall be removed from the points of contact on metal surfaces before ground connections are made. Where the finish has been removed from equipment to install ground connections, the finish shall be repaired in accordance with Section 9.1 (Painting).

d. Cost--The cost of furnishing and installing the grounding system shall be included in the lump sum price bid in the schedule, for furnishing and installing electrical systems, which lump sum price shall include the cost of all materials, labor, and equipment, including earthwork, to install the grounding system.

8.1.5 Electrical Conduit System

a. General--The contractor shall furnish and install all electrical rigid steel conduit and accessories required for the power system as shown on the drawing.

Conduit accessories shall include conduit fittings, bushed elbows, nipples, chase nipples, connectors, reducers, outlet bodies, outlet body extensions, 1/2 inch pipe extensions for conduit drains, outlet boxes, outlet box extensions, caps, pipe plugs, locknuts, bondnuts, bushings, pull boxes, concrete yard pull boxes, junction boxes, junction box extensions, octagonal concrete rings and backplates, adapters, adhesive, sealing varnish, threaded joint compound, expansion couplings, sealtight conduit fittings, materials for sealing the ends of conduits terminating at outdoor equipment, and all other incidentals required to complete the conduit system, and to fasten, clamp, attach, and support conduit in place.

b. Materials--Materials for the electrical conduit installations shall conform to the standards of Underwriters' Laboratories, Inc., and to the latest edition and amendments of the following specifications:

(1) Rigid steel conduit--W-C-581d(3), zinc coated.

(2) Flexible metal conduit--Shall be galvanized steel core with a copper bonding conductor between the spiral segments and with an extruded synthetic jacket overall to insure a watertight conduit. Conduit shall be American Brass "Sealtite" Type UA or equal with grounding-type fittings approved for this type of flexible conduit.

(3) Conduit Fittings--W-F-406b(1) and W-F-408c(1).

(4) Plastic-coated conduit and plastic-coated conduit fittings--Shall be rigid steel conduit WW-C-581d(3), W-F-406b(1), and W-F-408c(1), zinc coated, with factory-applied plastic-compound protective coat at least .040 inch thick and placed uniformly around the conduit and equal to Republic Steel Corporation DEKORAN, Pittsburg Standard PLASTI-BOND, General Electric Company plastic-jacketed rigid conduit, or OCAL, made by Occidental Coating Company. All joints of plastic-coated conduit shall be taped so that a complete and positive seal is assured (see Subparagraph (10) below).

(5) Protective varnish--Protective varnish shall conform to General Electric Company "Glyptal" No. 1201-B, Westinghouse Electric Corporation No. B-6-614, or equal.

(6) Outlet bodies--W-C-586b, cast iron, malleable iron, or cast aluminum, Class 1 for embedded conduit systems. Covers for outlet bodies shall be metal and covers on bodies exposed to moisture shall be provided with gaskets.

(7) Junction boxes; junction box extensions; and junction box covers (steel, cadmium, or zinc coated)--W-J-800c(3).

(8) Pull boxes, terminal boxes, and junction boxes--Unless stated otherwise in these specifications, these boxes shall be constructed of sheet steel of not less than No. 10 United States Standard gage and shall be thoroughly cleaned and have a primer coat of red vinyl resin paint followed by a coat of gray vinyl resin paint. Terminal blocks shall be provided where required.

(9) Tape--Tape for wrapping the joints of plastic-coated conduit shall be not less than 2 inches wide and not less than 0.01 inch thick and shall consist of a polyvinyl-chloride or polyethylene film having high-strength and close-molding properties and having a pressure-sensitive adhesive.

c. Installation--All conduit shall be installed with necessary fittings and supports, and all bends shall be gradual and smooth to permit the pulling of insulated electrical wires and cables without undue stress or damage to the insulated electrical wires and cable sheath or to the conduit. All conduit runs and bends shall be entirely free from kinks, indentations, or flattened surfaces. All metal conduit bends made in the field shall be bent cold to prevent damage to the protective coating. Burrs and sharp corners at the ends of each piece of metal conduit shall be removed.

The male threads of rigid conduit joints shall be coated with a suitable sealing material before making joints and shall be tightened securely to prevent the entrance of moisture or any other foreign material. For steel conduit, the completed joints and terminations, all wrench marks, and all other places where the zinc covering is damaged shall be covered entirely with a protective varnish to provide protection from corrosion. Bushings or chase nipples shall be installed on the ends of conduit to protect the insulation or sheath of the wires or cables from abrasion; and locknuts and bondnuts shall be installed to provide tight ground connections between conduit boxes, and cabinets.

