DOE/FE/05121--T1

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DE82 014501

The Design, Construction, and Operation of a Process-Development Unit for the High-Rate, Entrained-Flow Coal-Gasification Process

Quarterly Technical Progress Report No. 3

October - December 1981

MASTER

Prepared for

United States Department of Energy

under

Contract No. DE-AC01-81FE05121

Submitted by

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DISCLAIMER

PATENT STATUS

TECHNICAL STATUS

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1.0 INTRODUCTION AND SUMMARY

1.1 Introduction

Mountain Fuel Resources, Inc., a subsidiary of Mountain Fuel Supply Company, Salt Lake City, Utah, is under contract with the U. S. Department of Energy for a program to design, construct and operate a high-rate, entrained flow coal gasification process development unit (PDU). The objective of the program is to develop equipment components for gasification of coal to form a clean, intermediate-Btu fuel gas or a synthesis gas that may be converted to methyl alcohol, gasoline, synthetic natural gas or many other desirable products. Ford, Bacon & Davis Utah, Inc., is the principal subcontractor on the program, and will be largely responsible for design, construction and operation of the PDU.

The design of the coal gasification PDU is based on earlier DOE-supported work at the Eyring Research Institute, Provo, Utah. Pulverized coal is fed to an entrained flow reactor where it is gasified by reaction with steam and oxygen. The ash in the coal is removed as an inert slag and the product gas may be cleaned to remove sulfur-containing compounds and carbon dioxide to yield a clean fuel gas with a heating value near 300 Btu/standard cubic foot.

The PDU is to be located adjacent to a brick plant operated by Interstate Brick Company in West Jordan, Utah. Interstate Brick is also a subsidiary of Mountain Fuel Supply Company. Because of the developmental nature of the program, the PDU will contain only those components and features necessary to develop the gasifier and to operate it safely. The PDU will be operated intermittently, with test durations ranging from a few hours up to a maximum of four weeks. During later tests, the gas will be used in firing the brick kilns in the brick plant.

A low-sulfur, Utah bituminous coal will be used for most of the testing. Near the end of the planned effort, several tests up to 100 hours each will be made with alternate coals: a high-sulfur bituminous coal, a low-sulfur sub-bituminous coal, a lignite, and a coal char or residue.

1.2 Summary

Radiant heat exchanger, steam superheater, and transition pipe design work by Deutsche Babcock was started in mid-October and the first set of the drawings were delivered to MFR and FBDU in early December. The radiant heat exchanger design was revised and finalized. The gasifier injector head and reaction chamber design was completed.

During this period, purchase orders were issued for approximately 80 percent of the major equipment. Specifications were being prepared for the remaining equipment, i.e., coal conveyor, radiant heat exchanger and steam superheater and the transition pipe in-between.

The site preparation work was started in late September and was completed in October. The site fencing was also completed in October. Most of the foundations, except the coal handling building and liquid oxygen and nitrogen area were completed as of the end of December.

Building material arrived at the site in late December. Toward the end of this period, the field construction work was hampered by severe weather conditions.

The project schedule was reviewed and revised. The delay in the schedule was mainly due to a delay in awarding the heat exchanger design contract to Deutsche Babcock and slow response of the venders in providing information.

In late September, a project review meeting was held in Morgantown, West Virginia. In mid-December another project review meeting was held in Salt Lake City. A cost proposal for the additional effort to prepare the hazards analysis and control report was submitted to DOE.

2.0 ENGINEERING AND DESIGN

2.1 Gasifier Design

The gasifier design was completed in December. The coal feeder design was about 75 percent completed. The final design of the feeder will be completed after receiving detailed dimensions from the vendor which are necessary for modification of the feeder for pressurized application. Figure 1 shows the injector head and reaction chamber design.

2.2 High Temperature Heat Exchanger Design

The design of the radiant heat exchanger, steam superheater, and transition pipe was started on October 12. The first set of the detailed drawings of the radiant heat exchanger was delivered to Mountain Fuel Resources, Inc. and Ford, Bacon & Davis Utah on December 7. After a series of review meetings, the drawings were revised and finalized on December 11. Manufacture's specifications for the radiant heat exchanger and superheater shells were being prepared based on the approved drawings of the radiant heat exchanger and the preliminary design information of the superheater. Figure 2 and 3 show the gasifier shell.

2.3 Revised Process and Instrument Drawings

The process and instrument drawings (P&ID) were reviewed in November and again in December. The revised P&ID are attached (See Attachment A).

2.4 Revised Schedule

Due to a delay in awarding the radiant heat exchanger and superheat design subcontract and a delay in receiving design information from the vendors, the project schedule was revised. Attachment B shows the revised Phase I detailed project schedule for the period November 1981 through June 1982. The revisions resulted in a tighter schedule toward the end of Phase I. If the project progresses according to this schedule, Phase II schedule will not be affected and the overall project will be completed as originally scheduled.

