655
5-20-81
Jub

MASTER

(2)

HA. 2678

NTIS-25
Burs - 161
Sp. - 400

DOE/MC/12186-126

SOLIDS THROTTLING VALVES FOR COAL CONVERSION AND
UTILIZATION DEVELOPMENT
FINAL REPORT

By

Gordon C. Sine, P.E.

November 1980

Prepared for

UNITED STATES DEPARTMENT OF ENERGY
Morgantown Energy Technology Center
Morgantown, West Virginia

Under Contract No. DE-AC21-79MC12186

TECHNICAL INFORMATION CENTER
UNITED STATES DEPARTMENT OF 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.

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."

This report has been reproduced directly from the best available copy.

Available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161.

Price: Printed Copy A07
Microfiche A01

SOLIDS THROTTLING VALVES FOR COAL CONVERSION AND
UTILIZATION DEVELOPMENT
FINAL REPORT

by

Gordon C. Sine, P.E.

TRW Energy Systems Group
Energy Engineering Division
Morgantown, West Virginia

John F. Gardner, P.E.

Project Manager
Valve Testing and Development Projects
Morgantown Energy Technology Center

November 1980

Prepared for

UNITED STATES DEPARTMENT OF ENERGY
Morgantown Energy Technology Center
Morgantown, West Virginia

Under Contract No. DE-AC21-79MC12186

THIS PAGE
WAS INTENTIONALLY
LEFT BLANK

PREFACE

The work reported herein pertains to a slurry test loop design related to prior work performed under Contract No. EW-78-A-21-8496 which presented program rationale, requirements, and test plans relative to valves for solids throttling applications in coal conversion and utilization processes. Significant assistance in the performance of the reported work was received from John F. Gardner of the Morgantown Energy Technology Center who was the contract Technical Project Officer; Steve L. O'Toole, The Pittsburgh and Midway Coal Mining Co., Project Engineer for the Solvent Refined Coal Plant; Jack S. Hubacher and Monte F. Kopke, TRW Energy Systems Group, who were responsible for the slurry test loop design; and Joseph T. Hickson, TRW Energy Systems Group, who performed the stress analysis of the test loop design.

CONTENTS

	<u>Page</u>
Abstract	1
Introduction	1
Summary and Results	3
Conclusions and Recommendations	26
References	30
Appendices	
A Final Drawings	
B Equipment Specifications	
C General Specification	
D ANSI B31.3 Code Compliance Report	
E Preliminary Drawings	

TABLES

Table I	Preliminary Equipment List Instrumentation, Control, and Data Acquisition Systems .	16
---------	--	----

FIGURES

Figure 1	Preliminary Schematic of Valve Test Loops	5
Figure 2	Preliminary Test Data Sheet	7
Figure 3	General Area Designated for Valve Test Loop Installation at the SRC Pilot Plant at Ft. Lewis, Washington	8
Figure 4	Solvent Flush Technique	10
Figure 5	Alternate Design to Eliminate 180° Bend	18
Figure 6	Minimum Modifications to METC Proposed Design	20
Figure 7	Maximum Modifications to METC Proposed Design	21
Figure 8	Coordinate System and Element Identification Numbers . .	25
Figure 9	Limit Stop Sketch at Deck Level	27
Figure 10	Limit Stop Sketch at 5½ Feet Above Deck	28
Figure 11	Thermal Limit Stop Sketch	29

SOLIDS THROTTLING VALVES FOR COAL CONVERSION AND UTILIZATION DEVELOPMENT

by

Gordon C. Sine, P.E.¹

ABSTRACT

A complete test system to test, evaluate, and develop control valves for slurry letdown service in coal liquefaction plants is needed. The site identified for the test system was the SRC II Pilot Plant located at Ft. Lewis, Washington. The U.S. Department of Energy, Morgantown Energy Technology Center, requested a test system design that would enable testing of various configuration letdown valves that would be compatible with the existing facility and have minimum impact on Pilot Plant operations. Drawings and specifications for such a test system were prepared, coordinated with Ft. Lewis personnel, revised to reflect Ft. Lewis operating personnel comments, and approved for use by the Morgantown Energy Technology Center. These drawings and specifications will enable the test system to be built, installed, and integrated with the existing facility by a general contractor.

INTRODUCTION

The need to lessen the dependency of the United States on foreign oil is acknowledged. One means of helping to alleviate this dependency is to convert an abundant national natural resource, coal, to alternate energy forms. Coal liquefaction is a method to accomplish this. Coal conversion processes that yield liquid products normally operate at moderate temperatures (less than 1000°F) but high pressures (2000 to 4000 psig, typical). The product, however,

¹Office Manager, TRW Energy Systems Group, Energy Engineering Division, Morgantown Office.

is usually delivered at atmospheric pressure requiring a significant letdown from process pressures. The product streams also typically contain some solid materials which tend to be abrasive. Normally, high velocities accompany the pressure letdown function, particularly when throttle valves are used as the letdown device. These high velocities in concert with the abrasive solids in the product streams result in a very erosive environment. Control valves used as letdown devices in coal liquefaction Process Development Units (PDU) and Pilot Plants have had to be replaced every 30 to 60 days. More reliable (durable) letdown valves are required for coal liquefaction processes to advance to a commercial scale activity.

In order to develop more reliable letdown valves a facility to test and evaluate them under actual service conditions is necessary. A separate test facility dedicated to testing pressure letdown devices would be the preferred approach. However, the time and expense involved in the construction of a test facility to accomplish this in light of the unpredictable market for letdown valves in this service has not proven attractive to valve manufacturers. The government has also not been convinced that the return from such a limited function facility would justify the expense.

Another approach is to utilize a pilot plant or plants to test the valves. This is logical and relatively straightforward. But, pilot plant operation is intended to demonstrate process feasibility, development, and optimization; they cannot perform those intended functions if consistently and continually shut down for test article maintenance, failure, or changeout. Therefore, a test facility in conjunction with a pilot plant would have to be designed around the existing plant and be relatively self-sufficient to have minimum impact on plant operations.

One of the coal liquefaction processes deemed most promising is the SRC-II process. Plans are progressing to build a demonstration scale plant with construction proposed to start in 1981. The need for delivery of the letdown

valves for the plant is forecast for 1983/1984. The demonstration plant project made it appropriate to target development efforts for valves for SRC-II service. The Ft. Lewis Pilot Plant was selected as the site for a Slurry Letdown Valve Test Loop because the SRC-II process was developed at this site and the operating conditions would be identical to service conditions for the proposed letdown valves. A contract was awarded to provide a design that would integrate a valve test loop with the existing pilot plant.

SUMMARY AND RESULTS

The objective of the contract was to design a test loop for slurry letdown valves that was compatible with the existing pilot plant and would have a minimum impact on pilot plant operation. The design effort was divided into four task areas: (1) data acquisition and evaluation, (2) conceptual layouts, (3) detailed design drawings, and (4) specifications.

Data acquisition and evaluation involved contacting and/or visiting, SRC-II Pilot Plant personnel, Argonne National Laboratory personnel, Morgantown Energy Technology Center personnel, and numerous potential vendors to gather engineering design information. Design requirements and criteria were developed from the information obtained. Basic design decisions such as materials of construction, instrumentation, number of test loops, and data acquisition equipment resulted from this effort.

Conceptual layouts were prepared using the information obtained from the data acquisition effort and actual field measurements made during visits to the pilot plant. These layouts were reviewed with Ft. Lewis and DOE personnel and a preferred layout was selected. Detailed design drawings and specifications were prepared based on the layout selected. A final design review was held at Ft. Lewis upon completion of the detailed drawings. At that time Ft. Lewis operating personnel presented objections to the design based on their experience with the existing letdown loops. They recommended numerous changes which were incorporated in a redesign. New layout and detailed drawings were prepared which were approved by all parties concerned. A comprehensive stress analysis

conforming to the requirements of ANSI Code B31.3 was performed on the approved design and a Code Compliance Report was generated. A general (installation) specification and generic equipment specifications were prepared. The specifications were adapted to those in use at Ft. Lewis so they would be compatible with the existing system. These documents will permit the integration of the Slurry Letdown Valve Test Loops with the SRC-II Pilot Plant at Ft. Lewis, Washington.

A total of five trips was made to the Ft. Lewis facility to promote cooperation and data exchange throughout the project. Information was obtained from project, design, instrumentation, data acquisition and analysis, and operating personnel. In addition, field measurements of the piping and structures in the area allocated to the slurry test loops were obtained.

After initial data acquisition from the sources noted above, a preliminary schematic consisting of five separate loops was generated (Figure 1). The functions of the five loops were:

<u>LOOP NO.</u>	<u>FUNCTION</u>
1	Dedicated for Pilot Plant use, to be nearly identical to the existing plant loop, incorporating any improvements recommended by Ft. Lewis personnel. This loop is intended to provide for continuous plant operation if test valve failures/maintenance/etc. occur.
2	An Instrumentation loop and bypass to determine test valve inlet conditions and for use in testing and development of instrumentation for liquefaction process systems.
3	A Test Valve loop that would be used for testing and development of existing valves and modifications thereto.
4	A Test Valve loop that would be used for testing and development of new valve designs and concepts for both letdown and blocking valves.
5	An Instrumentation loop and bypass to determine test valve outlet conditions and for use in testing and development of instrumentation for liquefaction process systems.

Figure 1. Preliminary Schematic of Valve Test Loops.

A preliminary test valve data sheet (Figure 2) was formulated to describe the frequency and type of data required. In addition to the items listed on the data sheet, information relative to composition, percent solids, and solids particle size distribution is desired. This information could be recorded in the last column of the data sheet on a once-a-shift, once-a-day, or once-a-week basis depending on process stability.

An initial trip was made to Ft. Lewis to review the proposed test loop concept and to obtain physical dimensions from field measurements as well as design criteria and interface information. The concept was approved. Design criteria presented included the use of double block valves to isolate any portion of the system; the use of specifications, equipment, and materials as near as possible to those in present use at Ft. Lewis, e.g., Type 347 stainless steel for piping material and 2 inch diameter for nominal pipe size; the option to include or add instrumentation being developed by Argonne National Laboratory (or others); isolation valves on the upstream side of any portion of the system are to be automated. Design priorities were stipulated to be: (1) safety, (2) reliability and operability, and (3) maintenance. The area of first stage letdown (LCV166) of Section 02 of the Pilot Plant was designated as the area allocated to the test loops. The present valve loops, providing redundant paths for plant operation, were located in the area (Figure 3). In addition, two pipelines (one cold solvent line and one process vapor line) were noted to be routed through the stipulated area. Field measurements were made throughout the area to obtain physical dimensions of the structure and the existing piping. Particular attention was directed to spatial and structural restraints. Information relative to the existing instrumentation and data acquisition/analysis systems was also obtained.

The data obtained during the initial visit were used to prepare conceptual designs. These were reviewed during a second visit to Ft. Lewis and approved in concept by METC and Ft. Lewis. These conceptual designs were identified as:

RECORDED TEST DATA																							
VALVE MFG.: XYZ CORP.			MODEL: 4127			TEST HOUR SEQUENCE: XXX-XXX			TEST LOOP: B			DATE TEST INITIATED: XX-XX-XX											
DATE	HOUR	FLOW RATE, LBS/HR			INLET PRESS. PSI			OUTLET PRESS. PSI			INLET TEMP. DEG. F			OUTLET TEMP. DEG. F			STEM TORQUE, IN.LB			STEM POSITION, DEG.			SIGNIFICANT LOG BOOK ENTRY
		AVE.	HI.	LOW	AVE.	HI.	LOW	AVE.	HI.	LOW	AVE.	HI.	LOW	AVE.	HI.	LOW	AVE.	HI.	LOW	AVE.	HI.	LOW	
XX-XX-XX	0100	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	0200	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	0300	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	0400	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	0500	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	0600	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	0700	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	0800	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	0900	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	1000	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	1200	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	1300	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	1400	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	1500	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	1600	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	1700	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	1800	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	1900	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	2000	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	2100	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	2200	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	2300	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	
	2400	XX,XXX	XX,XXX	XX,XXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	

Figure 2. Preliminary Test Data Sheet.