All exposed conduits shall be rigidly supported at intervals of not more than 10 feet, unless otherwise specified or directed. The supports shall be of a design acceptable to the contracting officer. The installation of exposed conduit shall include, where required, the drilling of holes in the bottom and top of enclosures or plates and in the side of enclosures of electrical equipment. The contractor shall drill all

holes in concrete or structural members required for installation of expansion anchors or clamps for exposed conduit runs. All exposed conduit shall be tightened securely and shall be supported rigidly in place. Flexible conduit shall be used to make conduit connections to electrical equipment such as motors and equipment where shown. All flexible conduit and connectors shall be approved grounding type.

All metal conduit buried directly in earth shall be protected by a factory-applied plastic coat. All joints of plastic-coated conduit shall be made with watertight fittings which shall be taped with polyvinyl-chloride or polyethylene tape or covered in accordance with the manufacturer's instructions and any damaged portions of the protective coat shall be repaired or covered in accordance with the manufacturer's instructions. The covering shall extend at least 3 inches above the ground surface, as applicable.

Bending of plastic-coated conduit shall be performed in accordance with the manufacturer's recommendations. Where the manufacturer warns of possible damage to plastic coating when bending the larger size of conduit, factory bends shall be used.

Buried electrical conduit shall have 2 inches of sand or fine earth around each conduit. The remaining portions of the trenches shall be backfilled and compacted as provided in Paragraph 2.1.6 (Excavation and Backfill for Trenches).

At electrical equipment enclosures not equipped with threaded hubs, conduits shall be terminated with double locknuts and end bushing.

Conduit low points shall be drained where and as directed by the contracting officer. Conduits used solely as drains shall be 1/2 inch.

8.1.6 Insulated Electrical Wires and Cables

a. General--The contractor shall furnish and install all single-conductor insulated electrical wires, cables, and cable installation accessories for the electrical system. Cable installation accessories shall include marking

tags, insulating tape, connectors, fittings, and other incidentals required for completing the installations. Aluminum connectors using aluminum screws will not be permitted.

For the electrical installation, the term "wire" applies only where a single solid insulated electrical conductor is used and the term "cable" shall apply to either a stranded electrical conductor (single-conductor cable) or a combination of electrical conductors insulated from one another (multiple-conductor cable), except grounding cable shall be uninsulated.

All wire and cable sizes shall be as shown on the drawings and as specified herein.

b. Materials--Insulated electrical wires and cables shall be "National Electrical Code" grade of the types listed below and shall have been manufactured within 24 months prior to receipt of notice to proceed. Unless otherwise specified, conductors shall be soft annealed, Class B, stranded copper. All conductors No. 6 AWG and larger shall be stranded.

(1) 600-volt, single-conductor, copper:
    (a) For 75°C conductor temperature, general use service: Type THW.
    (b) For 90°C conductor temperature: Types THHW or XHHW.

c. Installation--The contractor shall install the wires and cables in conduits, wireways, or enclosures, where required.

Sufficient length shall be left at the ends of wires and cables to make connections conveniently to the equipment and devices.

Wire and cables shall not be pulled into conduits until the conduit runs have been cleaned and are free from obstructions and sharp corners. A clean, dry, tight-fitting rag shall be drawn through the conduit immediately before installing the wire or cable. The wires and cables shall be installed so that there will be no cuts or abrasions in the insulation or protective

covering or kinks in the wires and cables. No splices shall be made in wires or cables, except at boxes, wireways, outlets, or electrical equipment enclosures. Only gradual and uniform pulling stresses will be permitted on wires and cables. Where a lubricant is needed as an aid to the pulling of wires and cables, only soapstone or other approved material not injurious to the wire or cable sheath shall be used. Any wire or cable damaged during installation shall be removed and replaced with equivalent wire or cable at the contractor's expense.

All wires and cables shall be marked with circuit designation at each end and where the wires or cables are connected to terminals, terminal blocks, or connectors. The designations shall be applied to the wire or cable ends by using identification markers similar to the W.H. Brady Company No. B-500 vinyl-cloth tape with a silicone-plastic overcoating.

All runs, connections, and taping of wires and cables shall be made carefully and neatly. Bolted solderless-type terminal lugs and connectors shall be used for joining or connecting cables larger than No. 8 AWG. All terminal lugs and connectors shall have current-carrying capacity equal to that of the conductor with which they are used. No. 8 AWG and smaller stranded cables shall have suitable solderless lugs for connecting to terminal blocks and terminal studs. When No. 8 AWG and smaller size wires and cables are spliced, they shall be joined so as to be mechanically and electrically secure. All insulated wire and cable splices and terminations shall be performed in accordance with the cable manufacturer's recommendations.

8.1.7 Motor Starter

a. General--The contractor shall furnish and install one motor starter for control of the booster pump.

b. Equipment--Starter shall be non-reversing, combination full voltage magnetic type and non-fusible disconnect switch, manufactured in accordance with the latest published NEMA standards, sizes, and horsepower ratings. Combination starter shall be mounted in NEMA 4 enclosure.