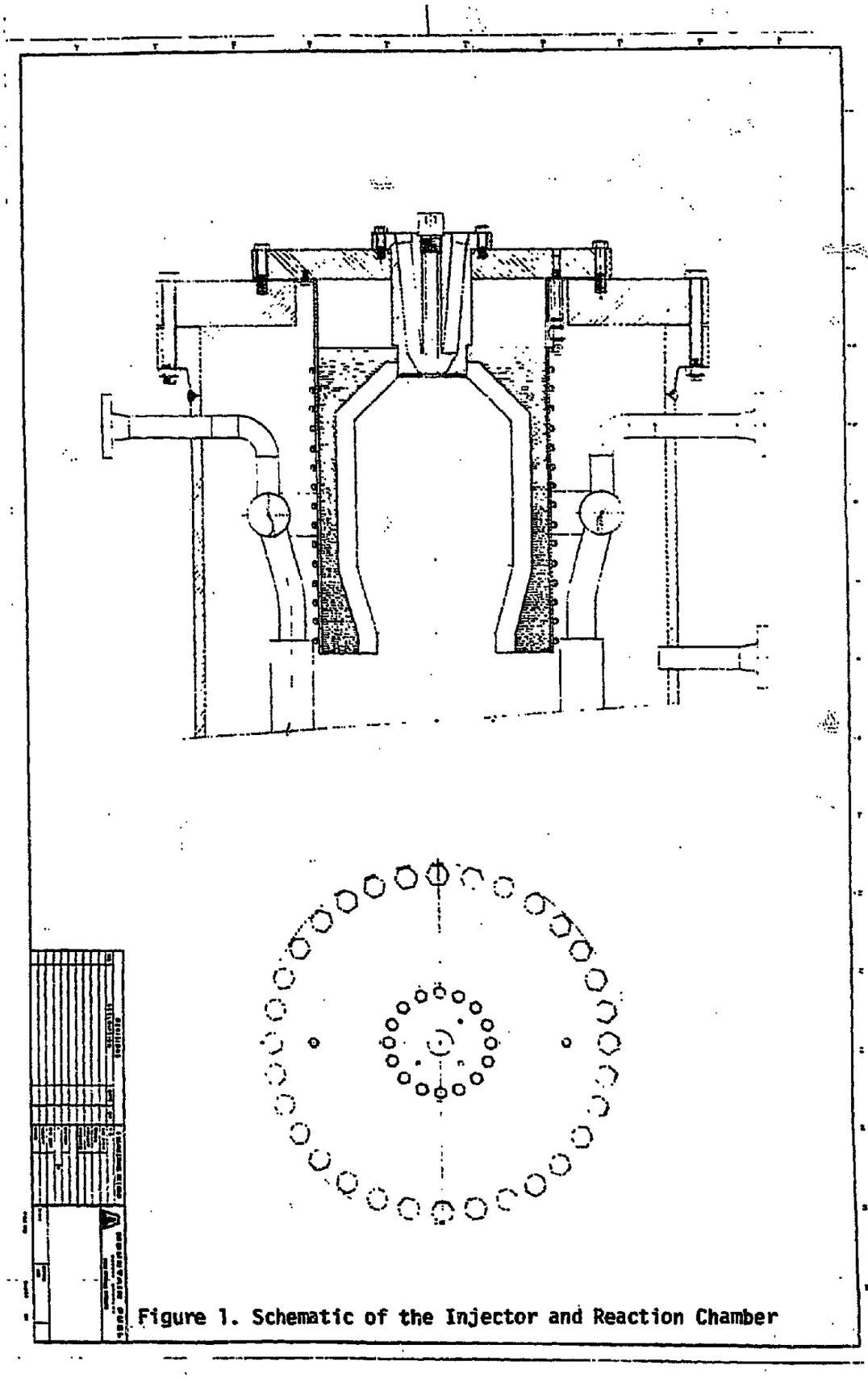


Figure 1. Schematic of the Injector and Reaction Chamber

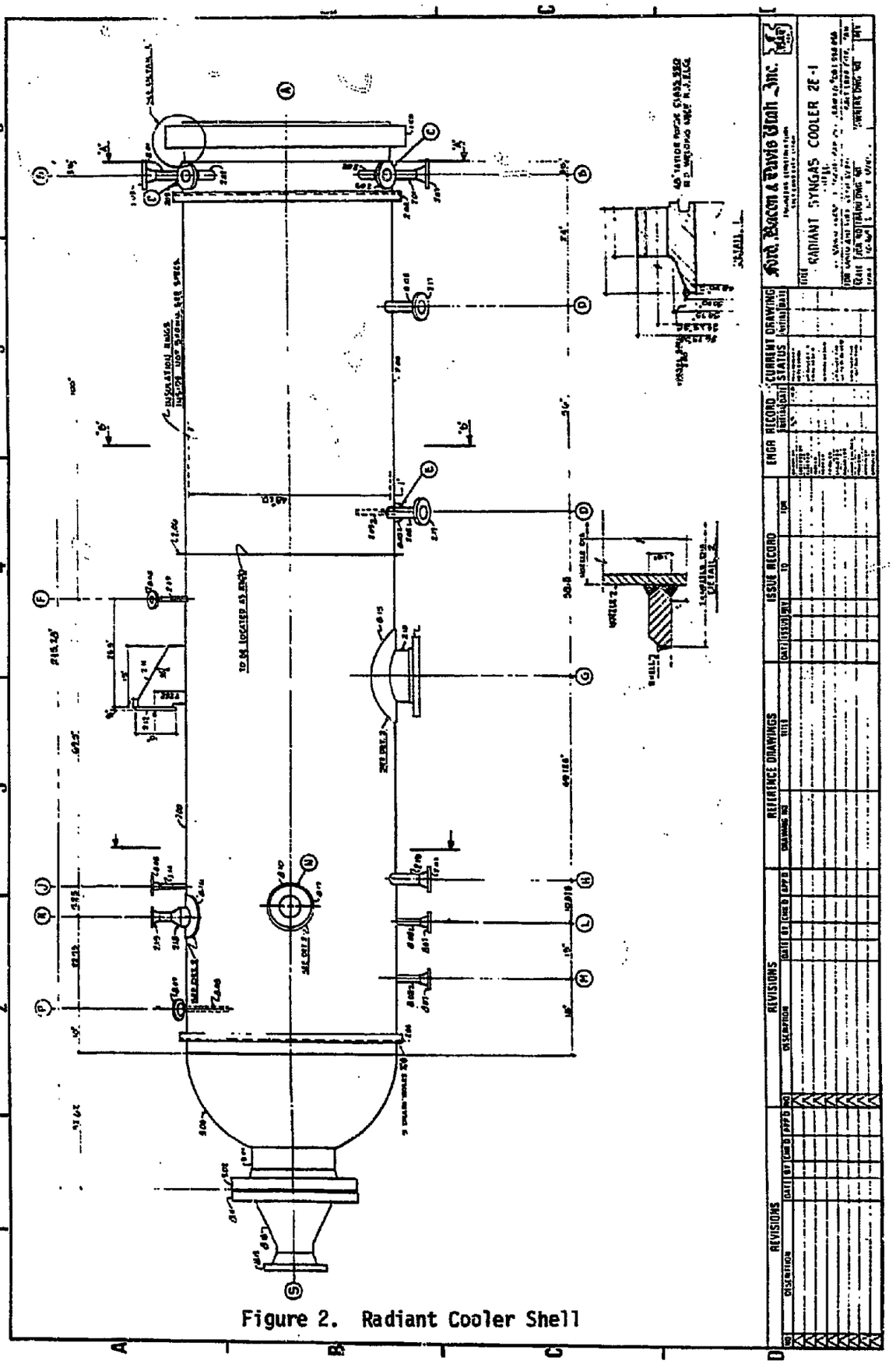


Figure 2. Radiant Cooler Shell

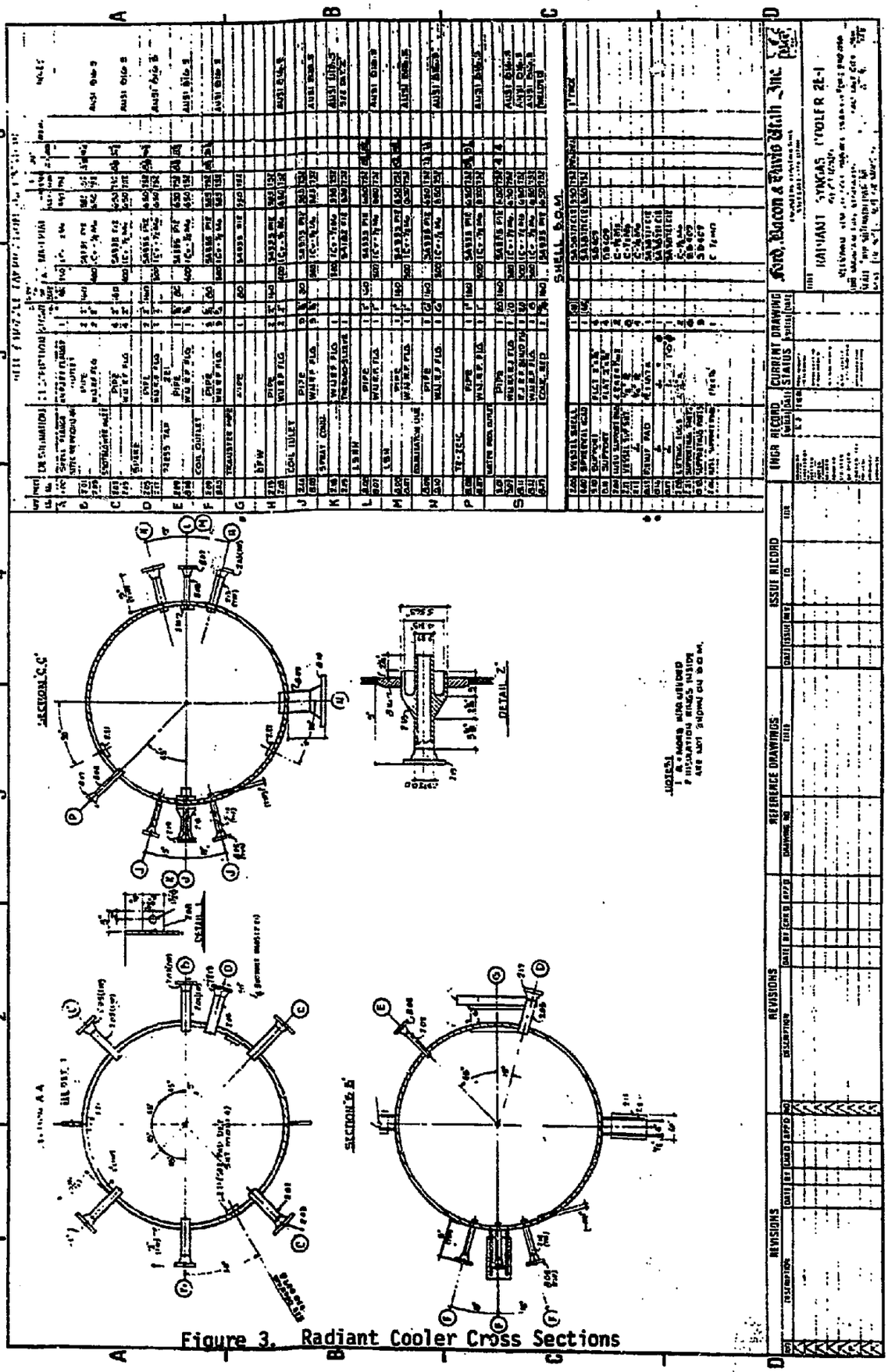


Figure 3. Radiant Cooler Cross Sections

3.0 PROCUREMENT OF MAJOR EQUIPMENT

Table 1 shows the status of the procurement of major equipment. Major equipment not shown in the table are the radiant heat exchanger, gasifier, steam superheater, transition pipe between radiant heat exchanger and superheater, front-end equipment of the coal handling system, including belt conveyor and storage bin. All of these are in the final design stage and specifications are being prepared.

As of the end of this reporting period, purchase orders had been issued for approximately 80 percent of the major equipment.

3.1 Specifications Issued

During this quarter, specifications were issued for the water softener (SP-369-P-109), static mixer (Sp-369-P-130), slurry filter (Sp-369-P-131), delumper (Sp-369-P-128), special control valves (Sp-369-11-SF-06A), hydroclone effluent pump (Sp-369-P-133), and motor control center (Sp-369-E-100).

3.2 Bids Received

Bids were received from the vendors on the recycle gas compressor, water softener, static mixer, slurry filter, delumper, oxygen superheater, and pneumatic coal transfer system.

3.3 Purchase Orders Issued

Purchase orders were issued for the deaerator, steam vent silencer, air compressor, air dryer, entrainment separator, flare, coal handling system (crusher, pulverizer, etc.), steam drum, hoppers, tanks and surge drums, chemical system, scrubber, packed column, scrubber recirculation pump, water softener and salt tank unit, wet ash cyclone, oxygen preheater, recycle gas cooler, recycle water pump, deaerator feed pump, steam drum feed pump, sump pump, slag slurry pump, drum recirculation pump, cooling water pump, and recycle gas compressor.

3.4 Equipment List

An equipment list was prepared (See Attachment C). The list includes equipment number, description of the equipment, equipment specification number, size and/or capacity of the equipment, shipping weight, and the vendor.

4.0 FIELD CONSTRUCTION

4.1 Site Preparation

The site preparation and earth work subcontract was awarded. The work was started in the last week of September and was essentially completed by the end of October. The contract covered the grading of the site, excavation and construction of the waste water pond and recycle water pond, installation of culverts, construction of access roads and concrete underneath the gates. Figure 4 through 9 present photographs of the site and the ponds.

TABLE 1. - Procurement of Major Equipment

Equipment	Specification No.	P.O. No.	Date Issue	Vendor	Remarks
Deareator	SP-369-P-110	M2801	10/06/81	Intermountain Boiler Co. 11 East Malvern Avenue Salt Lake City, UT 84115 (801) 485-3523	Cleaver Brooks Number 20 Packed Column, Horizontal
Steam Vent	SP-369-P-118	M2803	10/06/81	Universal Silencer P.O. Box 411 Stoughton, WI 53589 (608) 873-4272	Universal Model HVG-8
Compressor	SP-369-P-114	M2805	10/06/81	Cate Industrial 2207 West 2415 South Salt Lake City, UT 84119 (801) 974-0555	Ingersoll-Rand SSR-2000 Model 400H
Air Dryer	SP-369-P-115	M2806	10/06/81	The Wild Company 125 West 2950 South Salt Lake City, UT 84115 (801) 974-0555	Airtek TW300 Air Dryer Airtek CF3316C Prefilter Airtek CF3316F Afterfilter
Entrainment Separator	SP-369-P-106	M2807	10/06/81	Wright-Austin Company 3245 Wight Street Detroit, MI 48207 (313) 259-1925	Wright-Austin Type "T" Separator
Flare	SP-369-P-112	M2808	10/22/81	John Zink Company 4401 South Peoria P.O. Box 7388 Tulsa, OK 74105	John Zink STF-U-12 Utility Flare with Constant Ignition Pilot
Coal Handling System	SP-369-M-2 Rev. 1	M2809	12/16/81	Williams Patent Crusher 2701 North Broadway St. Louis, MO 63102 (314) 621-3348	Williams Model GP1512 Crusher Williams Roller Mill Comet 30" Pulverizer Hopper, Heater, Blower, Cyclone Griffin Enviro Model JV-54-9X Dust Collector