Figure 3. General Area Designated for Valve Test Loop Installation at the SRC Pilot Plant at Ft. Lewis, Washington.

<u>TRW Sketch No.</u>	<u>Title</u>
0443-68-1	Preliminary Test Loop Isometric
0443-68-2	Current Valve Configuration
0443-68-3	Preliminary Test Loop Configuration
0443-68-4	Schematic of Valve Test Loops
0443-68-5	Test Loop R.

Various type block valves were discussed at this time. A decision was made to consider block valves from the following manufacturers as being representative and the test loops would be designed to accommodate them as a minimum. The manufacturers were:

- (a) Rockwell/Edward
- (b) WKM
- (c) Gray Tool Company
- (d) Con Val
- (e) McEvoy
- (f) Willis

The primary fitting (end connection) to be used was the Grayloc fitting. However, it was noted that Rocky Mountain Nuclear Corporation manufactured a fitting similar to Grayloc and it was decided to evaluate their fitting and if it proved acceptable incorporate some in the test loop design. If their service proved successful a second source would be available for a very long lead time item. During review of the concepts it was requested that the decking in the area be extended to provide additional "floor space" for the test loops and that the two pipelines in the area be re-routed to prevent interference with the proposed test loops. These requests were acceptable to Ft. Lewis. Ft. Lewis recommended a solvent flush technique (Figure 4) that has the advantage of eliminating solvent or slurry disposal problems since all flushing materials are returned to the process system. The technique was incorporated in the design. Additional information relative to instrumentation was also obtained. It was determined that the data required with the exception of the Valve Stem Torque (or operating force for pull stems) was currently being collected in the Ft. Lewis plant. The major changes in the controls area needed to incorporate the conceptual valve test loops were:

TYPICAL CONTROL VALVE TEST LOOP

FLUSH SEQUENCE

1. Shut off Loop by closing V_A and V_E .
2. Open V_G and V_F , source of high pressure clean solvent.
3. Open V_A and back flush slurry lines with clean solvent.
4. Close V_A and then V_B on clean solvent.
5. Open V_E and flush slurry lines with clean solvent.
6. Close V_E and then V_D on clean solvent.
7. Close V_G and V_F .
8. Open V_H and V_J to vent Pressure

Figure 4. Solvent Flush Technique.

- (a) Incorporation of Stem torque (or operating force) transducers and connecting them into the process computer.
- (b) Modification of the Letdown Control Valves Switching System to incorporate three test loops vs. the current two loops.
- (c) Incorporation of control systems for opening/closing the four powered blocking valves. The actuators for these four powered blocking valves will be air driven diaphragm type.
- (d) Incorporation of additional information on control room panel boards.
 - Valve test loop in-use.
 - Switches and position indicators for powered blocking valves.

Other decisions made concerning the detailed designs were:

- (a) Loop A, the Pilot Plant Operations Loop, was approved with Willis Block Valves and the Fisher DBAQ Control Valve.
- (b) The inlet and outlet instrument loops were approved with Willis and Rockwell/Edward Block Valves.
- (c) Loop B will be the horizontal test loop and will contain Willis Block Valves. Initially the control valve will be an angle type valve similar to the Fisher DBAQ valve.
- (d) Loop C will be the vertical test loop and will be designed initially with Rockwell/Edward Block Valves and a straight through control valve.
- (e) A stress analysis conforming to ANSI Code B31.3 would be needed.

Using the above information, the following detail drawings were prepared to Morgantown Energy Technology Center (METC) format.

<u>METC Drawing Number</u>	<u>Title</u>
E800012	Slurry Letdown Valve Test Loops at Ft. Lewis SRC Pilot Plant
E800013	Loop "A"
E800014	Loop "B"
E800015	Loop "C"
E800016	Inlet Instrument Loop
E800017	Outlet Instrument Loop
E800018	Structural Steel for Platform Extension
E800019	Schematic of Valve Test Loops

A trip was made to Ft. Lewis to review the piping drawings and to obtain additional information on the instrumentation and data acquisition system requirements. The drawings were approved with minor comments. During discussions on instrumentation, it was determined that all equipment would have to be approved by Factory Mutual (FM) (insurance underwriter) to FM specification requirements for Class 1, Group B, Division II. The stress analysis for the system was discussed and resulted in the following guidelines:

- design for temperature, pressure, and weight loadings only
 - design for seismic zone 3 requirements
 - use a program that produces an ANSI B31.3 code compliance report
- be aware that technicians may use the piping as a ladder.

Ft. Lewis drawing comments were incorporated and the drawings are included as Appendix E, Preliminary Drawings, of this report. These drawings were submitted to Ft. Lewis and DOE for final approval.

Various methods for performing the stress analysis were examined. It was determined that a commercially available computer program, Pipeline, would meet the majority of the requirements and it was subsequently used for the static analysis and the ANSI B31.3 code compliance report. For the purposes of this project, it was determined that an equivalent static load approach based on information contained in ANSI A58.1 would suffice for the seismic analysis and it was performed without using a computer. The anchor points for the stress analysis were supplied by Ft. Lewis. The piping should be assumed to be rigid at the pipe flanges where the piping attaches to the vessels shown in Ft. Lewis Drawing No. P4-02-8. Preliminary work on the stress analysis commenced using the drawings and information mentioned above.

The preliminary approach taken for instrumentation, control, and data collection at Ft. Lewis is summarized here. The valve testing program at Ft. Lewis will be accomplished by replacing the existing main loop and by-pass system with a three loop configuration. The primary loop "A" will be dedicated for pilot plant operation. Valve testing will be performed using one of the secondary loops "B" or "C". Two solenoid operated blocking valves will isolate loop "A" and two solenoid operated blocking valves will isolate loops "B" and "C". Manual blocking valves will be used to select either loop "B" or "C" for service. Each loop will have a pressure letdown valve that will be operated by an actuator receiving its control signal from the control room. Operating data to be collected for each valve, in addition to data presently obtained by existing Ft. Lewis data acquisition systems, are valve position and actuation force. This will be accomplished by adding transducers to the actuator assembly for a given valve.

The position indicator is a two part device. The transmitter is a pneumatic device providing an output signal of 3-15 psig proportional to the valve stem position (Note: Local indication of output pressure will be provided by a pressure gauge). This device is mounted on the yoke of the actuator. The output pneumatic signal will be converted to a 4-20 mdc signal by a pressure transmitter. The electronic package will have a zero and span

adjustment which will be used to make the 4-20 mdc signal correspond to 0-100% of stroke. A record of the actual stroke (in inches) of each valve will be made and updated as changes develop.

The force transducer is a pressure transmitter measuring the pressure on the diaphragm of the actuator and providing a 4-20 mdc signal output. (Note: Local indication of pressure is provided by a pressure gauge mounted on the valve positioner). The force exerted will be obtained by multiplying the pressure reading by the effective area of the diaphragm. Return spring rate information, available for each actuator from the serial number, will be a part of the record.

Several tests should be run before a valve is put in service to obtain empirical force measurements at different valve stem positions. These data should be collected with the line empty and the repeatability of the data verified. Test plans and operating procedures should permit the empty line to be loaded with SRC at operating pressure prior to putting the loop in service. Tests should be repeated to obtain empirical force measurements at the previously determined valve stem positions with pressurized SRC in the line but no flow. These data along with the operating pressure should be recorded.

Fort Lewis Pilot Plant operating parameters are currently being collected by an existing Foxboro Spec 200 System with Interspec to communicate the information to a Foxboro 2/30 Computer System. The data are being read onto a drum and dumped periodically onto magnetic tape. The following data relative to valve testing are currently being brought into the computer and recorded:

Upstream Pressure	PT 161
Upstream Temperature	TT 167
Downstream Pressure	PT 173
Downstream Temperature	TT 176
Output of LC 186 to LCV 166	(Assumed to be in data collected by the computer)
SRC Flow Rate	(currently a calculated number)

The additional field instrumentation required for valve testing will result in two additional analog and three additional switch closure inputs to the Spec 200 System. These inputs will provide raw data for the new tape record. This record will include

Force on Valve Stem Currently in Service	WT 166A
" " " "	WT 166B
" " " "	WT 166C

Position of Valve Currently in Service	ZT 166A
" " " "	ZT 166B
" " " "	ZT 166C

Identification of Loop Currently in Service
A, B, or C (Switch Closure)

The reading of the force transducers must be multiplied by the effective area of the actuator to produce a meaningful force measurement. The force measurement will be a part of the record.

An approach for collection of the data on the valve tests is to add a separate tape deck to the existing system. This would provide a separate output device to minimize operator interface. The tapes could be shipped to an off-site location for data reduction. Interpretation of the data may require a narrative discussion of the tests and any manually taken data. A handwritten log of the valve test proceedings shall be maintained for this purpose.

The approach described above was used to prepare the preliminary equipment list and cost estimate presented in Table I and the Piping and Instrumentation Diagram for Slurry Letdown Valve Test Loops, METC Drawing No. E800020. The drawing is included in Appendix E, Preliminary Drawings. In addition, three engineering sketches were prepared for the electrical system.

Table I
Preliminary Equipment List*
Instrumentation, Control, and Data Acquisition Systems

<u>Item</u>	<u>Tentative Identification</u>	<u>Description</u>	<u>Typical Mfg. P/N</u>	<u>Quantity</u>	<u>Estimated Unit Cost</u>
1	LCV 166	Diaphragm Actuator	Fisher 657-40	3	\$214.00
		Electro-pneumatic Valve Positioner	Fisher 3590T		\$415.00
		Mounting Kit for above			\$ 45.00
2	ZT 166	Valve Stem Position Indicator Transmitter	Fisher 3583	3	\$334.00
3		Signal Converter P/I	Foxboro E11GM-15AB-2-CS-E-FBA	3	\$750.00
4	WT 166	Pressure Transmitter	Foxboro E11GM-15AB-2-CS-E-FBA	3	\$750.00
5	V166A1 V166A2 V166BC1 V166BC2	Diaphragm Actuator with Solenoid Valves	Fisher	4	\$400.00
6		Switches for Solenoid Valves		2	
7		Status Indicator for Solenoid Valves		2	
8		Selector Switch for Flow Loops		1	
		5P-3T 3 Position			
9		Magnetic Tape Transport DECTE10		1	\$12,000.00
10		4-20 mdc Input Card	Foxboro 2AI-IZV-FGB	1	\$329.00
11		Contact Input Isolator	Foxboro 2AI-CZL-FGB	1	\$119.00
12		Spec 200 Nest	Foxboro ZANU-D-FGB+DP10-FGB	1	\$392.00
13		AIM Card	Foxboro ZAX + IM	1	\$451.00
14		AIM	Foxboro ZDNA-C+SA8 +LM	1	\$5,605.00
15		Cable for AIM		1	\$821.00
16		Expanding Existing AIM to Dual Ported		1	\$1,303.00

- *NOTES: (1) All equipment is FM approved and in compliance with Class 1, Group B, Division II.
- (2) Foxboro should install any additions to the Spec 200 or Interspec system.
- (3) D.E.C. should install and run diagnostic of the additional tape deck. The cost estimates do not reflect this.