Starter shall be 3-pole, 480 volt, 3-phase, NEMA Size 1, equipped with three overload relays. Overload relays shall be ambient compensating or of adjustable type to compensate for ambient conditions. Starter shall be provided with 2 NO and 2 NC auxiliary contacts in addition to the hold-in interlock. Starter shall also be provided with H-O-A selector switch mounted on the door of the enclosure. The starter shall have 120 volt coil.

Operating handle for disconnect switch shall not be mounted on the door of the enclosure but to the side of the door and shall be always in control of the disconnect device with the door opened or closed. The disconnect handle shall be clearly marked as to whether the disconnect device is ON or OFF.

c. Installation--The motor starter shall be installed at the location shown on the drawing. The starter shall be securely mounted on steel frame as detailed on the drawing. Painting removed from pipe support rack in the process of welding shall be restored to its original condition.

8.1.8 Circuit Breaker

a. General--The contractor shall furnish and install one circuit breaker for overcurrent protection of booster pump feeder.

b. Circuit Breaker--Circuit breaker shall be manufactured in accordance with the latest NEMA standards (Publication No. AB1) Molded Case Circuit Breakers, with number of poles and trip rating as indicated on the drawing. The circuit breaker shall be furnished with thermal-magnetic overload devices and shall have an interrupting rating of 14,000 symmetrical RMS amperes at 480 volts. The circuit breaker shall be installed in a NEMA 4 enclosure.

c. Installation -- The circuit breaker shall be installed at the location shown on the drawing or as directed by the contracting officer.

8.1.9 Motor Control

Pump protector underload (cavitation) power sensing analog control KRATOS part no. 85.312 or approved equal.

8.1.10 Payment

Payment for furnishing and installing the electrical service for booster pump shown on the drawing and herein specified will be made at the lump sum price bid therefor in the schedule, which price shall include all labor, materials, motor starter, conduit and wiring, earthwork, transportation, and all incidentals required for complete installation of the electrical system.

DIVISION 9 -- PAINTING

SECTION 9.1--PAINTING

9.1.1 Painting

a. General--The contractor shall furnish all materials, clean surfaces and apply the paint and protective coatings listed in Paragraph 9.1.2. (Painting Tabulation) and in accordance with Paragraph 9.1.3. (Color Schedule for Painting).

Items or surfaces not required to be painted or coated but which are adjacent to surfaces to be cleaned and painted shall be protected against contamination and damage during the cleaning and painting operations. The cleaning and painting operations shall be so conducted that dust or other contamination from the cleaning process will not fall on wet, newly painted surfaces, and newly painted metalwork shall not be moved until the paint is dry hard. All contractor-applied coatings exposed to view, including any touchup repair painting, shall present a uniform color-matched appearance. Any items or surfaces damaged or contaminated by painting operations shall be returned to their original condition by and at the expense of the contractor. Before topcoating any coated surfaces, the contractor shall reclean any exposed metal and apply paint as necessary to restore to the specified condition all previously applied paint in areas which are defective or damaged. Materials which have been painted shall be handled with care and protected as necessary to preserve the coating in good condition.

Temporary or permanent welding for the convenience of the contractor will not be permitted on areas where the welding will damage paint or other protective coatings unless the areas of coatings which would be damaged thereby are accessible for repairing and inspection. Unless otherwise specified, the contractor will not be required to disassemble machinery, equipment or other metalwork for the purpose of painting the interiors. The contractor shall provide adequate ventilation, lighting and the necessary safety equipment for the protection of the workmen during painting and coating operation.

b. Preparation of surfaces--Surface preparation shall be in accordance with one of the following methods. The method to be used for each item is indicated in the painting tabulation. Weld spatter, slag burrs, or other objectionable surface irregularities shall be removed or repaired before cleaning. Any contaminants to the paint coating, from cleaning operations or other sources, shall be removed before the surface are painted. Cleaning solvent shall be mineral spirits or xylol. Cleaning cloths and solvents shall be discarded before they become contaminated to the extent that a greasy film would remain on the surface after preparation of the surface. In the event that rust forms or the surfaces become otherwise contaminated in the interval between cleaning and painting, or between coats of paint, recleaning will be required. Any coatings not required by and not shown in the painting tabulation shall be removed from the surfaces by suitable and effective means, unless otherwise directed.

Method A All oil, grease, and dirt shall be removed by the use of clean solvent and clean, lint-free wiping material or other effective means. Surfaces with gloss or semigloss paints shall also be sanded lightly.