Equipment	Specification No.	P.O. No.	Date Issue	Vendor	Remarks
Steam Drum	SP-369-P-102	M2812	10/29/81	Dyna-Therm Corporation P.O. Box 73420 Houston, TX 77273-3420 (713) 444-9759	
Hoppers, Tanks & Surge Drums	SP-369-P-105 SP-369-P-105-SK1 SP-369-P-105-SK2 SP-369-P-105-SK3 SP-369-P-105-SK4 SP-369-P-111 SP-369-P-111-SK5 SP-369-P-111-SK6 SP-369-P-127	M2813	11/03/81	Rocky Mountain Fabrication 960 North 400 East North Salt Lake, UT 84054 (801) 298-3243	Ash Lock Hopper Coal Lock Hopper Slurry Discharge Tank Coal Feed Tank Blowdown Flash Tank Deareator Feed Tank Recycle Gas Surge Drum Soot Blowing Gas Surge Drum Natural Gas Surge Drum
Chemical System	SP-369-P-103	M2814	11/03/81	Alpine Technical Service 429 Eastview Drive Alpine, UT 84403 (801) 974-3530	
Scrubber, Packed Column, Recirculation Pump	SP-369-P-103	M2815	11/03/81	Control Equipment Co. Ametek Schutte & Koerting Div. Cornwells Heights, PA 19020 (215) 639-0900	SK Ejector-Venturi Scrubber, Type 7010 SK Packed Tower, Type 7055 Storage Tank, Type 7041 Durcomet 100 Pump
Water Softener & Salt Tank Unit	SP-369-P-109	M2817	11/17/81	Alpine Technical Service 429 Eastview Drive Alpine, UT 84403 (801) 974-3530	
Wet Ash Clycone	SP-369-P-113	M2818	11/17/81	Krebs Engineers 1205 Chrysler Drive Menlo Park, CA 94025 (415) 325-0751	Krebs Cyclone, Model D6WB
Oxygen Pre-heater & Recycle Gas Cooler	SP-369-P-104 SP-369-P-125	M2819	11/17/81	Brown Fintube Co. P.O. Box 2739 Tulsa, OK 74101 (918) 584-2621	Brown Fintube 7 BEP0423 Recycle Gas Cooler Brown Fintube 51-1E040-025 Oxygen Preheater

Equipment	Specification No.	P.O. No.	Date Issue	Vendor	Remarks
Recycle Water Pump	SP-369-P101C	M2820	11/24/81	Inpac P.O. Box 2605 Salt Lake City, UT 84110 (801) 974-3140	Sunflow Model P2BEK
Deareator Feed Pump & Steam Drum Feed Pump	SP-369-P-101A	M2822	11/24/81	H.A. Folsom & Assoc. 1815 West 2300 South Salt Lake City, UT 84119 (801) 972-4600	MTH Regenerative Turbine Pump Model 141-I MTH Regnerative Turbine Pump Model 153-I
Sump Pump & Slag Slurry Pump	SP-369-P-129 SP-369-P-101D	M2823	11/24/81	Duriron Company 9500 So. 500 W.,Suite 211 Sandy, UT 84070 (801) 566-8787	Durco, 1½ x 1 - US 6 Durco, 3 x 1½ - 8/Mark II
Drum Recirculation Pump & Cooling Water Pump	SP-369-P-101B SP-369-P-101E	M2824	11/24/81	C.H. Spencer 210 West 33rd So. Salt Lake City, UT 84115 (801) 486-1081	Goulds Model 3700, 3x6-9 Goulds Model 3935, BP100-21
Recycle Gas Compressor	SP-369-P-107	M2825	12/18/81	Cooper Air Compressor Div. 1800 Gardner Expressway Quincy, IL 62301 (217) 222-5400	Gardner-Denver 3½x5 MLATB, single stage, reciprocating gas compressor
Delumper	SP-369-P-128			1/3*	Issued for Quote 11/20/81 Quote Received 12/07/81
Static Mixer	SP-369-P-130			3/3	Issued for Quote 11/20/81 Quote Received 12/03-12/07/81
Hydroclone Effuent Pump	SP-369-P-133			5/5	Issued for Quote 12/22/81 Quote Received 12/31/81
Oxygen Superheater	SP-369-P-116			3/5	Issued for Quote 8/03-9/15/81 Quote Received 9/08-9/30/81
Slurry Filter	SP-369-P-131			2/3	Issued for Quote 11/20/81 Quote received 12/07-12/08/81

Equipment	Specification No.	P.O. No.	Date Issue	Vendor	Remarks
Pneumatic Transfer System	SP-369-P-132			4/4	Issued for Quote 12/01/81 Quote Received 12/18-12/30/81
Slag Handling Valves	SP-369-11-SF-06A			/8	Issued for Quote 12/21/81

* No. of Quotes Received/No. of Invitations to Quote Issued

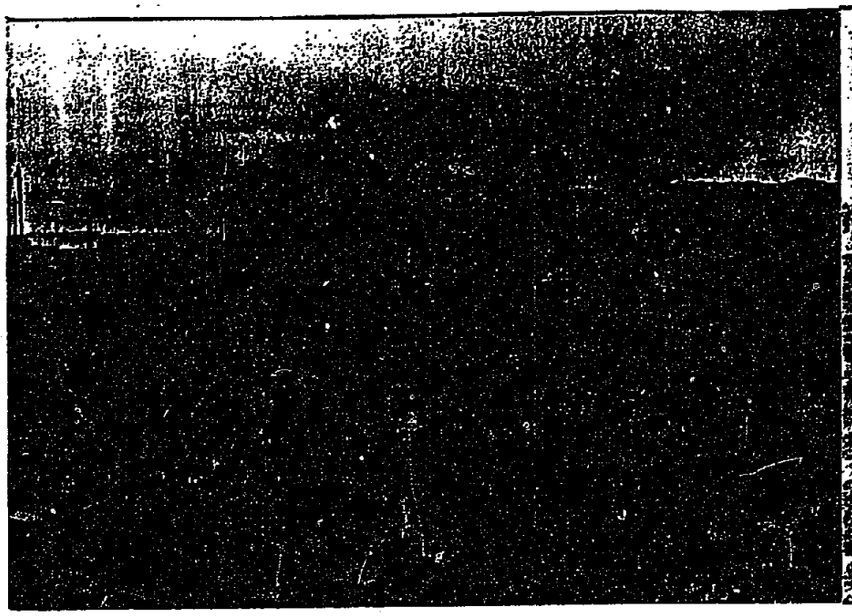


Figure 1. PDU site before field construction (end of September 1981).

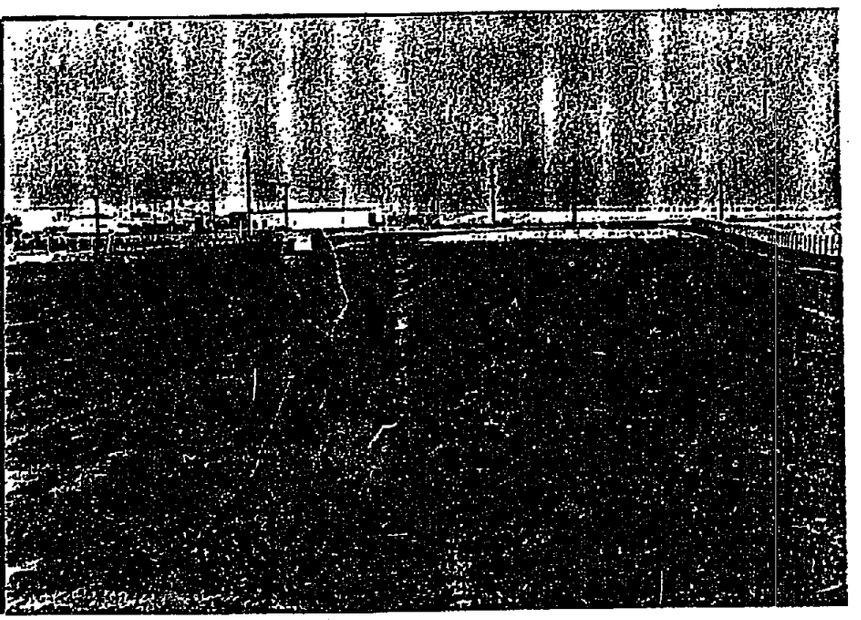


Figure 2. PDU site as of the end of October 1981.

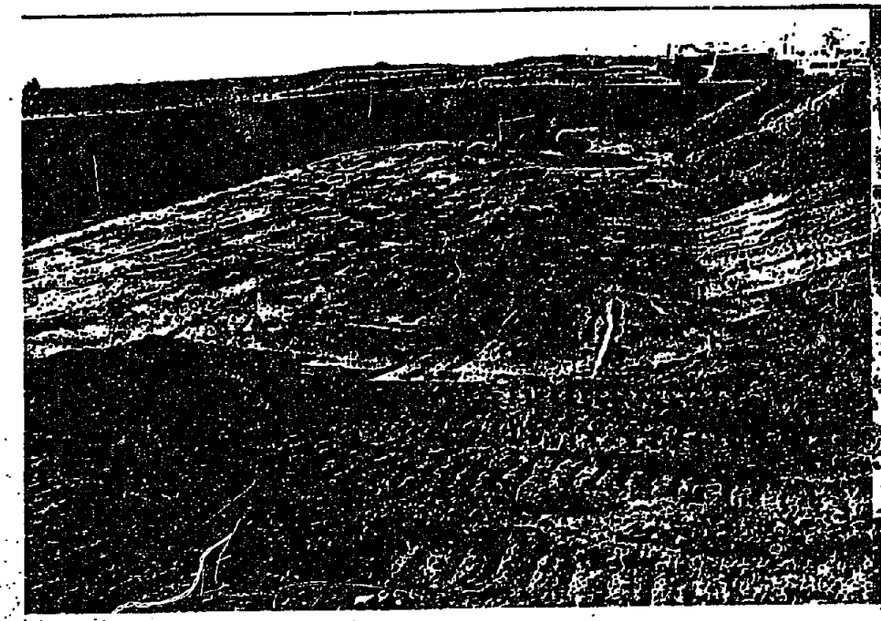


Figure 3. Excavation of recycle water pond.