A trip was made to Ft. Lewis for the final design review on the drawings included in Appendix E of this report and to finalize the electrical system design. It was at this time that the operating personnel at Ft. Lewis expressed dissatisfaction with the proposed design. After approving the original design, further reflection resulted in concerns based on their experience operating the pilot plant. Their comments are summarized as follows:

1. Keep Rockwell Edward valves in the "A" Loop since operations personnel have learned how to successfully perform plant startup and shutdown with this loop using the Edward valves.
2. Use the design shown in Figure 5 to replace the 180° piping bends which tend to act as solids traps. If plugging or blockage occurs in the Figure 5 arrangement, the blind Grayloc connectors will permit easy access to the piping for cleaning by rodding or hydroblasting.
3. Eliminate actuated block valves on the "A" Loop because the actuators require considerable maintenance to assure their operation and interlocks must be incorporated to assure they are not opened when maintenance is being performed on the line. If the letdown valves fail to operate, the plant operators have 15 minutes to correct problems due to the large storage capacity of the high pressure flash drum. Actuated valves on the "B" and "C" Loops are preferred with a remote (on a column at grade level) hand-operated pneumatic valve.
4. Keep the "A" and "B" Loops the same configuration as currently used at Ft. Lewis and only use the instrumentation loops when the "C" Loop is in operation. This recommendation is based on the number of block valves that the slurry must pass through in the proposed new design. Operating personnel believe the pressure drop through the block valves may be detrimental to operation of the pilot plant should the proposed "B" or "C" Loop be used.
5. Use Rocky Mountain Connectors (R-Con) on the "C" loop only. All other loops and all 1" bleed lines should use Grayloc Connectors.

Review of these concerns resulted in the following alternatives:

- a) No change from METC proposed design.

Figure 5. Alternate Design to Eliminate 180° Bend.

b) Minimize the design changes as follows:

- Eliminate the manual Willis block valves following the actuated Willis block valves separating the "A" Loop from the "B" and "C" Loops.
- Eliminate the instrument loop sections, but leave Grayloc blind connectors to enable future connections.
- Make the instrument by-pass a straight run without blocking valves but with a bleed connection.

Figure 6 depicts the schematic of the test loops with these minimum modifications to the proposed METC design.

c) This option represents the maximum change to the proposed METC design as follows:

- Do not make any changes to the "A" and "B" Loops as they exist in the plant today.
- Construct the "instrumentation" loops and the "C" Loop in parallel with the "A" and "B" loops.

Figure 7 depicts the schematic of the test loops with these maximum modifications to the proposed METC design.

These alternatives were evaluated and the subsequent final design incorporated features from each.

The electrical system design was reviewed and approved. Each of the three control valves (LCV 166 A, B & C) will have pneumatic actuators. To these actuators will be added the following:

Valve Stem Positioner (I/P 166 A, B & C)

Valve Stem Load Transducer (WT 166 A, B & C)

Valve Stem Position Transducer (ZT 166 A, B & C)

Figure 5. Minimum Modifications to METC Proposed Design.

Figure 7. Maximum Modifications to METC Proposed Design.

The valve stem positioner takes a 4-20 ma signal and provides air output to control the actuator.

The valve stem load transducer is a pressure transducer measuring the pressure on the diaphragm in the actuator. The pressure will become a force when it is multiplied by the effective area of the actuator. This will be done in the computer.

The valve stem position transducer will provide an output pneumatic pressure signal of 3-15 psig proportional to the position of the valve. This pressure is converted to a 4-20 ma signal by a pressure transmitter.

The three signal lines to each valve are brought into the control room to a selector switch. The signal controlling the valves comes from existing equipment and will go to that selector switch. Any loop can then be selected for service.

The above information was used to prepare the final design. The "A" Loop design will be identical to the existing design and will use the existing drawing by reference (PAMCO Drawing No. B7-02-44). Provisions to accept two additional block valves, MOGAS and Kamyr ball valves, will be incorporated in the "C" Loop design. Engineering sketches (TRW Sketch Nos. 0443-70-1 through 0443-70-4) were prepared incorporating the changes noted and a meeting was held at the Ft. Lewis Pilot Plant to obtain approval prior to preparation of final drawings. The design was approved and preparation of the final drawings and specifications commenced. Draft specifications were prepared and approved by METC and Ft. Lewis.

Final drawings, listed below, were prepared and are included as Appendix A of this report.

<u>Item No.</u>	<u>METC Dwg. No.</u>	<u>Title</u>
1.	E800257	Ft. Lewis SRC Pilot Plant Slurry Letdown Valve Test Loops
2.	E800258	Ft. Lewis SRC Pilot Plant Loop "B"
3.	E800259	Ft. Lewis SRC Pilot Plant Loop "C"
4.	E800260	Ft. Lewis SRC Pilot Plant Piping Inlet and Outlet Interface
5.	E800261	Ft. Lewis SRC Pilot Plant Structural Steel for Platform Extension
6.	E800262	Ft. Lewis SRC Pilot Plant Schematic of Valve Test Loops
7.	E800263	Ft. Lewis SRC Pilot Plant Piping and Instrumentation Diagram for Slurry Letdown Valve Test Loops
8.	E800264	Ft. Lewis SRC Pilot Plant Control Loops

Equipment specifications, listed below, were prepared and are included as Appendix B of this report.

<u>Item No.</u>	<u>METC Specification No.</u>	<u>Title</u>
1	METC 6-80-1	Valve Actuators (Control Valve)
2	METC 6-80-2	Pressure Instruments (Force and Position Transmitters)
3	METC 6-80-3	Receiver Instruments (Force and Position Receivers)
4	METC 6-80-4	Rotary Switches
5	METC 6-80-5	Magnetic Tape Transport
6	METC 6-80-6	Printer
7	METC 6-80-7	Valve Actuators (Blocking Valves)

A General Specification, METC Engineering Specification No. 5-80, "Specification For Fabrication and Installation of Slurry Letdown Valve Test Loops at the Ft. Lewis SRC Pilot Plant, Ft. Lewis, Washington", was prepared and is included as Appendix C of this report.

A stress analysis conforming to the requirements of ANSI B31.3-1976 was performed on the final design utilizing a commercially available computer program entitled "Pipeline". In addition, a seismic analysis was performed using ANSI A58.1-1972 as a guide. This analysis was performed by hand. A stress analysis report including the following items was prepared and delivered to METC.

- a) "Pipeline" computer program stress report containing thermal, deadweight, thermal plus pressure plus deadweight, and B31.3 code compliance reports.
- b) A list of definitions for nomenclature used in the code compliance report of the "Pipeline" output.
- c) The hand calculations performed as seismic analyses.
- d) Sketches of recommended and required pipe support modifications.

The code compliance report is included as Appendix D of this report. The report indicates that the total piping system is within the Code allowable stresses and stress ranges, when the recommended restraints are imposed. If any stress had exceeded an allowable, a series of asterisks would have appeared directly over that value. Two areas of restraint are required as a result of the stress analysis. Figure 8 presents the coordinate system (compatible with that used at Ft. Lewis) and element identification numbers pertinent to the final design used for stress analysis purposes.

The first area of restraint resulted from the thermal analysis of the system. The supports at points (15) and (75) of Figure 8 must be restrained to provide zero movement in the plus X-direction. This modification was necessary to reduce nozzle stresses at elements (90) and (91) and stresses in Tee crotches at (1) and (87) as a result of thermal movements. The limit stops are to be installed in the cold condition. A typical installation is shown in Figure 11.

Figure 8. Coordinate System and Element Identification Numbers.

The second area of restraint resulted from the seismic analysis performed. The calculation results indicate the need to restrict displacement of test loop A to ± 1 inch in the Z directions with a ± 0.25 inch tolerance measured at a point 211 inches above the High Pressure Flash Drum nozzle, element (90). This corresponds to $5\frac{1}{2}$ feet above the deck. An alternative is to limit the movement near the deck at elements (1) and (87) to ± 0.75 in. and ± 0.25 in. respectively with a ± 0.1 inch tolerance for both. Either limit stop arrangement chosen must be set in the hot condition.

The $\pm$ limit stop arrangements shown in Figure 9 and Figure 10 are typical. However, any scheme which accomplishes the limit stops specified is acceptable with the following exception:

If a limit stop arrangement near the deck is selected, movement in the $\pm X$ -direction should not be limited for data point (87). Calculated thermal movements of combined thermal, pressure and dead weight analysis indicate movements in excess of the limit stop clearances. This would cause a pre-stress which has not been analyzed if the same ± 0.25 in. clearance were used all around the pipe.

Delivery of the drawings, specifications, and stress analysis completed the project.

CONCLUSIONS AND RECOMMENDATIONS

It was concluded that loops for testing solids throttling and isolation valves could be incorporated with the Ft. Lewis SRC Pilot Plant and that their incorporation would have minimum impact on pilot plant operations. The documents presented in Appendices A through C and this report will provide the information necessary to effect the integration. The report presented in Appendix D indicates the resulting installation will comply with the requirements of ANSI B31.3-1976, American National Standard Code For Pressure Piping, Chemical Plant and Petroleum Refinery Piping.

REFERENCE: TRW LETTER # 80-1453-JTH-11

ENGINEERING SKETCH		TRW <small>DEFENSE AND SPACE SYSTEMS GROUP</small> ONE SPACE PARK • REDONDO BEACH, CALIFORNIA	
ORIGINATOR J.T. HICKSON	DATE 10/21/80	FT. LEWIS SLURRY VALVE TEST LOOP TYPICAL LIMIT STOP ARRANGEMENT AT DECK LEVEL FOR DISPLACEMENT LIMITS UNDER CALCULATED SEISMIC LOADS	
		SIZE A	FSCM NO. 11982
		SK-012	
MJO		SCALE NONE	SHEET 1 OF 2

Figure 9. Limit Stop Sketch at Deck Level.

REFERENCE: TRW LETTER # 80-1453-JTH-11

ENGINEERING SKETCH		TRW <small>DEFENSE AND SPACE SYSTEMS GROUP</small> ONE SPACE PARK • REDONDO BEACH, CALIFORNIA	
ORIGINATOR J.T. HICKSON	DATE 10/21/80	TYPICAL LIMIT STOP ARRANGEMENTS 5 1/2 FT. ABOVE DECK LEVEL FOR DISPLACEMENT LIMITS UNDER CALCULATED SEISMIC LOADS	
		SIZE A	FSCM NO. 11982
		SK-012	
MJO		SCALE NONE	SHEET 2 OF 2

*Figure 10. Limit Stop Sketch at 5 1/2 Feet Above Deck.

WELD WITH PIPE SYSTEM IN
COLD CONDITION AND
ZERO CLEARANCE
PER NOTE BELOW

FLAME GOUGE
THRU
(2) SLOTS
APPROX. 3" LONG
SPACE AS REQ.

WELD WITH PIPE SYSTEM IN
COLD CONDITION AND ZERO
CLEARANCE PER NOTE ABOVE

REFERENCE: TRW LETTER # 80-1453-JTH-11

NOTE: ARRANGEMENT SHOWN IS REQUIRED AT (2) PLACES

ENGINEERING SKETCH		TRW <small>DEFENSE AND SPACE SYSTEMS GROUP</small> ONE SPACE PARK • REDONDO BEACH, CALIFORNIA	
ORIGINATOR J.T. HICKSON	DATE 10/21/80	FT. LEWIS SLURRY VALVE TEST LOOP LIMIT STOPS REQUIRED FOR THERMAL GROWTH AT ELEMENTS (15) AND (75) OF REFERENCE	
		SIZE A	FSCM NO. 11982
MJO		SK-013	
		SCALE NONE	SHEET 1 OF 1

Figure 11. Thermal Limit Stop Sketch.

It is recommended that the restraints described on pages 24 through 29 of this report be implemented to reduce pipeline stresses and that the suggestions on page 14 relative to force measurements be incorporated in valve test procedures. The use of a valve test log with daily manual entries is also recommended.

REFERENCES

1. American National Standard Code for Pressure Piping, Chemical Plant and Petroleum Refinery Piping, ANSI B31.3-1976. Available from American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018.
2. American National Standard, Building Code Requirements for Minimum Design Loads in Buildings and Other Structures, ANSI A58.1-1972. Available from American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018.
3. Test Plan for a Control Valve for Slurry Letdown Service. METC/CR-79/9, June 1979. Available from National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22161.
4. Facility Requirements for Testing Control Valves for Slurry Letdown Service. METC/CR-79/11, June 1979. Available from National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22161.
5. Design Criteria for a Control Valve for Slurry Letdown Service. METC/CR-79/13, June 1979. Available from National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22161.
6. Program Rationale, Valves for Solids Throttling Applications In Coal Conversion and Utilization Processes. METC/CR-79/14, August 1979. Available from National Technical Information Service, U.S. Department of Commerce, Springfield, Virginia 22161.