Method B All oil and grease shall be removed by the use of clean solvent and clean, lint-free wiping materials. Following the solvent cleaning, the surfaces shall be cleaned of all defective or damaged areas of existing paint, and of all loose rust, loose mill scale, and other foreign substances by scraping, chipping, wire brushing, grit-blasting, commercial grade sandblasting, or other effective means.

c. Preparation of other surfaces--All surfaces not covered by the above sub-paragraphs shall be prepared by methods common to good practice for the particular surface being prepared.

d. Application--Materials shall be thoroughly mixed at the time of application. Surfaces shall be clean and free from moisture at the time of application. Items to be painted that are not thoroughly dry at the time of paint application shall be heated to a sufficient temperature (80°F) to drive off any moisture present before paint is applied. Effective means shall be provided for removing free oil and moisture from the air-supply lines of all spraying equipment. Care shall be exercised during spray application to hold the nozzle sufficiently

close to the 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. Nozzle pressure consistent with acceptable finish results shall be employed when spray painting.

Each coat shall be applied in such a manner as to produce an even film of uniform thickness which will completely cover irregularities, fill crevices, and be tightly bonded to the metal or previous coat. Each coat shall be free from runs, pinholes, and sags.

Each coat shall be allowed to dry or to harden before the succeeding coat is applied. Thicknesses shall be measured by an approved dry-film thickness gage and shall be not less than the minimum specified thickness at any point on the coating. Acceptance will be based on the total dry-film thickness gage and shall be not less than the minimum specified thickness at any point on the coating. Acceptance will be based on the total dry-film thickness as measured by an Elcometer, Mikrotest, or other suitable dry-film thickness gage, after the complete paint system has thoroughly dried.

Red lead priming paint, regular aluminum paint, and enamels, and oil base paints may be thinned if necessary to permit satisfactory application, in which event mineral spirits shall be used and the amount of thinner shall be kept to a minimum but in no event shall it exceed 1 pint per gallon of paint.

If necessary to improve application properties, cold-applied paints may be heated by means of a hot-water bath to temperatures not to exceed 100°F. Paint shall not be applied when the temperature of the item to be painted or the surrounding air is under 45°F., except that vinyl resin paints shall not be applied when metal or air temperatures are above 110° or below 40°F. Painting shall proceed only when the humidity and the temperatures of atmosphere and of surfaces to be painted are such that evaporation rather than condensation will result. Brush coats may be applied by the conventional brushing procedure, or the paint may be delivered to the surface in a fluid stream by means of spray equipment employing air pressure only on the material and the paint then spread immediately by brushing to an even smooth coating.

Tinting, where required for color contrast, shall be accomplished by using not more than 3 ounces of tinting color per gallon of paint.

Application of specific materials shall be as follows:

(1) Red lead priming paint shall be applied at a maximum coverage of 500-square-feet-per gallon per coat for Type II but the dry film thickness shall be not less than 1.0 mil for the first coat. Zinc-dust-zincoxide paint shall be applied at a maximum coverage of 500-square feet-per-gallon per coat. Following the first coat of red lead paints, an additional tinted coat shall be applied over all rivets, welds, bolts, seams, sharp corners, and edges before subsequent painting. Alternate coats shall be tinted for color contrast using 1B black. The first coat shall be applied by brush or roller and subsequent coats shall be applied by either brush, roller, or spray, except that Type II red lead priming paint may be applied by spraying when Method B surface preparation is specified and the surface is cleaned by "commercial" grade blast cleaning.

(2) Aluminum paints shall be applied by spraying at a maximum coverage of 500-square-feet-per-gallon per coat for regular aluminum paint. The paints shall be prepared by mixing 2 pounds of aluminum paste per gallon of mixing varnish and only enough paint for each day's use shall be prepared at one time. The first coat shall be tinted for color contrast using 2A blue. The final coat of aluminum paint shall be "stripe free" with a uniform appearance.

(3) Enamels, and oil base paints, shall be applied by brush, roller, or spray at a maximum coverage of 500-square-feet-per-gallon per coat.

e. Materials--All pigmented paints and primers shall be purchased in containers not larger than 5 gallons as packaged by the manufacturer. Colors of finish paints shall be as directed in accordance with Federal Standard No. 595a. All colors shall be factory mixed and ground. Tinting with universal tinting colors will not be permitted, and tinting with colors-in-oil is permitted only where specified for slight contrast between coats. Materials shall be in accordance with the following specifications, or may be in accordance with the subsequent revisions thereto: Provided, that the samples or certifications are identified with the proper specifications revision:

Group I

(1) Federal Specifications--

(a) Red lead priming paint, TT-P-86g, Type II.

(b) Mixing varnish for regular aluminum paint, TT-V-81d, and aluminum paste, TT-P-320c, Type II, Class 2.

(c) Zinc dust-zinc oxide primer, TT-P-641f, Type II.