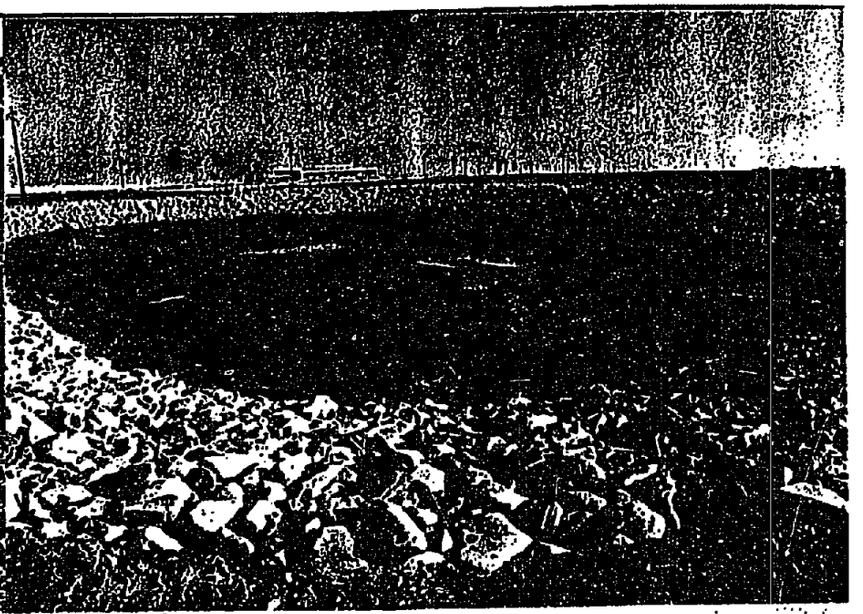


Figure 4. Recycle water pond viewed from southwest corner.

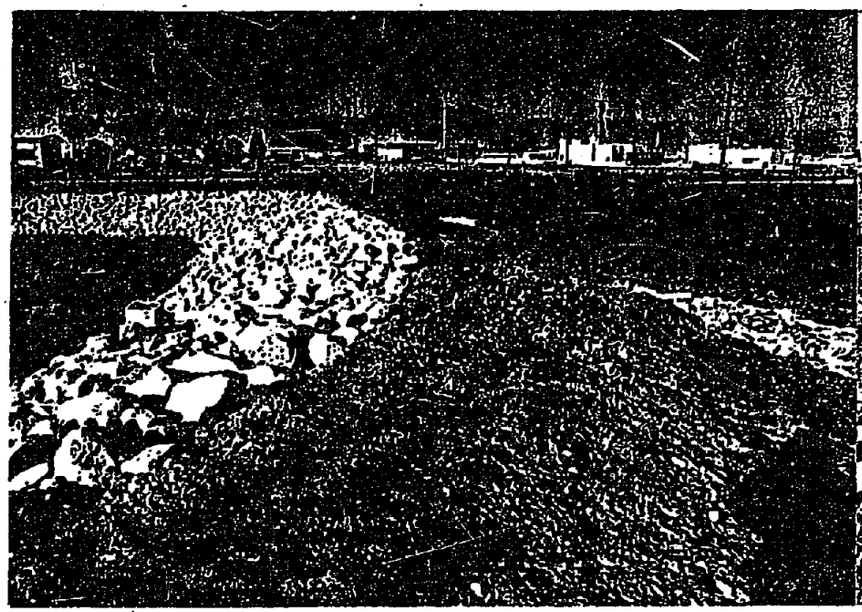


Figure 5. Northeast corner of recycle pond showing recycle water intake pipe, overflow pipe and sump housing.

Figure 6. Waste water pond viewed from northwest corner.

Figure 7. One of the three gates and fence on west side of the site.

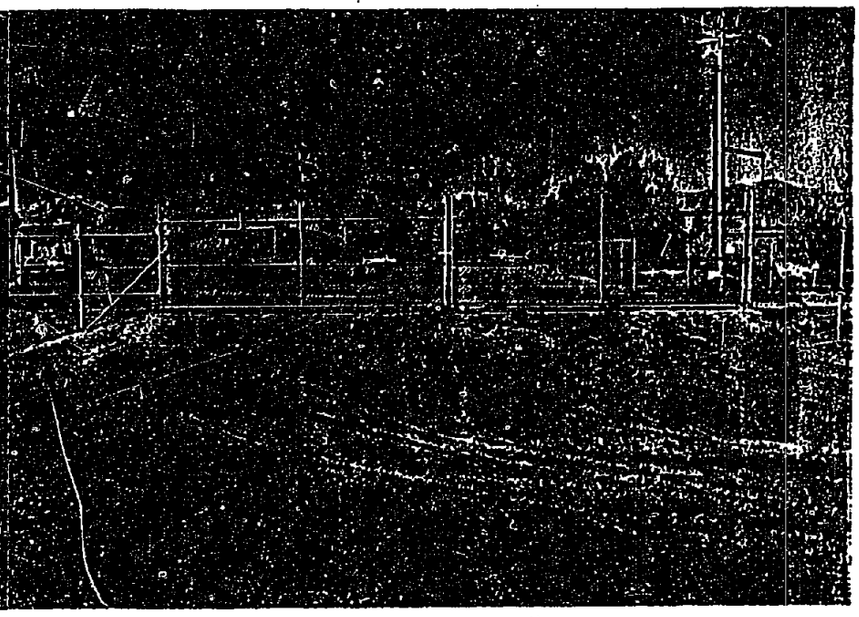


Figure 8. Interstate Brick viewed through the side fence.

4.2 Site Fencing

The fencing contract was awarded and completed in the month of October. The work covered approximately 2,635 feet of chain link fence and three 35 feet slide gates. Figure 10 and 11 show the fence and the gate.

4.3 Foundations

The Phase I concrete foundation contract was awarded in late November. Phase I consists of the Service/Shop Building slab and foundation, MCC/Control Building slab and foundation, oxygen and nitrogen storage pad and transformer pad. As of the end of this reporting period, Phase I was about 95 percent complete. The only work remaining was pouring concrete into forms in place for the oxygen and nitrogen storage pad and the apron east of the Process Tower. Severe snow fall and prolonged below freezing temperature occurred in late December causing a delay in all field construction work. The Phase II subcontract consists of coal handling area foundation, recycle gas surge tank pad and flare pad. The specification was issued in December. The work is expected to start in late January and completed in late February (weather permitting).

4.4 Building

The building contract was awarded on November 9. Building materials were delivered to the site on December 17. However, the erection was delayed due to severe weather conditions. The scope of work covered under this contract was to furnish and install two pre-engineered buildings, i.e., MCC/Control Building and Service/Shop Building.

5.0 OPEN ITEMS

5.1 Project Review Meeting

The first project review meeting was held on September 24, 1981, at DOE Morgantown Energy Technology Center. The review included a discussion of operating safety. The second project review meeting was held in Salt Lake City from Wednesday, December 16, through Friday, December 18. The review covered PDU design, cost analysis, hazard analysis, schedule assessment and planned test program. The meeting concluded with a visit to the PDU site in West Jordan, Utah.

5.2 Plant Visit

The Project Manager and Deputy Project Manager visited BiGas Pilot Plant at Homer City, Pennsylvania on November 9, and Hydrocarbon Research, Inc.'s Fast Fluid Bed Coal Gasification PDU in Lawrenceville, New Jersey on November 10, 1981. Besides the plant tour, a meeting was held at the BiGas Plant attended by the DOE Program Manager to discuss MFR's gasification process design, particularly with regard to safety. The objective of the visit to HRI was to see their gasification facility and to determine which surplus equipment might be used in this PDU.

5.3 Construction Permit and Fees

In November the construction permit was obtained from the City of West Jordan and land development and flood control fees were paid to the city (See Attachment E).

ATTACHMENT A

Revised P&ID

MISC. PIPING SYMBOLS

- MAIN PROCESS LINE
- SECONDARY PROCESS LINE
- FUTURE LINE
- EXISTING LINE
- TIE-IN TO EXISTING LINE (CONFIRM CONDITION OR VERIFY REFERENCE NUMBER)
- EQUIPMENT & INSTRUMENTATION
- 8-100-S-902 — LINE CONTINUATION (EXISTING QTY. DWG. NO.)
- STEAM TRAP
- PERMANENT Y-TYPE STRAINER W/ BLOW-OFF VALVE & CAP
- TEMPORARY STRAINER
- FILTER OR BASKET STRAINER
- DUPLEX FILTER
- AIR FILTER
- MISTING NOZZLE
- LINE MOISTURE SEPARATOR
- DAMPER / LOUVER
- EXPANSION JOINT
- MOTOR
- OPEN DRAIN
- CLOSED DRAIN
- CLOSED HEADER DRAIN
- INSULATION W/ TRACING
- HOSE CONNECTION
- HEADER FLING
- SPECTACLE BLIND (NORMALLY OPEN)
- SPECTACLE BLIND (NORMALLY CLOSED)
- CAP
- LINE SIZE CHANGE
- FLEX HOSE
- SPECIALTY ITEM

VALVES

- GATE
- KNIFE GATE
- PINCH
- GLOBE
- CHECK
- BUTTERFLY OR LOUVERED
- BALL
- PLUG
- NEEDLE
- 3-WAY (SHOWING FAIL POSN)
- 4-WAY (SHOWING FAIL POSNS)
- ANGLE
- PRESSURE RELIEF
- VACUUM RELIEF
- RUPTURE DISC, PRESSURE RELIEF
- RUPTURE DISC, VACUUM RELIEF
- VALVE TAG NUMBER

ACTUATORS

- DIAPHRAGM
- DIAPHRAGM W/ POSITIONER
- DIAPHRAGM W/ MANUAL OVERRIDE
- SELF-CONTAINED PRESSURE REGULATOR
- PISTON, SINGLE-ACTING
- PISTON, DOUBLE-ACTING
- SOLENOID
- SOLENOID W/ MANUAL RESET
- MOTOR

INSTRUMENTATION

- LOCAL
- MOUNTED ON MAIN PANEL
- MOUNTED BEHIND MAIN PANEL
- MOUNTED ON LOCAL PANEL
- MOUNTED BEHIND LOCAL PANEL
- ORIFICE PLATE
- TURBINE TYPE FLOW METER
- VENTURI-TYPE OR FLOW NOZZLE
- ROTAMETER OR ELBOW-TYPE FLOW METER
- INTERLOCK LOGIC
- PNEUMATIC SIGNAL
- CAPILLARY TUBING
- ELECTRICAL SIGNAL
- HYDRAULIC SIGNAL

LINE IDENTIFICATION

XX"-XXX-XXX-XXX-X"-XXX
(XX.XXX XXX.XXXXX)

1. NOMINAL LINE SIZE IN INCHES.
2. SERVICE/COMMODITY DESIGNATION (SEE BELOW).
3. LINE SPECIFICATION (SEE BELOW).
4. LINE NUMBER.
5. INSULATION THICKNESS IN INCHES.
6. SPECIAL INSULATION REQUIREMENTS.
   - PP = PERSONNEL PROTECTION
   - ST = STEAM TRACING
   - ET = ELECTRICAL TRACING
   - CST = STEAM + ELECTRICAL TRACING
   - STC = STEAM TRACING PLUS HEAT TRANSFER CEMENT

EXAMPLE:

FOR INFORMATION ONLY

JAN 81 1982

INSTRUMENT IDENTIFICATION

FIRST LETTER: MEASURED OR INITIATING VARIABLE	MODIFIER	SUCCEEDING LETTERS: READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A ANALYSIS		ALARM		
B BURNER FLAME		USER'S CHOICE	USER'S CHOICE	USER CHOICE
C CONDUCTIVITY (ELECTRICAL)			CONTROL	
D DENSITY (MASS) OR SPECIFIC GRAVITY	DIFFERENTIAL			
E VOLTAGE (EMF)		PRIMARY ELEMENT		
F FLOW RATE	RATIO (FRACTION)			
G GAGING (DIMENSIONAL)		GLASS		
H HAND (MANUALLY INITIATED)				HIGH
I CURRENT (ELECT.)		INDICATE		
J POWER	SCAN			
K TIME OR TIME-SCHEDULE			CONTROL STATION	
L LEVEL		LIGHT (PILOT)		LOW
M MOISTURE OR HUMIDITY				MIDDLE OR INTERMEDIATE
N USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O USER'S CHOICE		ORIFICE (RESTRICTION)		
P PRESSURE OR VACUUM		POINT (TEST CONNECTION)		
Q QUANTITY OR EVENT	TOTALIZE OR INTEGRATE			
R RADIOACTIVITY		RECORD OR PRINT		
S SPEED OR FREQUENCY	SAFETY		SWITCH	
T TEMPERATURE			TRANSMIT	
U MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V VISCOSITY			VALVE, DAMPER OR LOUVER	
W WEIGHT OR FORCE		WELL		
X UNCLASSIFIED		UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y USER'S CHOICE			RELAY OR COMPUTE	
Z POSITION			DRIVE, ACTUATE OR UNCLASSIFIED FINAL CONTROL ELEMENT	

EXAMPLES: LAL — LEVEL — LOW ALARM; PDAH — PRESSURE DIFFERENTIAL — HIGH ALARM; FFC — FLOW RATIO — CONTROLLER — RECORDING; ZS — POSITION — SWITCH

ABBREVIATIONS

AS	20# AIR SUPPLY	SD	SHUTDOWN
CSC	CAM SEAL CLOSED	S/F	STEAM TO FLANGE
CSO	CAM SEAL OPEN	SP	SAMPLE POINT
DFR	DESIGN FLOW RATE	SS	SELECTOR SWITCH
ESD	EMERGENCY SHUTDOWN	S/S	STEAM-TO-STEAM
"F"	FURN. BY EQUIPMENT VENDOR	TDH	TOTAL DIFFERENTIAL HEAD
FC	FAIL CLOSED		
FI	FAIL INTERMEDIATE		
FL	FAIL LOCKED		
FO	FROM		
FO	FAIL OPEN		
GPM	GALLONS PER MINUTE		
HDR	HEADER		
HSM	HAND-OFF-AUTOMATIC		
IP	INJECTION POINT		
I/P	ELECTRIC TO PNEUMATIC SIGNAL		
LC	LOCK CLOSED		
LO	LOCK OUT		
NC	NORMALLY CLOSED		
NO	NORMALLY OPEN		
PB	PUSH BUTTON		
RED	REDUCER		

PIPING SPECIFICATIONS

3CA	150# ANSI CLASS. CARBON STEEL BODY'S. SCREWED, BUTT WELDED AND FLANGED. FOR WATER SERVICE.
3CB	150# ANSI CLASS. CARBON STEEL BODY'S. SOCKET WELD, BUTT WELD AND FLANGED. FOR FLAMMABLE GASES, STEAM, CONDENSATES, AND HYDROCARBON LIQUIDS.
3CC	150# ANSI CLASS. CARBON STEEL AND COPPER PIPING. SCREWED, BUTT WELDED AND FLANGED. FOR AIR AND INERT GASES.
3PC	150# ANSI CLASS. PLASTIC AND PLASTIC LINED PIPE. FLANGED AND FLANGED. FOR CORROSIVE LIQUID SERVICE.
3CD	300# ANSI CLASS. CARBON STEEL BODY'S. SOCKET WELD, BUTT WELD AND FLANGED. FOR FLAMMABLE GASES, STEAM CONDENSATE, HCO SUBSTANCES LIQUIDS.
3SD	300# ANSI CLASS. STAINLESS STEEL BODY'S. SOCKET WELD, BUTT WELD AND FLANGED. FOR STEAM GAS, CORROSIVE LIQUIDS.

SERVICE / COMMODITY DESIGNATIONS

AIR	AIR WATER SUPPLY
BFW	BOILER FEEDWATER
BFWC	BOILER FEEDWATER CHEMICALS
C	COAL
CON	STEAM CONDENSATE
CW	COOLING WATER
CWC	COOLING WATER CHEMICALS
IA	INSTRUMENT AIR
N	NITROGEN
NG	NATURAL GAS
O	OXYGEN
OW	OILY WATER
PA	PLANT AIR
PG	PRODUCT GAS
PW	POTABLE WATER
RG	RECYCLE GAS
PW	PROCESS WATER
SM	STEAM MEDIUM PRESSURE
WW	WASTE WATER

REVISIONS

NO	DESCRIPTION	DATE	BY	CHK'D	APP'D

REVISIONS

NO	DESCRIPTION	DATE	BY	CHK'D	APP'D

REFERENCE DRAWINGS

DRAWING NO	TITLE

ISSUE RECORD

DATE	ISSUE	REV	TO	FOR
1-14	-	A	Technical File	Approval

ENGR. RECORD

	INITIAL	DATE
ORIGINATOR		
CHECKED		
PROJECT ENGR.		
PROJECT MGR.		
LEAD ENGR.		
DEPT. MGR.		
LEAD ENGR.		
DEPT. MGR.		