Appendix A

Final Drawings

The following final drawings are in this Appendix.

<u>Item No.</u>	<u>METC Dwg. No.</u>	<u>Title</u>
1.	E800257	Ft. Lewis SRC Pilot Plant Slurry Letdown Valve Test Loops
2.	E800258	Ft. Lewis SRC Pilot Plant Loop "B"
3.	E800259	Ft. Lewis SRC Pilot Plant Loop "C"
4.	E800260	Ft. Lewis SRC Pilot Plant Piping Inlet and Outlet Interface
5.	E800261	Ft. Lewis SRC Pilot Plant Structural Steel for Platform Extension
6.	E800262	Ft. Lewis SRC Pilot Plant Schematic of Valve Test Loops
7.	E800263	Ft. Lewis SRC Pilot Plant Piping and Instrumentation Diagram for Slurry Letdown Valve Test Loops
8.	E800264	Ft. Lewis SRC Pilot Plant Control Loops

MATERIALS LIST				
NOTE	PART NO.	DESCRIPTION	NO. REQD.	MAT'L SPEC.
			(24-1)(24-2)(24-3)	

INLET INTERFACE PIPING
SEE DRWG NO. 800260

EXISTING LOOP "A"
SEE PITTSBURGH AND
MIDWAY COAL MINING
COMPANY DRWG NO.
87-02-44

LOOP "C"
SEE DRWG NO. 800259

OUTLET INTERFACE PIPING
SEE DRWG NO. 800260

EXISTING PIPE TO BE RAISED 24"
AND SUPPORTED ON NEW PIPE SUPPORT.
SEE SHEET 2

SEE DRWG NO. 800261
VIEW A FOR PIPE SUPPORT
AND ASSEMBLY

SEE DRWG NO. 800261
VIEW B FOR PIPE SUPPORT
AND ASSEMBLY

LOOP "B"
SEE DRWG NO. 800258

- NOTES
- 1 THE TEST LOOPS AND STRUCTURAL STEEL SHALL BE FABRICATED IN ACCORDANCE WITH METC ENGINEERING SPECIFICATION NO. 5-40
 - 2 SHEET 1 OF THIS DRAWING SHOWS PIPING ONLY WITHOUT STRUCTURAL DETAILS
SHEET 2 OF THIS DRAWING SHOWS STRUCTURAL DETAILS ONLY WITHOUT PIPING

FT. LEWIS SRC PILOT PLANT APPROVAL	
Drawing No. <i>800258-1</i>	Rev. <i>1</i>
Approved By <i>S.L. Jones</i>	Date <i>8/9/81</i>

REV. DATE DESCRIPTION BY CDR APPVD 800258 800259 800260 800261 800262			
MORGANTOWN ENERGY TECHNOLOGY CENTER PROJECT NO. <i>800258</i>			
TITLE FT LEWIS SRC PILOT PLANT SLURRY LETDOWN VALVE TEST LOOPS			
DRWG. TYPE E	DESIGNED BY 800258 800259 800260 800261 800262	CHECKED BY 800258 800259 800260 800261 800262	DATE 8/9/81 8/9/81 8/9/81 8/9/81 8/9/81
PROJECT NO. <i>800258</i>			

MATERIALS LIST				
NOTE	PART NO.	DESCRIPTION	NO. REQ'D. (OR-1)(OR-2)(OR-3)	MAT'L SPEC.
				ZONE

FT. LEWIS SRC PILOT PLANT APPROVAL	
Drawing No. <u>800257</u>	Rev. <u>2</u>
Approved By <u>G. J. Smith</u>	Date <u>2/8/87</u>

REV	ZONE	DATE	DESCRIPTION	BY	CHK	APPV
 MORGANTOWN ENERGY TECHNOLOGY CENTER						
ORG. TYPE E		TITLE FT LEWIS SRC PILOT PLANT SLURRY LETDOWN VALVE TEST LOOPS				
REF. ORG. NO. 800253 800254		DESIGNED BY 800258 800259 800260 800261 800262	DATE 21 JAN 80	PROJECTING DATE	DATE	DATE
CHECKED BY 800263		DATE 21 JAN 80	DRAWN BY DATE	DATE	DATE	DATE
CODE SHEET NO.		SCALE 1" = 1'-0"	SHEET NO. 800257	OF 1	OF 1	OF 1

34

CONTROL VALVE	DIM X	DIM Y
FISHER DBA3	22 1/2"	11 1/2"

MATERIAL LIST					
NOTE	PART NO	DESCRIPTION	NO REQ'D	MATL SPEC	ZONE
	1	2" DIA. SCHEDULE 40 SEAMLESS PIPE	~5'	ASTM A312, Q1 TP307	
	2	2" x 2" x 2" TEL. GASKET, SOCKET WELD.	2	ASTM A182, F307	
		WOL 816, 11			
	3	2" GRAYLOC CONNECTORS, 3 OF 14, CLAMP-WELD	6	317 SS NUBS	
		80-110-10013, SEAL RING-51272	24 IS		
	4	90-115 ANGLE VALVES	4	TYPE 91-115 H.O.V.	
	5	CONTROL VALVE	1	SEE FABRICATION	G-9
	6	CONTROL VALVE ACTUATOR	1	FISHER 652 MODEL NO	
	7	RESTRICTION ORIFICE ASSEMBLY	1	WILLIS - 9-31" ORIFICE

[illegible]

MATERIALS LIST						
NOTE	PART NO	DESCRIPTION	NO REQ'D		MATERIAL SPEC	ZONE
			GR-1	GR-3		
1	2"	DIAMETER, SCHEDULE 30 SEAMLESS PIPE	5		ASTM A312, GR TP304	
2	2" x 2" x 2"	TEE, 6000#, SOCKET WELD	2		ASTM A182, F707	
		ANSI B16.11				
3	2"	ORLYCLO CONNECTORS 7 OR 14, CLAMP #40502			307 SS HUBS	
		BOLTING-POMPS, SEC. RING-S1772	SET			
4	2"	8-CON CONNECTORS 8H-2, S1515			307 SS HUBS, SEAL S-1510, CLAMP C-2	
5		VALVES, TEST BLOCKING, 8"			307 SS BODY	
6		CONTROL VALVE	1		SEE TABULATION	C-9
7		CONTROL VALVE ACTUATOR	1		FISHER 657 MODEL NO

NOTES:

1. PIPING SHALL BE FABRICATED, INSPECTED, HEAT TREATED AND DIMENSIONED IN ACCORDANCE WITH MEFC ENGINEERING SPECIFICATION NO. 5-00.
2. WHEN LOOP "C" IS IN OPERATION, LOOPS "A" AND "B" ARE OFF LINE.

FT. LEWIS SRC PILOT PLANT APPROVAL Drawing No. <u>2-12-10-10-1</u> Rev. <u>2</u>	
Approved By <i>S. A. [Signature]</i>	Date 2/9/61

[illegible]

37

- NOTES:
1. PIPING SHALL BE FABRICATED, INSPECTED, HEAT TRACED AND INSULATED IN ACCORDANCE WITH METC ENGINEERING SPECIFICATION NO. 5-40.
 2. OVERALL LENGTH DIMENSIONS FOR PIPING ASSEMBLY INCLUDE 1/4\"/>

MATERIAL LIST					
NOTE	PART NO.	DESCRIPTION	NO. REQ'D (GR.1) (GR.2)	MAT'L SPEC.	ZONE
	1	2" DIA. SCHEDULE 40 SEAMLESS PIPE	~8	ASTM A312 GR TP304	
	2	2" GEARLEAVE CONNECTOR, 2 GR 14, CLAMP-#6502, BOLTING-TOWNS, SEAL BING-51772	1 SET	2WT 55 HUBS	
	3	BLIND VALVE ACTUATOR	2	FISHER	
	4	BLIND VALVE, 2"	7	RTLLS. TYPE W-1 HT. N.D.V.	
	5	2" 1/2" X 2" TEE, 6000#, SOCKET WELD, ANSI B16.11	5	ASTM A182, F307	
	6	2" GEARLEAVE BLIND, PART NO. 59310, SEAL BING 51772, CLAMP-#6502, BOLTING-TOWNS	3	216 SS	
	7	2" 2" X 2" CROSS, 6000#, SOCKET WELD, ANSI B16.11	1	ASTM A182, F307	
VIEW A - QUANTITIES PER ASSEMBLY					
	8	REDUCER, 2" 1/2", 6000#, SOCKET WELD, ANSI B16.11	1	ASTM A182, F307	
	9	1" DIA SCHEDULE 40 SEAMLESS PIPE	~17	ASTM A312 GR TP304	
	10	1" GEARLEAVE CONNECTOR, 1 GR 3, SEAL BING, GEARLEAVE CLAMP-#6734, BOLTING-TOWNS	1 SET	2WT 55 HUBS	
	11	VALVE BODY, 1" SCHWABE FIC. 6629, 1"	2	2WT 55 BODY	
	12	1" CAP, SCHWABE, 6000#	1	ASTM A182, F307	

FT. LEWIS SRC PILOT PLANT APPROVAL	
Drawing No. E800246	Rev. D
Approved By SL03006	Date 2/6/97

REV	ZONE	DATE	DESCRIPTION	BY	CHK	APVD
 MORGANTOWN ENERGY TECHNOLOGY CENTER <small>Morgantown, WV</small>						
FT LEWIS SRC PILOT PLANT INLET AND OUTLET INTERFACE PIPING			TITLE			
800257 800258 800259 800260 800261 800262	800257 800258 800259 800260 800261 800262	DATE 17 JUL 90 DATE 17 JUL 90 DATE 17 JUL 90 DATE 17 JUL 90 DATE 17 JUL 90	DESIGNED BY DATE 17 JUL 90 CHECKED BY DATE 17 JUL 90 SCALE 1/4\"/>	800257 800258 800259 800260 800261 800262	DATE 17 JUL 90 DATE 17 JUL 90 DATE 17 JUL 90 DATE 17 JUL 90 DATE 17 JUL 90	800257 800258 800259 800260 800261 800262

PT. LITTLE OIL FIELD PLANT ADDENDUM

Drawing No. FB-140, 2 1/2 Rev. 2

Approved By SLASH Date 2/19/87

DRWG SIZE	DRWG NO 800260	REV. 1
E	SCALE	ENT. 2

MATERIAL'S LIST						
NOTE	PART NO	DESCRIPTION	NO REQD		MATL SPEC	ZONE
			GR-1	GR-3		
	1	STEEL CHANNEL, AISC C 6 X 13	-27		ASTM A-36	
	2	STEEL BEAM, AISC W 8 X 17	-27		ASTM A-36	
	3	STEEL STRIP, AISC 3" X 1/4"	-85		ASTM A-36	
	4	TUBE, STEEL, AISC, TUBE 1 1/2" O D X 1/2 X 3/16	-4		ASTM A-501	
	5	DEQ GRATING, STEEL 1 1/4" X 3/4 16"	-52		MUMM TYPE B19-N, GALVANIZED	
	6	STEEL BEAM, AISC W 8 X 20	-27		ASTM A-36	
	7	STEEL CHANNEL, AISC C 2 X 2 X 1/4	-43		ASTM A-36	
	8	STEEL PLATE, 1/2" THICK	-5		ASTM A-36	
	9	STEEL PIPE, 1 1/2" O D X SCHEDULE 40	2		ASTM A-53	
	10	STEEL PLATE, 1/4" THICK	2		ASTM A-36

The diagram illustrates a complex pneumatic control system with three parallel channels. Each channel includes a pressure sensor (LV), a pressure indicator (PI), and a pressure transmitter (PT). The system is controlled by a flow loop selector switch (FP-ST 3-POSITION) and a dual 4-20mA input card. The diagram shows the interconnection of these components via a common air supply line and a common air return line. The system is labeled with various components and their connections, including valves, relays, and electrical connections.