(d) Primer coating, zinc cust, chlorinated rubber, TT-P-001046(1), (Galvanizing repair compound.)

(e) Enamel, gloss, TT-E-489f(1), Class A.

(2) Miscellaneous Specifications--

(a) Paint and coating materials required to be used on work covered by these specifications and which are not covered by this paragraph will be classified as Group I materials, unless otherwise indicated.

Group II

(1) Federal Specifications--

(a) Pigment-in-oil (tinting colors), TT-P-381E(1). Colors 1B black and 2A blue, or equal tinting color in oil.

(b) Mineral spirits, TT-T-291E, Grade 1.

(c) Xylol (xylene), TT-X-916b, Grade A or B.

f. Sampling, testing, and certification of materials--The Government will test or require certification of each batch, type, or color of paints or related materials prior to use of application. However, acceptance of the material under the clause of the General Provisions entitled "Inspection and Acceptance" will not be made until the material has been satisfactorily applied and the equipment installed at the jobsite.

The contractor shall furnish copies of all purchase orders for paint or related materials to the contracting officer. Copies of purchase orders shall be furnished far enough in advance of planned use so that the samples, shall be furnished far enough in advance of planned use so that the samples, if required, will be available to the Government to allow a testing period of at least 45 days. The Government will then inform the contractor in writing whether materials covered by each purchase order will be tested or whether the manufacturer's certification will be required. The Government will then inform the contractor in writing whether materials covered by each purchase order will be tested or

189 whether the manufacturer's certification will be required. The Government will act on certifications as to paint conformance within 16 days after receipt of the certifications by the Government, and will notify the contractor. Purchase orders and the required certifications or samples shall be furnished by the contractor to the Bureau of Reclamation, Construction Engineer, Yuma Projects Office, P.O. Bin 5569, Yuma, Arizona 85364, shipping costs prepaid, and copies of all correspondence shall be sent to the authorized representative of the contracting officer at the jobsite.

Certifications for each type, batch, or color of Group I materials shall include detailed results of laboratory tests covering all of the applicable specifications requirements and a general statement that the materials comply with the requirements of the specifications. Certifications for quantities of 10 gallons or less of each type, batch, or color of Group I materials may be furnished with only the manufacturer's quality control and composition data, and a general statement that the materials comply with the requirements of the specifications. The certifications shall also contain specific identification data as to material identification, batch number, date of manufacture, quantity being furnished, and the Bureau of Reclamation specifications number. Certifications for Group II materials need not include detailed laboratory testind data but shall comply in other respects with the requirements stated above. The Government reserves the right to test any materials furnished on certification when in the opinion of the Government, such tests are necessary. The contractor shall be responsible for the accuracy of all certifications submitted or data contained therein whether submitted by him, a manufacturer, a supplier, or a subcontractor.

The contractor shall purchase the total quantity of each item of material that is expected to be used in a reasonable length of time to avoid repetitive purchases that would impose additional testing expense on the Government. The costs and delays from additional testing required as a result of either unnecessary small purchases or rejection of the materials submitted shall be the responsibility of the contractor.

g. Costs--The cost of furnishing, preparing, and applying all materials for the cleaning, painting, or coating operations shall be included in the applicable prices bid in the schedule for the items of work requiring painting.

9.1.2 Painting Tabulation

Contractor furnished items shall receive the cleaning and coating systems shown in the tabulation following. Coatings shall be applied as required under Paragraph 9.1.1 (Painting).

No.	Item	Surface Preparation Method	Paint or Coating Material	Number of Coats
1	Damaged areas of paint on metalwork and equipment which are furnished complete painted or coated including:	Repair damaged areas to equal and color match undamaged contiguous areas.		
2	Damaged areas of galvanized surfaces that do not require finish painting	B	Zinc dust-zinc-oxide paint	2
3	Exterior exposed metalwork and exposed piping	B	Red lead priming paint, Type II	1
	a. Structural steel manifold piping supports		Regular aluminum paint	2

9.1.3 Color Schedule for Painting

The colors and gloss of finish coats of paints will be as selected by the contracting officer except as provided in Paragraph 9.1.2 (Painting Tabulation). If items are furnished with a manufacturer's finish painting, the color and gloss of which are acceptable to the contracting officer and which meet the cleaning and painting requirements of Paragraph 9.1.1. (Painting), such items will not require field painting except for repair of damaged painted surfaces.

Color schedules for painting will be provided by the contracting officer.

DIVISION 10 -- DRAWINGS

SECTION 10.1--DRAWINGS

10.1.1 Drawings, General

a. General--In the event there are minor differences as determined by the contracting officer between details and dimensions shown on the drawings and those of existing features at the site, the details and dimensions of existing features at the site shall govern.