CURRENT DRAWING STATUS

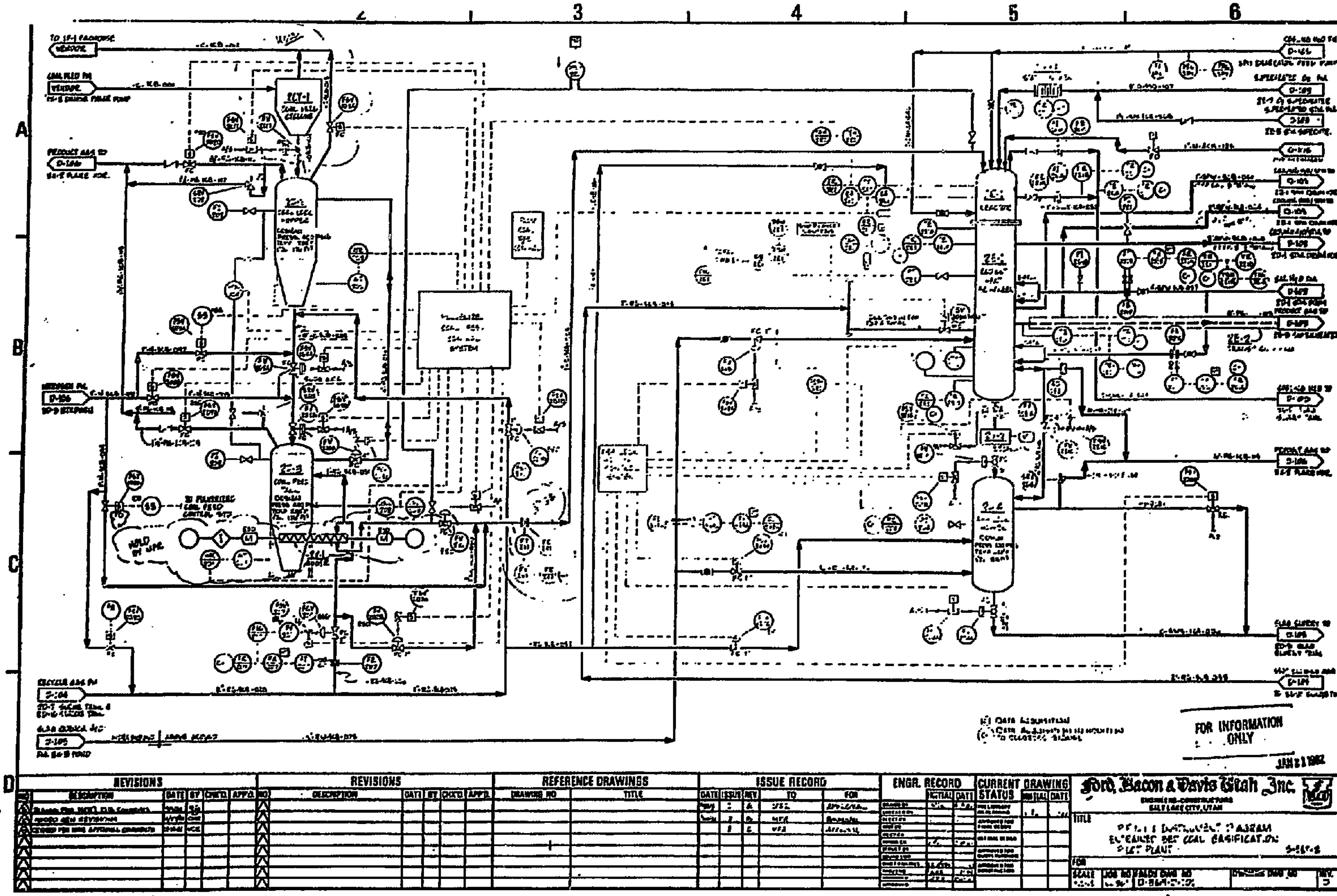
	INITIAL	DATE

Ford, Bacon & Davis Utah Inc.
ENGINEERS CONSTRUCTORS
SALT LAKE CITY, UTAH

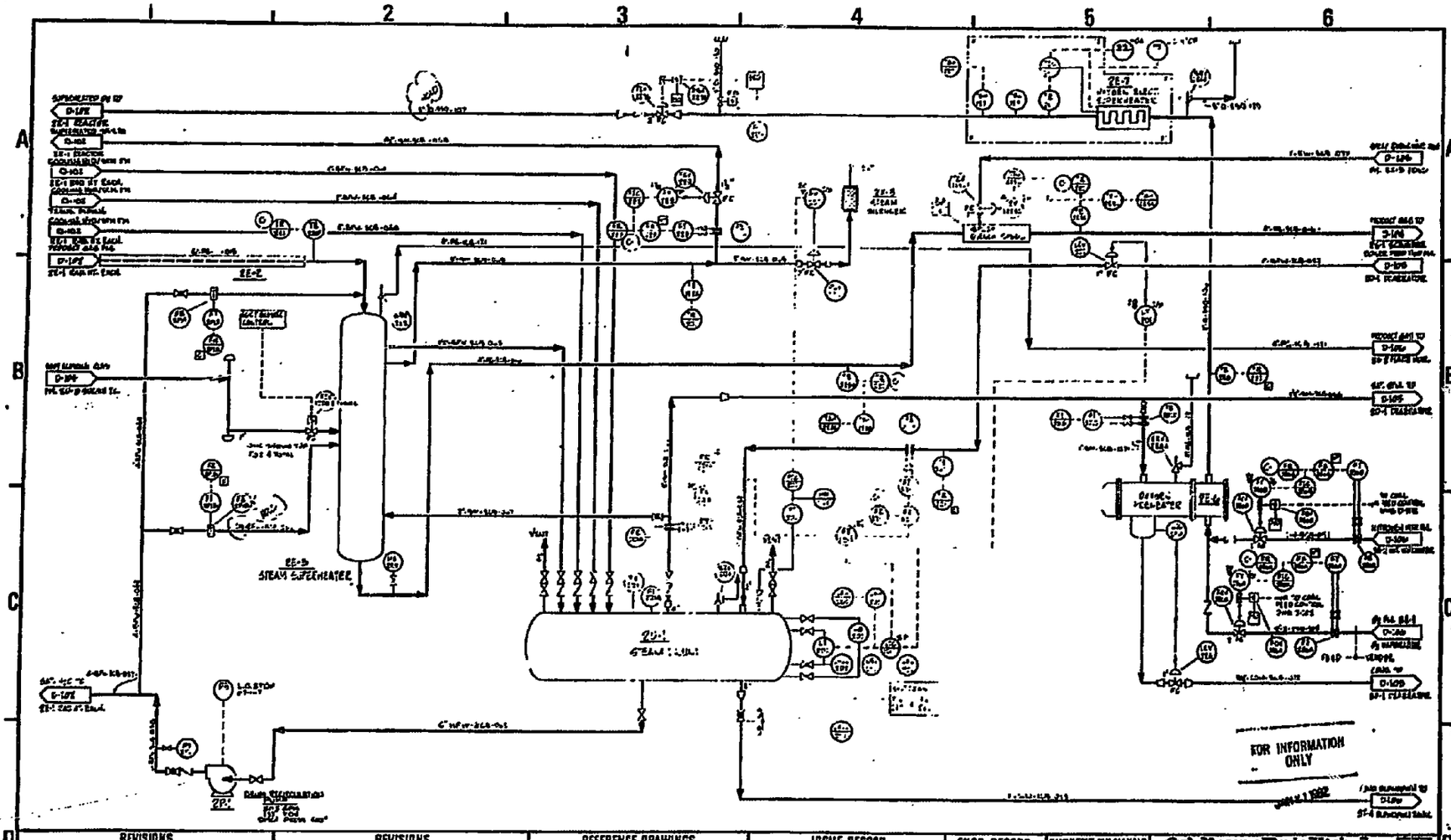
TITLE: PIPING & INSTRUMENT DIAGRAM
ENTRAINED BED COAL GASIFICATION
PILOT PLANT - LEGEND AND SYMBOLS

FOR MOUNTAIN FUEL RESOURCES

SCALE	JOB NO	FB&DU DWG NO	OWNER'S DWG NO	REV
NOT TO SCALE	MC-369	D-369-D-100		A



FOR INFORMATION ONLY
JAN 21 1982
Ford, Bacon & Davis Utah Inc.
SALT LAKE CITY, UTAH
REVISIONS
REFERENCE DRAWINGS
ISSUE RECORD
ENGR. RECORD
CURRENT DRAWING STATUS
TITLE



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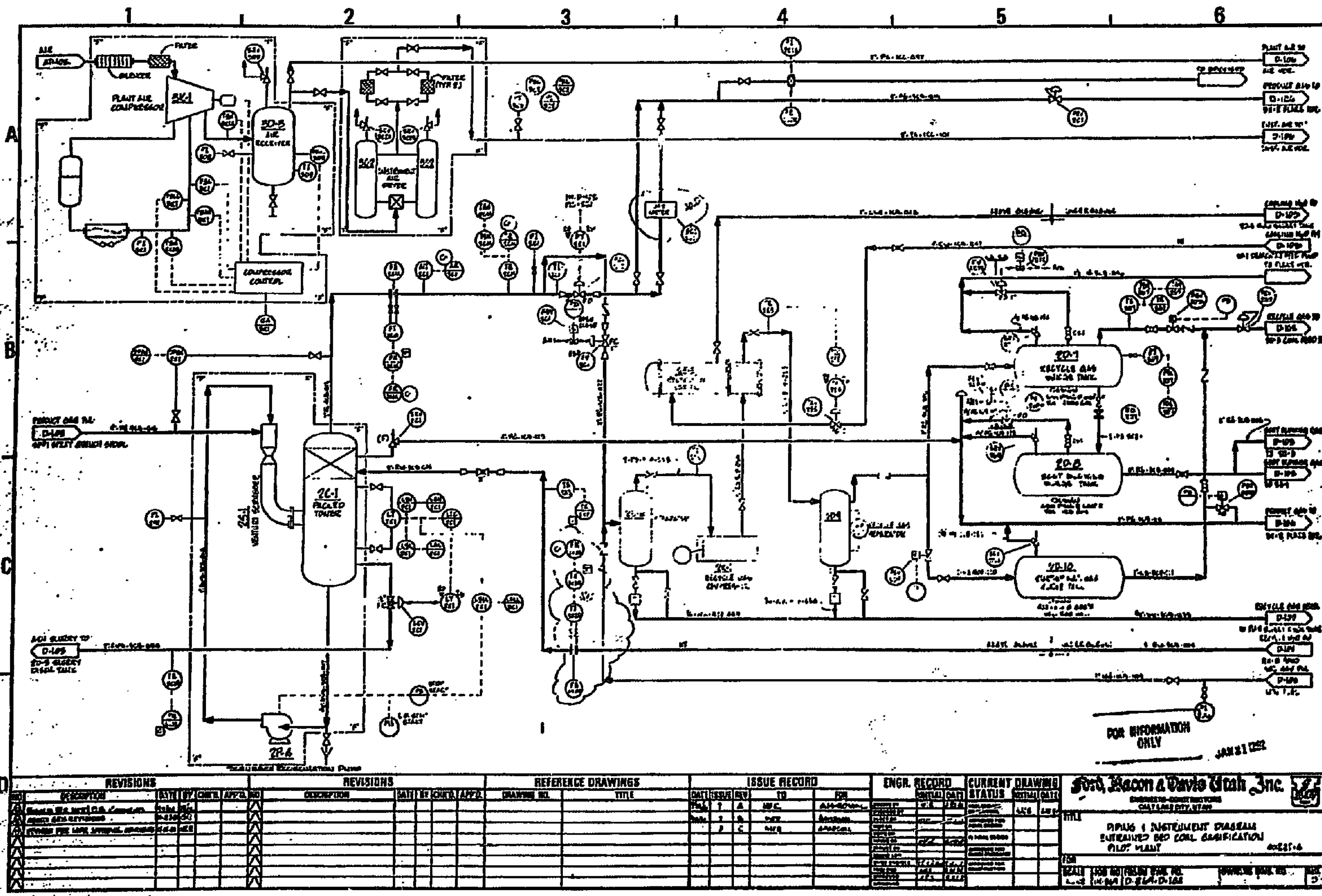
NO.	DESCRIPTION	DATE	BY	CHK'D	APP'D	NO.	DESCRIPTION	DATE	BY	CHK'D	APP'D	DRAWING NO.	TITLE	DATE	ISSUE	REV	TO	FOR		INITIAL	DATE		INITIAL	DATE	ENGINEERS-CONSTRUCTORS SALT LAKE CITY, UTAH
														May	1	A		APPROVAL							
														July	2	B		BIDDING							
															3	C		APPROVAL							

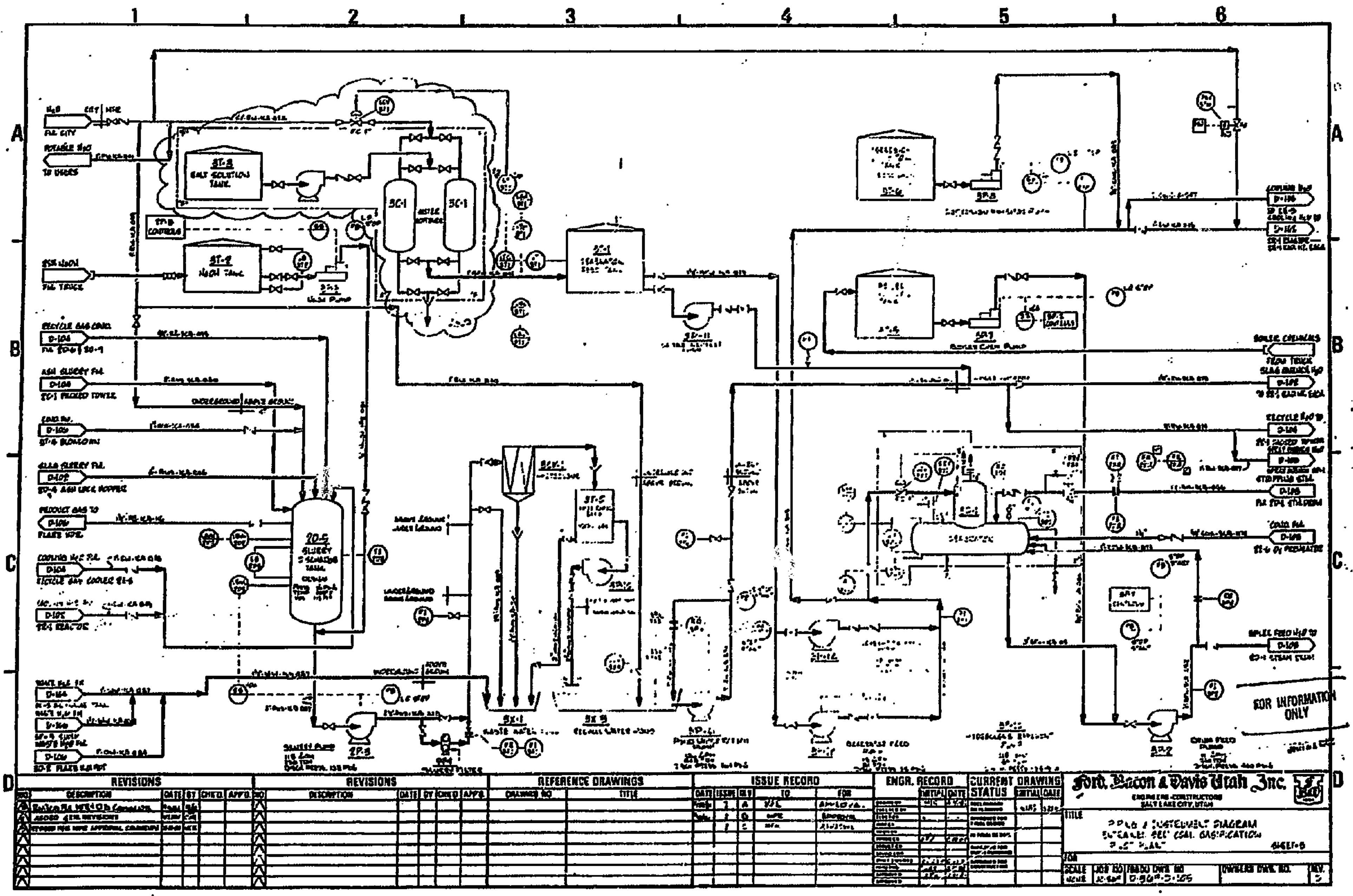
TITLE
PIPING & INSTRUMENT DIAGRAM
ENTRAINED BED COAL GASIFICATION
PILOT PLANT
SHEET 8