MATERIALS LIST						
NOTE	PART NO	DESCRIPTION	NO REQ'D		MAT'L SPEC	ZONE
			QRY-1	QRY-2		
	1	BLKCK VALVE, INST AIR	8		PARQD SPEC R-32320-QZ-11-11-15	
	2	PRESSURE REGULATOR, AIR	3		PARQD SPEC R-32320-QZ-11-11-15	
	3	CONTROL VALVE ACTUATOR	3		NETC SPEC R-80-1	
	4	STEP LQWD TRANSLOCATOR	3		NETC SPEC R-80-2	
	5	STEP POSITION TRANSLOCATOR	3		NETC SPEC R-80-1	
	6	CURRENT TO PRESSURE CONVERTER	3		NETC SPEC R-80-1	
	7	PRESSURE TO CURRENT CONVERTER	3		NETC SPEC R-80-2	
	8	SELECTOR SWITCH	1		NETC SPEC R-80-4	
	9	TEMP' CARD (EXISTING)	1		NETC SPEC R-80-3	
	10	DIGITAL INPUT MODULE (EXISTING)			17500000	
	11	MAGNETIC TAPE	1		NETC SPEC R-80-5	
	12	LOW PRESSURE	1		NETC SPEC R-80-6	
	13	BLACK VALVE ACTUATOR	2		NETC SPEC R-80-7	
	14	MANO ACTUATED 3-WAY VALVE	1		PARQD SPEC R-32320-QZ-11-11-15

PT. LINDS SEC PILOT PLANT APPROVAL

Drawing No.	<u>E800241, Sh. 171</u>	Rev.	<u>C</u>
Approved By	<u>S.L. Oswald</u>	Date	<u>2/9/89</u>

REV	FORM	DATE	DESCRIPTION	BY	CR	APP
<p>United States Department of Energy</p> <p>MORGANTOWN ENERGY TECHNOLOGY CENTER</p> <p>Morgantown WV</p>						
DRWG TYPE I		TITLE:				
DRWG NO. E		FT LEWIS SRC PILOT PLANT CONTROL LOOPS				
REF. DRWG NO.		800257 800736 800239 800280 800761 8007 NO 761				
CODE IDENT NO		DRWG P LAM DESIGNER CHECKED BY DATE SCALE NONE	DRAWN 24-24-80 DATE 4-2-81 DATE 4-2-81	REPT ENG 24-24-80 BRANCH 4-2-81 4-2-81	DATE 4-2-81 4-2-81	800257 800736 800239 800280 800761 8007 NO 761
CODE IDENT NO		800257 800736 800239 800280 800761 8007 NO 761	800257 800736 800239 800280 800761 8007 NO 761	800257 800736 800239 800280 800761 8007 NO 761	800257 800736 800239 800280 800761 8007 NO 761	800257 800736 800239 800280 800761 8007 NO 761

THIS PAGE
WAS INTENTIONALLY
LEFT BLANK

Appendix B

Equipment Specifications

The following equipment specifications are in this Appendix.

<u>Item No.</u>	<u>METC Specification No.</u>	<u>Title</u>
1	METC 6-80-1	Valve Actuators (Control Valve)
2	METC 6-80-2	Pressure Instruments (Force and Position Transmitters)
3	METC 6-80-3	Receiver Instruments (Force and Position Receivers)
4	METC 6-80-4	Rotary Switches
5	METC 6-80-5	Magnetic Tape Transport
6	METC 6-80-6	Printer
7	METC 6-80-7	Valve Actuators (Blocking Valves)

	VALVE ACTUATORS				SHEET	OF	
	NO	BY	DATE	REVISION	SPEC. NO.	REV.	
					METC 6-80-1		
					CONTRACT	DATE	
					REQ. - P.O.		
					BY	CHK'D	APP.

GENERAL	Tag No.	LCV 166A	LCV 166B	LCV 166C	
	Service	Slurry	Slurry	Slurry	
	Line No./Vessel No.				
	Line Size/Sched. No.				
	Model No. & Size	Fisher 657-40	Fisher 657-40	Fisher 657-40	
	Type of Actuator	Diaphragm	Diaphragm	Diaphragm	
	Close at	Open at			
	Flow Action to	6 psig 130 psig	6 psig 30 psig	6 psig 130 psig	
	Fail Position	Last	Last	Last	
	Handwheel & Location				
	MFR. & Model No.	Fisher 3590S	Fisher 3590S	Fisher 3590S	
	Filt. Reg.	Gages	Bypass		
	Input Signal	4-20 DCMa	4-20 DCMa	4-20 DCMa	
	Output Signal	0-30 psig	0-30 psig	0-30 psig	
	Air Supply Pressure				
	Make & Model No.	Fisher 3583	Fisher 3583	Fisher 3583	
	Input Signal	--	--	--	
	Output Signal	3-15 psig	3-15 psig	3-15 psig	
	OPTIONS				

Notes:

Actuator will be used to operate Fisher control valve model no. DBAQ or equivalent.

48

		RECEIVER INSTRUMENTS				SHEET OF 	
						SPEC. NO.	REV.
		NO	BY	DATE	REVISION	CONTRACT	DATE
						REQ.	P.O.
						BY	CHK'D
						APPR.	
1	Tag No. <u>W-166& Z-166</u> Service _____						
GENERAL	2	Function Record ☐ Indicate ☐ Control ☐ Blind ☐ Integ ☐ Deviation ☐ Other <u>Spec 200</u>					
	3	Case MFR STD ☒ Nom Size _____ Color: MFR STD ☒ Other _____					
	4	Mounting Flush ☐ Surface ☐ Rack ☒ Multi-Case ☐ Other _____ For Multiple Case, See Spec. Sheet _____					
	5	Enclosure Class General Purpose ☐ Weather Proof ☐ Explosion-Proof ☐ Class _____ For Use in Intrinsically Safe System. ☒ Other <u>FM</u>					
	6	Power Supply 117 V 60Hz ☐ Other ac _____ dc ☐ _____ Volts					
	7	Chart Strip ☐ Roll ☐ Fold ☐ Circular ☐ _____ Time Marks _____ Range _____ Number _____					
	8	Chart Drive Speed _____ Power _____					
	9	Scales Type _____ Range 1 _____ 2 _____ 3 _____ 4 _____					
	N.A. CONTROLLER	10	Control Modes P = Prop (Gain), I = Integral (Auto Reset), D = Derivative (Rate), Sub: s = Slow, f = Fast P ☐ PI ☐ PD ☐ PID ☐ I _f ☐ D _f ☐ I _s ☐ D _s ☐ Other _____				
11		Action On Meas. Increase Output: Increases ☐ Decreases ☐					
12		Auto-Man Switch None ☐ MFR STD ☐ Other _____					
13		Set Point Adj. Manual ☐ External ☐ Remote ☐ Other _____					
14		Manual Reg None ☐ MFR STD ☐ Other _____					
INPUTS	15	Output 4-20 mA ☐ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other _____					
	16	Input Signals 4-20 mA ☒ 10-50 mA ☐ 21-103 kPa (3-15 psig) ☐ Other _____					
	17	No. of Inputs 1 ☐ 2 ☒ 3 ☐ 4 ☐					
N.A. ALARMS	18	Power for XMTRS External ☐ This Inst ☐ No. of Independent Supplies _____ For Transmitters, See Spec Sheet _____					
	19	Alarm Switches Quantity _____ Form _____ Rating _____					
20	Function Meas. Var. ☐ Deviation ☐ Contacts To _____ On Meas. _____ Other _____						
21	Options Filter-Reg ☐ Supply Gage ☐ Charts ☐ Int. Illumination ☐ Other _____						
22	MFR & Model No. <u>Foxboro 2A1-1ZV-FGB</u>						
Notes:							

	ROTARY SWITCHES				SHEET <u>1</u> OF <u>1</u>	
	NO	BY	DATE	REVISION	SPEC. NO.	REV.
					METC 6-80-4	
					CONTRACT	DATE
					REQ. - P.O.	
					BY	CHK'D

<u>Electrical</u>	
Current & voltage rating Current capacity Dielectric strength Contact resistance Contact material Surface resistivity Insulation material	1.5 @ 28 VDC 9 amps 1500 VAC 3.5 milliohms Brass, silver plated Excess of 100 megohms Ceramic
<u>Construction</u>	
Mounting Mounting hardware Index type Stop strength Materials and finishes Index angle Total number of poles Total number of positions Rows per section Number of sections MFR & model	Single hole, bushing mount Nut & washer Bull & valley 10 in/lbs minimum All metal parts non-corrosive material or suitably plated to prevent rust and corrosion Positive, 30° 8 3 2 4 Central Lab PA 2027 or equivalent.

ISA Form S20.3c

	MAGNETIC TAPE TRANSPORT				SHEET <u>1</u> OF <u>1</u>	
	NO	BY	DATE	REVISION	SPEC. NO.	REV.
					METC 6-80-5	
					CONTRACT	DATE
					REQ. - P.O.	
					BY	CHK'D
					APPR.	
<p>Magnetic tape transport is an add-on to an existing Fox 2-30 system. The transport must be compatible with a Digital Equipment Corporation Model TU-10 tape transport and controller. DEC recommends the TE 10 magnetic tape transport.</p> <p>Specifications</p> <ul style="list-style-type: none"> • 5-20 million characters storage capacity per reel • 45 inches per second read/write speed • 7 or 9 track • 200, 256, or 800 characters per inch • NRZI recording format • 19 inch cabinet • 3μ sec average transfer time/character 						
ISA Form S20.3c						

	PRINTER				SHEET <u>1</u> OF <u>1</u>																																			
	NO	BY	DATE	REVISION	SPEC. NO.	REV.																																		
					METC 6-80-6																																			
					CONTRACT	DATE																																		
					REQ. - P.O.																																			
					BY	CHK'D	APPR.																																	
<p>Printers currently in service are manufactured by Digital Equipment Corporation (model LA-36). DEC recommends the LA 120 as a comparable device.</p> <p>Specifications</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 40%;">● Max. Print Speed</td> <td>180 cps</td> </tr> <tr> <td>● Paper Feed</td> <td>Pin-feed, tractor drive handling fanfold paper up to 6 parts (0.020" thick max., 3"-14-7/8" wide.)</td> </tr> <tr> <td>● Lines per Inch</td> <td>2, 3, 4, 6, 8, 12</td> </tr> <tr> <td>● Characters per Inch</td> <td>5, 6, 6.6, 8.25, 10, 12, 13.2, 16.5</td> </tr> <tr> <td>● Margins</td> <td>Left/Right, Top/Bottom</td> </tr> <tr> <td>● Tabs</td> <td>217 horizontal, 168 vertical</td> </tr> <tr> <td>● Baud Rates (bps)</td> <td>50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600</td> </tr> <tr> <td>● Split Baud Rates (bps)</td> <td>600 or 1200 receive with 75 or 150 transmit; 2400 or 4800 receive with 300 or 600 transmit</td> </tr> <tr> <td>● Parity</td> <td>Odd, even, or none</td> </tr> <tr> <td>● Interface</td> <td>EIA standard</td> </tr> <tr> <td>● Character Codes</td> <td>7-bit ASCII plus ANSI-compatible escape sequences</td> </tr> <tr> <td>● Full Duplex Modem Control Protocols</td> <td>Selectable XON/XOFF or restraint signal data synchronization</td> </tr> <tr> <td>● Half Duplex Modem Control Protocols</td> <td>Coded control with or without reverse channel; reverse channel supervisory line control</td> </tr> <tr> <td>● Dimensions</td> <td>27.5" W X 24" D x 33.5" H</td> </tr> <tr> <td>● Weight</td> <td>102 lbs (46.4 kg)</td> </tr> <tr> <td>● Power Input</td> <td>87 to 128 VAC, 60 Hz; 4.2 Amps max. at 115 VAC</td> </tr> <tr> <td>● Heat Dissipation</td> <td>440 Watts max. printing</td> </tr> </table>							● Max. Print Speed	180 cps	● Paper Feed	Pin-feed, tractor drive handling fanfold paper up to 6 parts (0.020" thick max., 3"-14-7/8" wide.)	● Lines per Inch	2, 3, 4, 6, 8, 12	● Characters per Inch	5, 6, 6.6, 8.25, 10, 12, 13.2, 16.5	● Margins	Left/Right, Top/Bottom	● Tabs	217 horizontal, 168 vertical	● Baud Rates (bps)	50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600	● Split Baud Rates (bps)	600 or 1200 receive with 75 or 150 transmit; 2400 or 4800 receive with 300 or 600 transmit	● Parity	Odd, even, or none	● Interface	EIA standard	● Character Codes	7-bit ASCII plus ANSI-compatible escape sequences	● Full Duplex Modem Control Protocols	Selectable XON/XOFF or restraint signal data synchronization	● Half Duplex Modem Control Protocols	Coded control with or without reverse channel; reverse channel supervisory line control	● Dimensions	27.5" W X 24" D x 33.5" H	● Weight	102 lbs (46.4 kg)	● Power Input	87 to 128 VAC, 60 Hz; 4.2 Amps max. at 115 VAC	● Heat Dissipation	440 Watts max. printing
● Max. Print Speed	180 cps																																							
● Paper Feed	Pin-feed, tractor drive handling fanfold paper up to 6 parts (0.020" thick max., 3"-14-7/8" wide.)																																							
● Lines per Inch	2, 3, 4, 6, 8, 12																																							
● Characters per Inch	5, 6, 6.6, 8.25, 10, 12, 13.2, 16.5																																							
● Margins	Left/Right, Top/Bottom																																							
● Tabs	217 horizontal, 168 vertical																																							
● Baud Rates (bps)	50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2400, 4800, 7200, 9600																																							
● Split Baud Rates (bps)	600 or 1200 receive with 75 or 150 transmit; 2400 or 4800 receive with 300 or 600 transmit																																							
● Parity	Odd, even, or none																																							
● Interface	EIA standard																																							
● Character Codes	7-bit ASCII plus ANSI-compatible escape sequences																																							
● Full Duplex Modem Control Protocols	Selectable XON/XOFF or restraint signal data synchronization																																							
● Half Duplex Modem Control Protocols	Coded control with or without reverse channel; reverse channel supervisory line control																																							
● Dimensions	27.5" W X 24" D x 33.5" H																																							
● Weight	102 lbs (46.4 kg)																																							
● Power Input	87 to 128 VAC, 60 Hz; 4.2 Amps max. at 115 VAC																																							
● Heat Dissipation	440 Watts max. printing																																							