The contractor shall check all drawings carefully and advise the contracting officer of any errors or omissions discovered.

b. Additional or revised drawings--Except as otherwise provided in these specifications for drawings to be furnished by the contractor, the specifications drawings will be supplemented by such additional or revised general and detail drawings as may be necessary or desirable as the work progresses; and the contractor will be required to perform the work in accordance with the additional general and detail drawings or revisions furnished by the Government at the applicable prices bid in the schedule for such work.

c. Additional copies of drawings--The contractor will be furnished such additional copies of the specifications and drawings as may be required for carrying out the work.

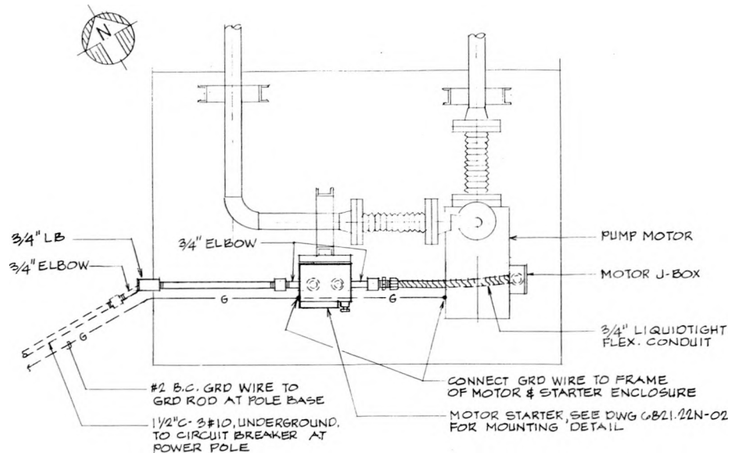
d. Mailing address--All drawings and data submitted by the contractor for which a specific mailing address is not given in these specifications shall be submitted to the Construction Engineer, Bureau of Reclamation, Yuma Projects Office, 3800 Avenue 3 East, P.O. Bin 5569, Yuma, Arizona 85364.

10.1.2 List of Drawings

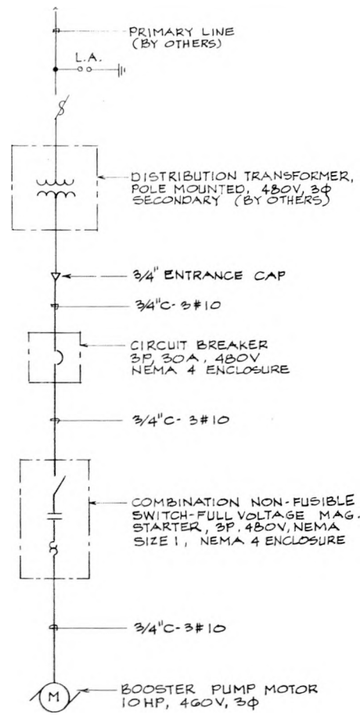
The following drawings are made a part of these specifications:

INJECTION PUMP SYSTEM

6821.22N-01	Site Plan and Electrical Details
6821.22N-02	Piping Plan and Details



BOOSTER PUMP PLAN
SCALE: 1" = 1'-0"



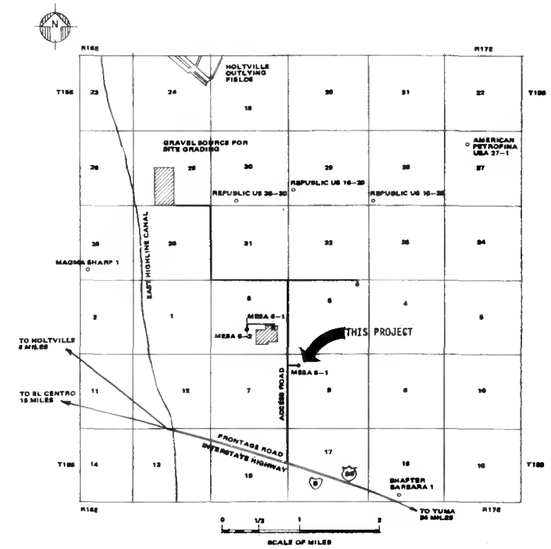
SINGLE LINE DIAGRAM

SITE PLAN
SCALE: 1" = 60'-0"