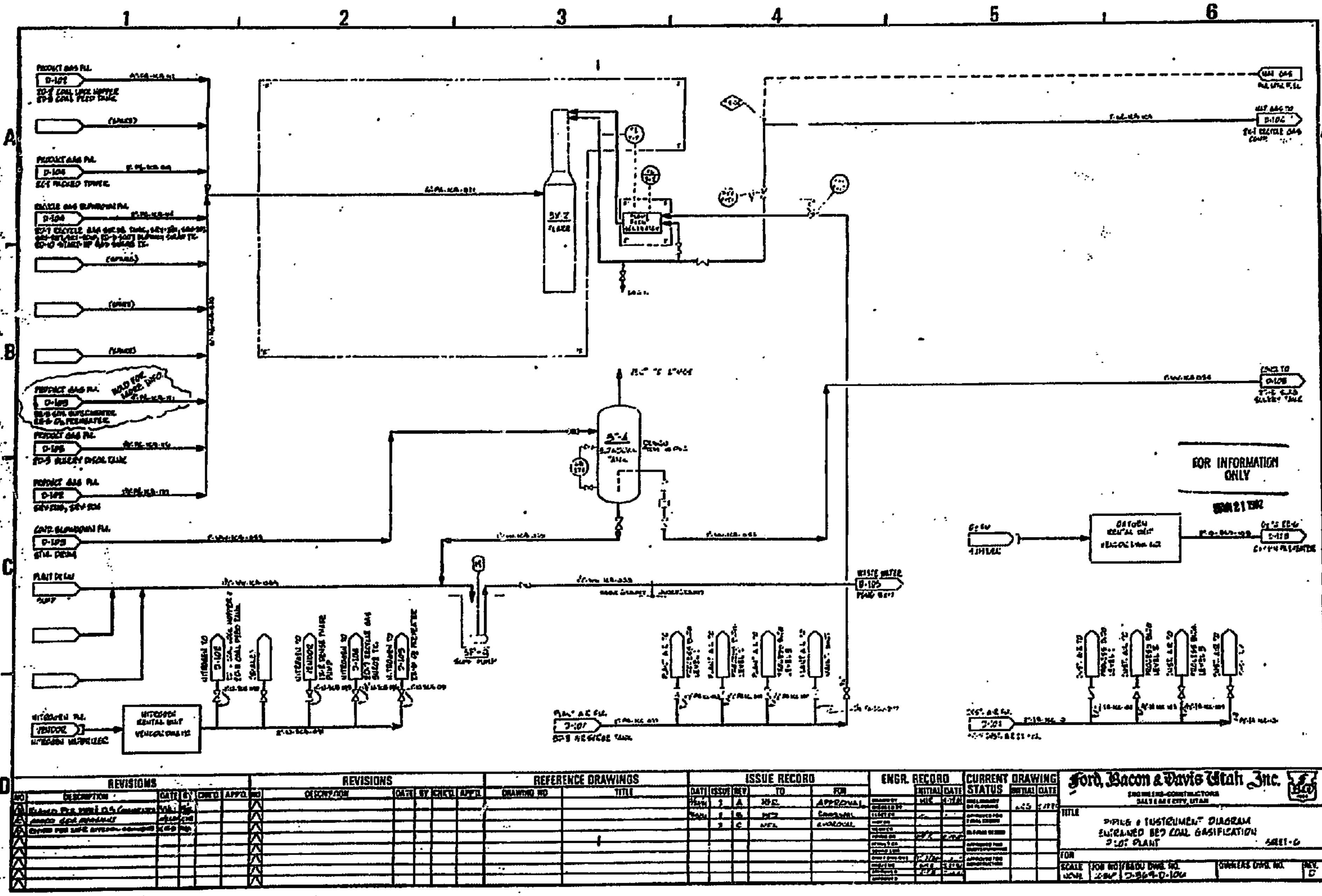
FOR

SCALE	JOB NO.	FB&D DWG. NO.	OWNER'S DWG. NO.	REV.
NONE	2-969	2-969-D-105		D



PLANT AIR COMPRESSOR
AIR RECEIVER
INSTRUMENT AIR DRYER
COMPRESSOR CONTROL
PACKED TOWER
VENTURI SCRUBBER
RECYCLE GAS
FOR INFORMATION ONLY
REVISIONS
REFERENCE DRAWINGS
ISSUE RECORD
ENGR. RECORD
CURRENT DRAWING STATUS
Ford, Bacon & Davis Utah Inc.
TITLE
PIPING & INSTRUMENT DIAGRAM
ENTRAINED BED COAL GASIFICATION
PILOT PLANT


ST-8
SALT SOLUTION TANK
ST-9
NaOH TANK
SC-1
SC-1
20-S
FOR INFORMATION ONLY
REVISIONS
REVISIONS
REFERENCE DRAWINGS
ISSUE RECORD
ENGR. RECORD
CURRENT DRAWING STATUS
Ford, Bacon & Davis Utah Inc.
TITLE



FOR INFORMATION ONLY
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REFERENCE DRAWINGS
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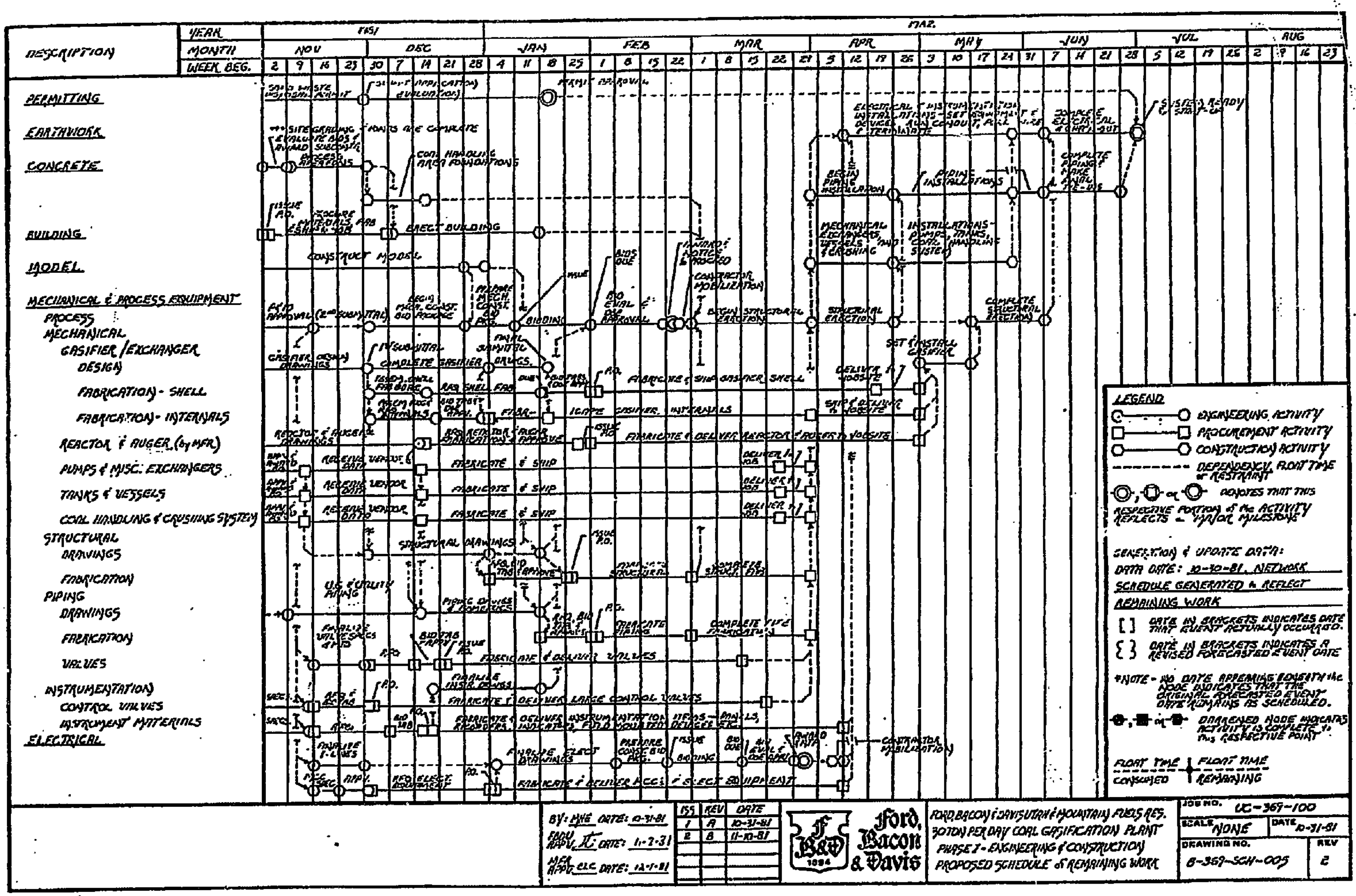
CURRENT DRAWING STATUS
Ford, Bacon & Davis Utah Inc.
ENGINEERS-CONSTRUCTORS
SALT LAKE CITY, UTAH
TITLE
PIPING & INSTRUMENT DIAGRAM
ENTRAINED BED COAL GASIFICATION
PILOT PLANT
FOR
SCALE
NONE
REV.
C