53

THIS PAGE
WAS INTENTIONALLY
LEFT BLANK

Appendix C

General Specification

The following general specification is in this Appendix:

METC Engineering Specification No. 5-80, "Specification
For Fabrication and Installation of Slurry Letdown Test
Loops at the Ft. Lewis SRC Pilot Plant, Ft. Lewis, Washington".

SPECIFICATION
FOR FABRICATION AND INSTALLATION
OF SLURRY LETDOWN VALVE TEST LOOPS
AT THE FT. LEWIS SRC PILOT PLANT
FT. LEWIS, WASHINGTON

United States Department of Energy
Morgantown Energy Technology Center
Morgantown, West Virginia 26505

FOREWORD

These specifications along with the Morgantown Energy Technology Center (METC) drawings 800012 through 800021, cover the fabrication and installation of slurry letdown valve test loops at the Ft. Lewis SRC Pilot Plant. The Pilot Plant was constructed and is operated for the U.S. Department of Energy by the Pittsburgh and Midway Coal Mining Company, a subsidiary of Gulf Oil Corporation. The requirements contained herein, have been derived from information supplied by the Pilot Plant engineering staff so that these test loops will meet the codes and safety criteria acceptable to plant operating personnel. When and if a difference exists between these specifications and pilot plant engineering requirements, the pilot plant engineering requirements shall govern.

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
I	Process Piping	1
II	Electrical Heat Tracing	8
III	Insulation	17
IV	Structural Steel	29

THIS PAGE
WAS INTENTIONALLY
LEFT BLANK

SECTION I
PROCESS PIPING

1.0 SCOPE

This specification accompanied by the Morgantown Energy Technology Center (METC) piping drawings and other referenced documents covers fabrication of all process piping. Wherever a difference exists between this specification and the drawings, the drawings shall govern.

2.0 REFERENCED DOCUMENTS

American National Standards Institute

ANSI B 31.3	American National Standard Code - Chemical Plant and Petroleum Refinery Piping
-------------	--

Pittsburg and Midway Coal Mining Company

B-33250-GC-11-IV-16	Piping Material Specification
B-33250-GC-11-IV-19	Welder Qualification Specification

Pipe Fabrication Institute

PFI LS-3	Fabricating Tolerances
----------	------------------------

Morgantown Energy Technology Center

Drawing 800012	Slurry Letdown Valve Test Loops at Ft. Lewis SRC Pilot Plant
800013	Loop "A"
800014	Loop "B"
800015	Loop "C"
800016	Inlet Instrument Loop
800017	Outlet Instrument Loop

All documents referred to herein are meant to be the latest edition, including all addenda, issued prior to the date of construction.

3.0 GENERAL

- 3.1 Piping shall be fabricated and tested in accordance with American National Standards Institute (ANSI) Code B31.3 - Petroleum Refinery Piping.
- 3.2 Piping material shall be in accordance with Pittsburgh and Midway Coal Mining Company Specification R-33250-GC-II-IV-15. Piping materials for service and line makeup for each line size within the service, shall conform to the requirements of the Piping Material Specification sheet indicated for that service. Any deviations will be noted on the piping drawings.
- 3.3 Piping components shall be new and clean.
- 3.4 Substitutions, including thicker wall materials, are not permitted without prior written approval from METC.
- 3.5 The Contractor shall at all times during fabrication and installation of piping provide METC or its designated representatives unrestricted access to the pipe fabricator's shop and to work in progress for purposes of observing procedures and inspecting materials and work for this Contract.

4.0 DRAWINGS, DIMENSIONS AND TOLERANCES

- 4.1 Piping drawings indicate the complete line, showing all welded and assembly items.

- 4.2 Dimensions on drawings are in inches. Dimensions are to the centerline of pipe and the contact face of Grayloc and R-Con connectors.
- 4.3 Reducers are concentric unless otherwise noted.
- 4.4 The Contractor shall field verify all dimensions prior to fabrication.
- 4.5 Dimensional tolerances shall conform to the Pipe Fabrication Institute Standard LS-3.

5.0 FABRICATION, ERECTION & INSTALLATION

- 5.1 Welding and weld inspection shall be in strict accordance with the Code for Pressure Piping ANSI B31.3, latest edition.
- 5.2 Welding on piping shall be performed only by qualified and certified welders, in accordance with code requirements and as specified herein.
- 5.3 Prior to using welders on the work, the Contractor shall submit photostats or other legible reproduced copies of the certified qualification test report(s) for each welding operator and for each class of work to be done to METC or their representative. Each certified test report shall show welder's name, welding method and materials for which qualified, date of qualification, the code under which qualified, and organization or individual certifying the qualification. The certification copy shall become the property of METC.

- 5.4 Each welder to be used on the work, regardless of certification, shall be required to pass the welding qualifications described in Pittsburgh and Midway Coal Mining Co. Specification B-33250-GC-II-IV-19.
- 5.5 The external surfaces of all welds on piping and associated equipment shall be free from undercuts, overlaps, abrupt changes in contour, cracks, pin-holes, craters and other defects, and shall merge smooth and gradual with the base metal surface. All butt welds and saddle welds in piping shall have full penetration for the entire length of joint. Defects such as cracks, burn through, undue roughness, and excessive protrusion on the pipe interior will be cause for rejection. Hot or cold peening of weld deposits and/or base metal to conceal the presence of cracks or defects will be cause for rejection.
- 5.6 The review and acceptance of welding procedures and operator qualification test reports by METC or their representative shall in no way relieve the Contractor of full responsibility for satisfactory welding, proper correction of any defects, or of otherwise fulfilling all requirements of this specification. Each weld shall have the welder's initials marked next to the weld.
- 5.7 Insofar as possible, all piping shall be shop fabricated and field welds shall be kept to a minimum. The Contractor shall determine the locations of all field welds.
- 5.8 The shop fabricator shall bevel and prepare the joints to be field welded.

- 5.9 Where the ends of piping components are to be joined by welding and the internal surface misalignment exceeds 1/16", that component, with the wall extending internally, shall be internally trimmed so that the adjoining internal surfaces are approximately flush.
- 5.10 Piping bends, when shown on piping drawings, shall have the required radius indicated. Completed bends shall be free from harmful defects and in accordance with ANSI B31.3 Paragraph 329.1.
- 5.11 When the work requires cutting of installed piping, all field operations of the Contractor shall be done when, and as scheduled by METC or their representative. When cutting or otherwise opening installed piping, every possible care shall be taken by the Contractor to prevent or minimize entry of cuttings, slag and other foreign matter into the existing piping, and to thoroughly clean such foreign matter from the piping before the opening is closed. Adequate support of the existing piping shall be maintained at all times.

6.0 INSPECTION AND TESTS

- 6.1 Visual inspection of welding operations on all fabricated piping shall be performed by the Contractor's inspectors and shall include examination of bevel details prior to welding, examination of surface holes, cracks and other defects during welding and examination for undercuts or other surface defects and reinforcement dimensions after welding. Visual examination of all completed welds shall be performed and necessary repairs made.

6.2 Radiographs and interpretation of reports shall be made by persons or firms acceptable to METC or their representative and a copy of all radiographs and the reports thereof shall be submitted to METC or their representative for review within seven (7) calendar days after the date on which taken. All costs associated with radiographing, had any required correction of defective welds and re-radiographing, shall be assumed by the Contractor. All radiographic inspection shall be in strict compliance with the requirements of the applicable code. Where joints will be field welded, access holes, if required, shall be provided during shop fabrication for inserting the gamma ray capsule. Upon METC or their representative's approval of films, the Contractor shall plug and weld closed all access holes.

6.3 100% radiographing shall be done on all welds.

6.4 After fabrication and field installations but prior to heat tracing and insulating, all process piping shall be pressure tested in accordance with ANSI B31.3.

7.0 CLEANING

7.1 After completion of fabrication, all piping shall be cleaned inside and outside to remove all loose scale, weld splatter, sand, and other foreign matter.

8.0 FIELD HANDLING AND STORAGE

- 8.1 Piping materials shall be stored at the jobsite in a manner to insure minimum contact and exposure to dirt, debris, etc.
- 8.2 Before installing prefabricated piping, it shall be visually inspected or blown to insure that all foreign matter has been removed.

SECTION II
ELECTRIC HEAT TRACING

1.0 SCOPE

This specification covers the requirements for the design, installation and testing of the electric heat tracing system for the piping shown on METC drawings for the slurry letdown valve test loops.

2.0 REFERENCED DOCUMENTS

State of Washington

State of Washington Electrical Construction Code

National Fire Protection Association

NFPA70 National Electric Code

Morgantown Energy Technology Center

Drawing 800012	Slurry Letdown Valve Test Loops at Ft. Lewis SRC Pilot Plant
Drawing 800013	Loop "A"
Drawing 800014	Loop "B"
Drawing 800015	Loop "C"
Drawing 800016	Inlet Instrument Loop
Drawing 800017	Outlet Instrument Loop

Thermon Manufacturing Company, San Marcos, Texas

Drawing E73-13-REV 1 Typical Installation, Type
SSK Heating Cable

In the event of differing requirements between the codes, the most stringent shall apply.

3.0 GENERAL

- 3.1 Material furnished and installed shall comply with established codes and regulations of the legally constituted authorities having jurisdiction, including the State of Washington.
- 3.2 All process piping and valves shown on the METC drawings for the slurry letdown valve test loops shall be heat traced.
- 3.3 The heat tracing contractor shall coordinate his work with the other contractors involved with the project.