WELL 8-1 BOOSTER PUMP

DRAWING INDEX

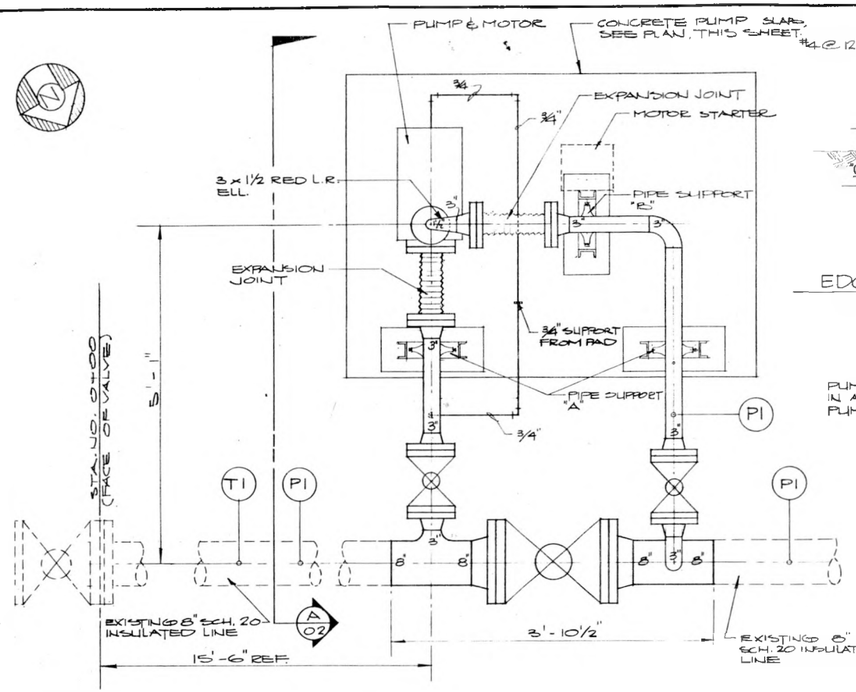
DRAWING NO.	TITLE
6821.22N-01	SITE PLAN AND ELECTRICAL DETAILS.
6821.22N-02	BOOSTER PUMP AND PAD DETAILS



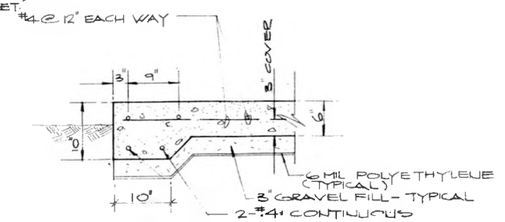
LOCATION PLAN

1" = 1'-0": 1' 9" 6" 3" 0 1 2 3 FEET
1" = 60'-0": 60' 40' 20' 0' 60' 120' 180' FEET

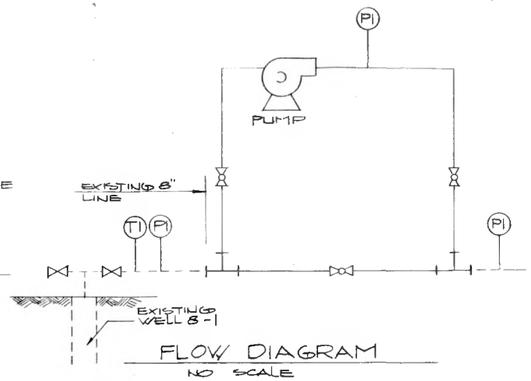
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
WELL 8-1 BOOSTER PUMP SITE PLAN AND ELECTRICAL DETAILS	
DATE 15 OCT 1976	DWG. NO. 6821.22N-01
DRAWN E.D.	
CHKD. RP	
APPRVD.	APPRVD. – PROGRAM OFFICE



PLAN – PUMP & PIPING INSTALLATION
SCALE: 1" = 1'-0"



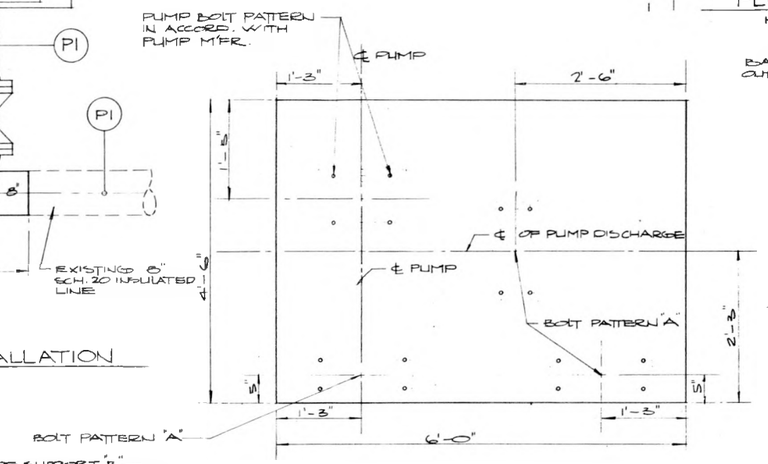
EDGE DETAIL – TYPICAL FOUR SIDES
SCALE: 1" = 1'-0"