ATTACHMENT B

Revised Phase I Schedule

p


DESCRIPTION
YEAR
MONTH
WEEK BEG.
1981
1982
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
PERMITTING
EARTHWORK
CONCRETE
BUILDING
MODEL
MECHANICAL & PROCESS EQUIPMENT
PROCESS
MECHANICAL
GASIFIER/EXCHANGER DESIGN
FABRICATION - SHELL
FABRICATION - INTERNALS
REACTOR & AUGER (by MFR)
PUMPS & MISC. EXCHANGERS
TANKS & VESSELS
COAL HANDLING & CRUSHING SYSTEM
STRUCTURAL
DRAWINGS
FABRICATION
PIPING
DRAWINGS
FABRICATION
VALVES
INSTRUMENTATION
CONTROL VALVES
INSTRUMENT MATERIALS
ELECTRICAL
LEGEND
ENGINEERING ACTIVITY
PROCUREMENT ACTIVITY
CONSTRUCTION ACTIVITY
DEPENDENCY, FLOAT TIME or RESTRAINT
DENOTES THAT THIS RESPECTIVE PORTION of the ACTIVITY REFLECTS A MAJOR MILESTONE
GENERATION & UPDATE DATA:
DATA DATE: 10-30-81. NETWORK SCHEDULE GENERATED to REFLECT REMAINING WORK
[ ] DATE IN BRACKETS INDICATES DATE THAT EVENT ACTUALLY OCCURRED.
{ } DATE IN BRACES INDICATES A REVISED FORECASTED EVENT DATE
*NOTE - NO DATE APPEARING BENEATH the NODE INDICATES THAT THE ORIGINAL FORECASTED EVENT DATE REMAINS AS SCHEDULED.
DARKENED NODE INDICATES ACTIVITY IS COMPLETE to THIS RESPECTIVE POINT
FLOAT TIME CONSUMED
FLOAT TIME REMAINING
BY: MHE DATE: 10-31-81
ENGR. APPV. DATE: 11-2-81
MGR. APPV. DATE: 12-1-81
ISS | REV | DATE
1 | A | 10-31-81
2 | B | 11-10-81
Ford, Bacon & Davis
1894
FORD, BACON & DAVIS UTAH & MOUNTAIN FUELS RES.
30 TON PER DAY COAL GASIFICATION PLANT
PHASE I - ENGINEERING & CONSTRUCTION
PROPOSED SCHEDULE of REMAINING WORK
JOB NO. UC-369-100
SCALE NONE
DATE 10-31-81
DRAWING NO. B-369-SCH-005
REV 2

p

ATTACHMENT C

Equipment List

Equipment List

High Rate Entrained Coal Gasification PDU

Equipment Number	Description	Size and/or Capacity	Shipping Weight	Vendor
1BC-1	Belt Conveyor Being Prepared			
1BN-2	18 Ton Pulverized Coal Storage Bin Being Prepared			
1CR-1	Crusher SP-369-M-2	6,000 lbs./hr.	1,300 lbs.	Williams Patent Crusher Co.
1CY-1	Clyclone Separator SP-369-M-2	Height = 9'10", Dia. = 5'		Williams Patent Crusher Co.
1F-1	Baghouse Dust Collector SP-369-M-2	Maximum Discharge Rate, 2,000 lbs./hr.		Williams Patent Crusher Co.
1FN-1	Air Fan SP-369-M-2	250 CFM		Williams Patent Crusher Co.
1FN-2	Pulverizer Fan SP-369-M-2	3,600 ACFM @ 36" H_2O		Williams Patent Crusher Co.
1FN-3	Vent Fan SP-369-M-2	1,300 ACFM @ 12" H_2O		Williams Patent Crusher Co.
1H-1	Air Heater SP-369-M-2	2 MBTU/hr.		Williams Patent Crusher Co.
1HP-1	Coal Grizzly/Receiving Hopper Being Prepared			
1HP-2	Crusher Feed Hopper SP-369-M-2			Williams Patent Crusher Co.
1VF-3	Feeder (Pulverized Coal Storage Bin) Being Prepared			

Equipment Number	Description	Size and/or Capacity	Shipping Weight	Vendor
IVF-2	Feeder (Receiving Hopper) Being Prepared			
1X-1	Pulverizer SP-369-M-2	5,800 lb./hr.		Williams Patent Crusher Co.
1X-2	Dense Phase Pump & Weighing Unit SP-369-P-132			
2C-1	Packed Tower SP-369-P-103	18" Dia. - 175 ACFM		Ametek-Schutte & Koerting
2CY-1	Bin Vent Filter SP-369-P-132			
2D-1	Steam Drum SP-369-P-102	4,879 lb./hr. steam	5,200 lbs.	Dyna Therm Corp.
2D-2	Coal Lock Hopper SP-369-P-105	4'0" O.D. x 13'0" T to T	8,202 lbs.	Rocky Mountain Fabrication
2D-3	Coal Feed Tank SP-369-P-105	4'0" O.D. x 13'0" T to T	8,562 lbs.	Rocky Mountain Fabrication
2D-4	Ash Lock Hopper SP-369-P-105	3'0" O.D. x 4'0" T to T	5,332 lbs.	Rocky Mountain Fabrication
2D-5	Slurry Discharge Tank SP-369-P-105	4'0" O.D. x 9'0" T to T	2,126 lbs.	Rocky Mountain Fabrication
2D-7	Recycle Gas Surge Tank SP-369-P-127	4'6" O.D. x 21'8" T to T	17,102 lbs.	Rocky Mountain Fabrication
2D-8	Soot Blowing Surge Tank SP-369-P-127	1'8" O.D. x 6'5" T to T	1,188 lbs.	Rocky Mountain Fabrication
2D-9	Recycle Gas Separator SP-369-P-106	1,479 lbs./hr.	50 lbs.	Wright Austin
2E-1	Radiant Heat Exchanger SP-369-M-1			

Equipment Number	Description	Size and/or Capacity	Shipping Weight	Vendor
2E-2	Transition Pipe Being Prepared			
2E-3	Steam Superheater SP-369-M-1			
2E-5	Recycle Gas Cooler SP-369-P-104	90,700 BTU/hr.	669 lbs.	Brown Fintube Co.
2E-6	Oxygen Preheater SP-369-P-125	256,000 BTU/hr.	685 lbs.	Brown Fintube Co.
2E-7	Oxygen Superheater (Elec.) SP-369-P-116	75 KW	1,900 lbs.	Watlow Industries
2K-1	Recycle Gas Compressor SP-369-P-107	372 SCFM		Garder Denver
2P-1	Drum Recirculation Pump SP-369-P-101B	505 GPM	1,776 lbs.	Goulds
2P-3	Slurry Pump SP-369-P-101D	113 GPM	850 lbs.	Durgo
2P-4	Scrubber Recirculation Pump SP-369-P-103	110 GPM		Ametek-Schutte & Koerting
2R-1	Reactor Being Prepared			
2S-1	Venturi Scrubber SP-369-P-103	175 ACFM		Ametek-Schutte & Koerting
2X-1	Auger & Intromiter Being Prepared			
2X-2	Delumper SP-369-P-128	8"		Franklin Miller Co.

Equipment Number	Description	Size and/or Capacity	Shipping Weight	Vendor
2X-3	Steam Silencer SP-369-P-118	Length = 61" Dia. = 18"	190 lbs.	Universal Silencer
2X-4	Static Mixer SP-369-P-130	Length = 11" Dia. = 3"	34 lbs.	Kenics Corp.
3C-1	Water Softener SP-369-P-109	25 GPM	4,555 lbs.	Alpine Technical Services
3C-2	Instrument Air Dryer SP-369-P-115	315 SCFM	875 lbs.	Airtek
3CY-1	Hydroclone SP-369-P-113	110 GPM	225 lbs.	Krebs Engineers
3D-1	Deaerator SP-369-P-110	10,000 lbs./hr.	2,100 lbs.	Cleaver Brooks
3D-3	Air Receiver SP-369-P-114	700 gallon		Ingersoll-Rand
3F-1	Slurry Filter SP-369-P-131			
3K-1	Plant Air Compressor SP-369-P-114	400 ACFM		Ingersoll-Rand
3P-1A,B	Deaerator Feed Pump SP-369-P-101A	16 GPM		MTH
3P-2	Drum Feed Pump SP-369-P-101A	156PM		MTH
3P-3	Caustic (NaOH) Pump SP-369-P-108	0-42 GPH		Milton Ray - Alpine Technical Services
3P-6	Recycle Water Pump SP-369-P-101C	111 GPM	1,325 lbs.	Sunflo
3P-7	Boiler Chemical Pump SP-369-P-108	1 GPH		LMI - Alpine Technical Services

Equipment Number	Description	Capacity	Shipping Weight	Vendor
3P-8	Corrosion Inhibitor Pump SP-369-P-108			Neptune - Alpine Technical Services
3T-1	Deaerator Feed Tank SP-369-P-111	10'0" Dia. x 9'6"	6,207 lbs.	Rocky Mountain Fabrication
3T-2	Caustic (NaOH) Tank SP-369-P-109	1,100 gallon		Alpine Technical Service
3T-3	Salt Solution Tank SP-369-P-109			Alpine Technical Services
3T-4	Blowdown Tank SP-369-P-111	1'0" O.D. x 6'0" T to T	308 lbs.	Rocky Mountain Fabrication
3T-5	Boiler Chemicals Tank SP-369-P-108	50 gallon		Alpine Technical Services
3T-6	Corrosion Inhibitor Tank SP-369-P-108	50 gallon		Alpine Technical Services
3X-1	Waste Water Pond SP-369-C-103	N/A	N/A	N/A
3X-2	Flare SP-369-P-112	Length = 12'		John Zink Co.
3X-3	Recycle Water Pond SP-369-C-103			
3P-11	Emergency Cooling Pump SP-369-P-101E	111 GPM		Goulds
3T-	Holding Tank Being Prepared			
3P-10	Recycle Water Spray Pump SP-369-P-133	115 GPM	300 lbs.	Durco
3D-4	Natural Gas Surge Drum SP-369-P-127	2'0" O.D. x 8'8" T to T	1,489 lbs.	Rocky Mountain Fabrication

Equipment Number	Description	Capacity	Weight	Vendor
3P-9	Sump Pump SP-369-P-129	30 GPM	300 lbs.	Durco
	Heat Exchanger Shells SP-369-M-1			