4.0 DESIGN

- 4.1 Contractor shall perform all heat trace sizing and layout design necessary to provide a completed heat trace installation as described in this specification.
- 4.2 Contractor shall perform all design calculations, drawings etc. necessary to accomplish 4.1 above. These shall include electrical power and control circuit design.
- 4.3 The design basis shall be:
 - (a) Maintain the piping system when off-line at an average pipe wall temperature of 550⁰F. Experience at Ft. Lewis has shown that a heat flux of 57 watts per linear foot of piping is necessary to maintain this temperature.

(b) The heat tracing material maximum design temperature is 950⁰F.

4.4 Heat tracing shall conform with manufacturer's recommended design and installation requirements. For example - Thermon Manufacturing Company drawing no. E73-1B-Rev 1 shows typical installation requirements for their SSK Heating Cable.

5.0 INSTALLATION REQUIREMENTS

5.1 The installation shall be under the direct supervision of an experienced craftsman approved by METC or its designated representative.

5.2 The installation shall be suitable for hazardous area classification, Class 1, Division 2, Group B.

5.3 Heat tracing manufacturer's Installation Instructions and Details shall be closely studied and understood by all workers prior to beginning installation work. For continuity and consistency of work and assurance of quality installation, it is recommended that one man be placed in charge of tracing installation, data recording, and as built mark-up drawings.

5.4 The approval by METC or its representative of the Contractor's recommendation shall not relieve the Contractor of his responsibility for the proper installation and operation.

5.5 The installation of all materials shall, in every way, be performed according to the highest standards of workmanship.

- 5.6 Accessibility for ease of maintenance shall be provided by locating accessories near to platforms, walkways, or at grade and/or as otherwise shown on the drawings.
- 5.7 All thermostats and transformers shall be readily accessible to operating and maintenance personnel except under prohibitive conditions with approval of METC or its representative.
- 5.8 Conduits, thermostat capability tubing and cold end leads shall be installed and routed so as to create minimum congestion and interference with other equipment, particularly those requiring maintenance.
- 5.9 All devices located outdoors and subjected to weather conditions shall have adequate protection from moisture, corrosive vapors and freezing.
- 5.10 Thermostats and transformers shall be grouped on common mounting plates whenever possible.
- 5.11 Field supports shall be painted when the mounted device covers a surface that is not accessible for painting after installation.
- 5.12 Before cutting any concrete or welding to structural members, the Contractor must obtain approval of METC or its representative. All such work shall be properly reinforced and patched to match the surrounding work as neatly as possible.
- 5.13 Selection of installation materials shall conform to piping and electrical specifications where applicable.

- 5.14 All equipment shall be checked: 1) Upon receipt from manufacturer, 2) Upon initial installation of each circuit and 3) Following insulation of traced item. Any failures or discrepancies shall be immediately reported to METC or its representative prior to continuation of installation work on circuit in question.
- 5.15 Conduit seals must be installed in the conduit line entering all thermostats and where conduits pass in or out of hazardous areas.
- 5.16 If Contractor deems it necessary to splice tracing cable he shall first obtain permission from METC or its representative. He shall then only use approved cold end terminations for making splice and shall show location of splice on as-built drawings. Such instances should only occur due to line, valve or similar changes.
- 5.17 At all tie-ins to existing tracer lines the Contractor shall confer with METC or its representative on the compatibility of the existing tracing circuits with tie-in and new tracing circuits. Where revision or repair of existing circuits is necessary, Contractor shall not proceed without approval and special instructions from METC or its representative.

6.0 CONTROL VALVES AND INSTRUMENTATION

- 6.1 Instrumentation devices and control valves, which require tracing and where designated on drawings shall be separately traced and provided with proper "cold end" termination in such a manner that the pipe line tracing cable need not be spliced if these devices are removed or replaced.

7.0 MATERIALS

- 7.1 Each set of heat tracing material shall be carefully inspected prior to installation to ensure that it conforms to the requirements stated for use on its particular line.
- 7.2 Contractor shall ensure that each heater cable assembly is tagged with a permanent identification tag securely attached to the junction box end of the "cold" section. The tag is required to state the heater number and cable type and length. The tag shall remain on the heater for permanent identification.
- 7.3 All heaters shall be thermostat controlled. Set points will be set at and located as near as possible to the downstream end of the sections of pipe being controlled. Where the ampere rating of the thermostat would be exceeded, it will be used in conjunction with a suitably rated contractor. Thermostats will have factory fabricated armored capillary tubing attached.
- 7.4 Where thermostats are specified, the bulb shall be installed against the pipe at least 90° from the heater cable, strapped firmly to the pipe, and heat transfer cement applied.

8.0 INSPECTING AND TESTING

- 8.1 Heater cables should be removed from carton and straightened by unrolling. Do not pull out in a spiral. Be particularly careful to prevent sharp bends anywhere in the cable.

- 8.2 Check identification tag before commencing with the installation. Install the heater cable in accordance with the manufacturer's electric heat tracing installation instructions. Cable shall not be field cut or spliced to adjust the length.
- 8.3 Heating cable shall be carefully laid out along pipe using temporary attachments per manufacturer's instructions. If length is not correct, Contractor shall inform METC or its representative and wait for design check before proceeding.
- 8.4 Before and after the heaters have been completely installed on the lines, but before pipes are insulated, tests shall be made as called for by the detailed design drawings.
- Note: Before insulation is applied the installation shall be inspected and approved and the test witnessed by METC or its representative.
- 8.5 Repeat the above tests and checks after pipe insulation is applied and installation is complete.
- 8.6 For each heating cable, the heater number and the test results obtained for each of the tests above shall be recorded both before and after installation of the heater cable and application of the insulation. Records will be given to METC or its representative.

9.0 RECEIVING AND STORAGE

- 9.1 The Contractor shall receive, unload, and transport to the job site all materials and equipment used by him in his work.

9.2 The Contractor shall provide adequate safe storage for all materials and equipment used by him in the work. When material or equipment arrives on job site, prior to arrival of the Contractor's personnel, it will be received by the owner. In such cases the Ft. Lewis Pilot Plant warehouse will be considered the point of receipt by the Contractor.

9.3 The Contractor will report any damage, shortages, incorrect equipment or material to the owner of any item furnished by the owner.

9.4 The Morgantown Energy Technology Center or its representative shall be permitted access to storage areas for inspection at any time.

10.0 PROTECTION

10.1 The Contractor must provide protection against dirt deterioration of all equipment for which he is responsible. This protection must be provided from the time the equipment is delivered to the job site to the time the Contractor's work is accepted.

11.0 RECORDS

11.1 One complete set of specifications, drawings and reference documents shall be maintained exclusively for record purposes by the Contractor. All significant changes, modifications, and additions shall be shown and noted thereon. Supplemental drawings or sketches may be added. Dimensions, material specification, relocation date, identification data, etc. required for a complete record shall be noted.

- 11.2 All test data, installation completions and calibration data must be recorded on suitable approved data sheets and the completed sheets submitted to the METC or its representative for approval.
- 11.3 A complete record of all inspections, official papers pertaining to permits and inspection shall be maintained by the Contractor.
- 11.4 The set of Contractor's drawings showing the complete record of as-built construction, all tests, installation, calibration, inspection records and all such records as may be requested by METC or its representative shall be submitted prior to final acceptance. In general, all test records shall be made on approved forms, and the forms shall be typed and made suitable for reproduction.

SECTION III

INSULATION

1.0 SCOPE

This specification covers the requirements for supply and installation of all piping insulation for the process piping which appears the Morgantown Energy Technology Center (METC) drawings for the slurry letdown valve test loops.

2.0 REFERENCED DOCUMENTS

American Society for Testing and Materials

ASTM B209	Aluminum Alloy Sheet and Plate
ASTM C195	Mineral Fiber Thermal Insulating Cement
ASTM C449	Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement
ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation

Morgantown Energy Technology Center

Drawing 800012	Slurry Letdown Valve Test Loops at Ft. Lewis SRC Pilot Plant
800013	Loop "A"
800014	Loop "B"
800015	Loop "C"
800016	Inlet Instrument Loop
800017	Outlet Instrument Loop

3.0 GENERAL

This specification defines the requirements for, and the application of, insulation of all process piping indicated on the referenced METC drawings.

3.1 Completion of Work Prior to Insulation

Before applying any insulation, it shall be the responsibility of the Contractor to insure that the particular pipeline or equipment item requiring insulation has, to the extent required, been completely installed, tested, heat traced and otherwise made ready for the application of insulation.

3.2 Surface Preparation

Before any insulation is applied, all surfaces to be insulated shall be thoroughly cleaned of scale, dirt or other foreign matter by use of wire brushes, scrapers or other devices as necessary to effectively accomplish the work. All surfaces shall be dry when insulated, and no insulation shall be installed in rainy or foggy weather, unless otherwise directed by METC representative.

3.3 Welding of Attachments

Unless approved in writing by METC or its designated representative for a specific location, no field welding of insulation clips or anchors will be permitted on any piping.

3.4 Equipment Data Plates

Where equipment name or data plates are located such that they would be covered by the required insulation thickness, the plate, or a nonferrous metal duplicate thereof, shall be relocated to the outside of the insulation and attached in a permanent and readily visible manner. When an equipment name

or data plate is located such that it is already raised above the surface to be insulated by a distance equivalent 2/3 or more of the required insulation thickness, the area under the plate shall be packed with insulating cement and surrounding insulation neatly mitered to expose the plate.

3.5 Supports and Accessories

Insulation saddles and similar items provided for support of piping requiring insulation shall have open spaces packed with insulation of a type suitable for the point of application. Piping for accessory items which are a functional part of insulated piping shall be insulated to a total thickness at least equal to the insulation thickness of piping of which the item is a functional part.

3.6 Maintenance Access

Insulation of pipe adjacent to bolted pipe connectors shall be cut back sufficiently to permit removal of connector bolts and connector halves without damage to the insulation, and insulation of connectors shall be extended beyond the cutback areas for a distance of no less than the specified pipe insulation thickness.

3.7 Heat Tracing Piping

When a single pipe is protected by heat tracing molded pipe insulation used shall be recommended by the electrical heat tracing manufacturer for the particular point of use. Insulation over heat tracing shall be arranged for ready removal and replacement to permit maintenance.

3.8 Recommendations of the Manufacturers

Manufacturer's recommendations and/or instructions pertaining to the storing, mixing, applying and use of their products shall be strictly observed by the Contractor.

3.9 Protection of Materials

Upon delivery at the job site, all materials shall be handled, stored, protected and installed by the Contractor as required to prevent damage, deterioration, wetting or soiling.

4.0 MATERIALS

4.1 Block Insulation

Block insulation shall be composed predominately of reacted calcium silicate reinforced with mineral fiber, and shall as a minimum meet all requirements of ASTM C533 "Calcium Silicate Block and Pipe Thermal Insulation". It shall be suitable for operating temperatures up to 1200⁰F.

4.2 Pipe Insulation

Thermal insulation for pipe shall be composed predominately of reacted calcium silicate reinforced with mineral fiber, and shall as a minimum meet the requirements of ASTM C533 and shall be suitable for temperatures to 1200⁰F.

4.3 Insulating Cement

Insulating cement shall be composed predominately of mineral wool and heat-resistant binder and shall conform to ASTM C195 "Mineral Fiber Thermal Insulating Cement".

4.4 Finishing Cement

Finishing cement shall conform to ASTM C449 "Mineral Fiber Thermal Hydraulic-Setting Thermal Insulating and Finishing Cement".

4.5 Poultry Netting

Poultry netting shall be one (1) inch hexagonal mesh, woven of No. 10 gage wire, and galvanized after weaving. Standard size rolls or widths to best suit the job requirements shall be used.

4.6 Tie Wires and Bands

Tie wire shall be copper clad annealed iron or galvanized annealed iron. Wire size shall be no less than No. 16 gage. Wherever used, bands shall be corrosion protected iron or steel, shall be of adequate thickness and width to properly retain the insulation, and shall be provided with suitable end fastening devices.