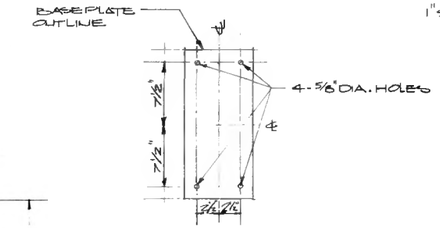
FLOW DIAGRAM
NO SCALE

LEGEND

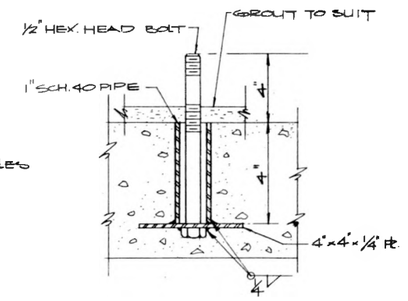
- T1 — TEMPERATURE INDICATOR
- PI — PRESSURE INDICATOR
- BALL VALVE
- GATE VALVE



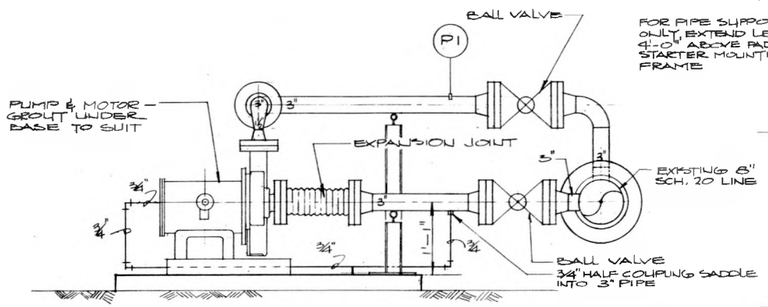
PLAN – PUMP SLAB
SCALE: 1" = 1'-0"



ANCHOR BOLT PATTERN "A"
SCALE: 1½" = 1'-0"

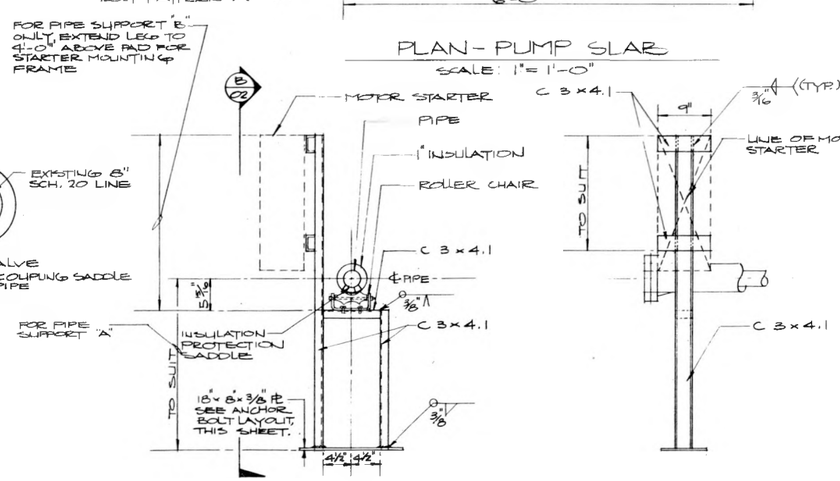


TYPICAL ANCHOR BOLT
NO SCALE

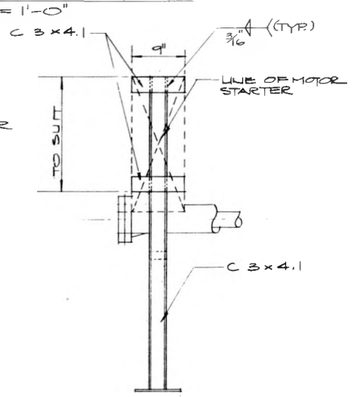


A/02 SECTION
SCALE: 1"=1'-0"

NOTE: INSULATION NOT SHOWN FOR CLARITY.



TYPICAL PIPE SUPPORT
SCALE: 1"=1'-0"



B/02 SECTION
SCALE: 1"=1'-0"

1" = 1'-0" — 1' 9" 6" 3" 0 1 2 3 FEET

1-1/2" = 1'-0" — 1' 9" 6" 3" 0 1 2 FEET

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION EAST MESA GEOTHERMAL COMPONENT TEST FACILITY	TRW SYSTEMS GROUP ENVIRONMENTAL, POWER AND FACILITIES DEPARTMENT SYSTEM INTEGRATION LABORATORY
WELL 8-1 BOOSTER PUMP BOOSTER PUMP AND PAD DETAILS	
DATE 15 OCT 1976 DRAWN D. RENAY CHKD. RP APPRVD.	DWG. NO. 6821.22N-02 APPRVD. – PROGRAM OFFICE R.O. Pearson