4.7 Metal Jacketing

Except as otherwise specified, jacketing for pipes shall be 3003H18 alloy, full hard aluminum with approximately 3/16 inch cross corrugations, and a factory applied moisture barrier of Kraft paper laminated with asphalt (similar to Walex, Aseeco or Childers).

4.7.1 Jacketing for piping insulation shall be no less than 0.016 inch thickness.

4.7.2 Jacketing for long radius pipe bends, and all removable insulation sections covering flanges, other similar items shall be fabricated of 0.024 inch or heavier sheet aluminum complying with ASTM B209, of a quality

equal to or better than 3003-H8 or C1A-H34 designation. Surfaces which will be in contact with the insulation shall be coated with asphalt. Wherever necessary to assure snug fit, the sheet of aluminum shall be machine rolled or otherwise formed to suit the contour of the insulation.

5.0 INSTALLATION AND APPLICATION

5.1 Intent

The methods of application as specified herein, are intended as a general guide. Any work for which procedures may not be established shall conform to best trade practices and must produce an end result acceptable to METC or its representatives. When completed, the work must be of uniformly neat and workman-like appearance.

5.1.1 Application Considerations

During plant operation all insulation and jacketing must be capable of accommodating thermal expansion and contraction movements without damage or noticeable distortions, and must remain free of hot spots, blisters, discolorations or other evidence of faulty material or workmanship.

5.1.2 Cleanup and Housekeeping

Any fluid or plastic material (paint, sizing, weather-proofing plastic insulation, etc.) which is spilled, sprayed or otherwise permitted to get on any object other than that to which it is being applied shall be removed at once, and the object upon which it was present shall be cleaned to remove all traces. The

Contractor shall keep the premises free of waste materials and rubbish at all times throughout the progress of the insulation work.

5.2 Preformed Insulations

- 5.2.1 All molded pipe and block insulation shall be applied in a manner resulting in tightly butted joints. In multiple layer applications, longitudinal joints shall be staggered by substantially one-half the segment or block width, and circumferential or block-end joints shall be staggered by the maximum possible amount consistent with the requirements for expansion joints or other similar considerations.
- 5.2.2 Each layer of pipe or block insulation shall be secured in place by tightly drawn tie wires or bands, and shall have all voids filled with insulating cement prior to applying any succeeding layer of insulation, or any specified finish coating or metal jacketing.
- 5.2.3 All long radius bends (regardless of pipe size) shall be insulated with molded pipe or segmental block insulation of the same material and thickness specified for the pipeline of which they form a part. Ends of such insulation shall be accurately mitered or otherwise cut to suit the point of application, such that a minimum of insulating cement will be required for pointing of joints. Valve bodies and fittings may be insulated with molded pipe covering or by the use of insulating cement at the option of the Contractor, excepting only that all flanges shall be insulated with molded pipe insulation. Regardless of the insulating method used, thickness of finished insulation shall be no less than that specified for the adjacent pipe.

5.2.4 Tie wires used for holding preformed insulation in place shall be spaced on not to exceed 9 inch centers, or such that any individual piece of insulation is retained by no less than two (2) wires, whichever results in the closest spacing. Tie wires shall be drawn taut to embed them flush with the face of the insulation. Ends shall be firmly twisted. Excess ends shall be cut off, bent over and embedded in the insulation.

5.2.5 Bands used for holding insulation on pipes shall be of suitable size for the use point, and spaced on not to exceed 12 inch centers. No individual piece of insulation is to be retained by less than two (2) bands. All bands shall be machine tightened and sealed while under tension.

5.3 Poultry Netting

When applied over insulation as a base for finishing cement or other coating, poultry netting shall be fitted, formed, stretched and securely attached in a manner which results in a netting surface free of loose areas, bulges or projecting wire ends. Abutting sides of netting shall be laced with No. 16 tie wire, and cut ends or sides shall be interwoven, or laced to anchor devices with No. 16 tie wire. If used as reinforcement in removable sections of insulation formed of insulating cement, the poultry netting shall be cut, formed and fitted to suit the point of use.

5.4 Insulating Cement

Insulating cement shall be mixed with clean water in strict accordance with the manufacturer's instructions, shall be applied by troweling or palming, and shall be reinforced when and as necessary to present a neat, finished installation. When used

for pointing joints or filling voids in molded pipe or block insulations, it may be applied to the thickness of that layer of insulation being pointed or filled. When used for insulating small valves and fittings, it shall be applied in layers of approximately 1/2 inch thickness, and each layer shall be dry when the succeeding layer is applied.

5.5 Finishing Cement

Finishing Cement shall be mixed with clean water in strict accordance with the directions of the manufacturer. It shall be applied in approximately 1/4 inch maximum thickness layers by troweling or palming, and shall be reinforced when and as necessary to present a neat, finished installation. When item is to be leftunjacketed, or when canvas jacketing is to be applied, two (2) coats of finishing cement shall be applied to obtain 1/2 inch total thickness. First layer shall be dry when second layer is applied. Second layer shall be tempered by adding 10% (by weight) of Portland cement to the insulating cement in order to produce a hard finish for the paint primer or canvas adhesive.

5.5.1 Application of finishing cement will not be required where metal jacketing is to be applied over pipe or block insulation on straight runs of pipe, tank shells or equipment items; nor will it be required over fast drying cement which has been applied to metal mesh reinforcement as a base for a weatherproof coating.

- 5.5.2 Regardless of type jacketing or finish specified, finishing cement shall be used where necessary to provide a smooth surface of contour on insulation covering long radius pipe bends, valves, fittings, speciality items, etc.

5.6 Metal Jacketing

Unless otherwise specified or indicated all molded pipe or other thermal insulation on pipes of one half inch nominal size and larger shall be covered with metal jacketing. Jacketing for long radius bends shall be accurately mitered sections of a uniform length to best suit the bend radius. Wherever field formed around pipes or other surfaces, jacketing shall be in firm contact with the insulation, and remain free of sags, bulges or other distortions after attachments are installed.

- 5.6.1 All joints in metal jacketing shall be lapped a minimum of two (2) inches in a direction to shed water. Circumferential laps over or adjacent to insulation expansion joints shall be no less than $3\frac{1}{2}$ inches, and shall be free of attachment screws at any location which would restrict the necessary movement at the expansion joint. Insofar as possible, longitudinal laps shall be located near the top of the pipe, on the side near a wall, etc., such that the joint will present minimum visibility from nearby floors, platforms and walkways.
- 5.6.2 All metal jacketing shall be fastened in place with self-tapping aluminum sheet metal screws of the binding head type. Unless otherwise permitted by the Owner, no

circumferential bands or straps shall be used. For longitudinal joints, the attachment screws shall be spaced on not to exceed 6 inch centers, and for short lengths of jacketing no less than two screws shall be used. For circumferential joints in horizontal runs, no fastening screws will be required. For circumferential joints in vertical runs, screws shall be used as necessary to permanently maintain the position of the jacketing.

5.6.3 A suitable mastic shall be used on all laps to assure water tightness, and weatherproof coating shall be used under and around any openings in the jacketing which are necessary to accommodate thermometer wells or other items.

5.6.4 Any openings cut in the jacketing to fit around exposed metal components shall provide approximately 1/4 inch uniform clearance between the jacketing and exposed metal to prevent any possible electrolytic action.

5.7 Weatherproof Coating

Weatherproof coating may be applied by troweling, palming or spraying as recommended by the manufacturer. When used on valves, fittings or other locations adjoining piping to be jacketed with metal, it shall be applied over the pipe insulation for sufficient distance to provide at least 5 inches overlap by the pipe jacketing. If recommended by the manufacturer for proper bonding to the coated surface, a suitable primer shall be applied over the entire area prior to applying the weatherproof coating.

- 5.7.1 When the insulation diameter on valves or fittings to be coated is 6 inches or greater, poultry netting shall be applied over the finishing cement or fast drying cement surface to reinforce the weatherproof coating. Any other reinforcement shall be provided in accordance with the coating manufacturer's recommendations.
- 5.7.2 The weatherproof coating shall be applied in one or more coats as recommended by the manufacturer for the product and application method being used. Regardless of number of coats or method of application, total thickness of the weatherproof coating when completely dry shall be approximately 1/8 inch.

6.0 THICKNESS OF INSULATION

6.1 Piping Insulation Thickness

All pipe insulation shall be of 3 inch thickness and shall be applied in two layers.

6.2 Valves and Fittings Insulation

Valve bodies (including bonnets), ells, tees, flanges and other fittings shall be insulated to a total thickness (including finishing cement) which is equal to or greater than 3 inches. Quilted type blanket insulation may be used on Graylok and R-con connectors.

SECTION IV
STRUCTURAL STEEL

1.0 SCOPE

This specification covers the requirements for supply and erection of all structural steel including handrails and grating to modify the platform which supports the slurry letdown valve test loops as shown on the METC drawings.

2.0 REFERENCED DOCUMENTS

American Institute of Steel Construction, Inc.

AISC Code of Standard Practice for Steel Buildings and Bridges
AISC Specification for Design, Fabrication and Erection of
Structural Steel for Buildings

American Welding Society

D 1.0 AWS Structural Welding Code

Pittsburg and Midway Coal Mining Company

B-33250-GC-II-II-28 Painting Specification

Morgantown Energy Technology Center

Drawing 100018 Structural Steel for Platform Extension

3.0 DESIGN

Unless otherwise specified or indicated, the work shall comply with American Institute of Steel Construction Specification for Design Fabrication and Erection of Structural Steel for Buildings and the AISC Code of Standard Practice for Steel Buildings and Bridges.

3.1 Design of Members and Connections

Design of members and connections for any portion of the structures not sized on the contract drawings shall be completed by the Contractor and indicated on the shop drawings. Design shall include proper earthquake and wind loadings as well as equipment and piping forces.

3.2 Substitutions

Substitutions of sections or modifications of details, or both, and the reasons therefor shall be submitted with the shop drawings for approval by METC or its representative.

3.3 Responsibility for Error

The Contractor shall be responsible for all errors of detailing, fabrication and for correct fitting and attachment of structural members. Before fabricating any structural steel, other than manufactured items which do not require special measurements, the Contractor shall obtain all necessary measurements pertaining to the work, and all work shall be built to suit actual conditions and measurements.

4.0 MATERIALS

Materials shall conform to the respective specifications and other requirements specified on the METC drawing.

5.0 SHOP DRAWINGS AND ERECTION PROCEDURE

Shop drawings shall be submitted for approval. Material shall not be fabricated or delivered to the jobsite before the approved shop drawings have been returned to the Contractor. Drawings shall include all shop and erection details, including cuts, copes, connections, and welds in structural steel. All welds, both shop and

field, shall be in accordance with the shop drawings. Drawings shall show size, length and type of each weld. Along with the shop drawings, the Contractor shall furnish for information, two copies of a detailed erection procedure, including sequence of erection and temporary staying and bracing. This procedure will not be returned.

6.0 INSPECTION AND TESTS

The material to be furnished may be subject to inspection and tests in the shop and will be inspected in the field by METC or their representative. When materials and workmanship do not conform to the specification requirements, METC reserves the right to reject material or workmanship, or both, at any time before final acceptance.

7.0 STORAGE OF MATERIALS

Structural material, either plain or fabricated, shall be stored above the ground upon platforms, skids, or other supports. All material and supplies shall be kept free from dirt, grease, and other foreign matter and shall be protected from corrosion.

8.0 FABRICATION

8.1 General

Structural material shall be fabricated and assembled in the shop to the greatest extent possible. Shearing, flame cutting, and chipping shall be done carefully and accurately. Stiffeners shall be fitted neatly between the flanges of girders, and, where tight fits are required to transmit bearing, the ends of stiffeners shall be milled or ground to secure an even bearing against the flange angles or shall be grooved and the joint groove-welded to the flange.

8.2 Connections

Connections shall be welded as indicated. Connections not indicated on the drawings, shall be shown on shop drawings and shall be made to conform to the AISC Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings. Onesided or other types of eccentric connections will not be permitted unless shown in detail and approved by METC or their representative on the shop drawings.

9.0 WELDING

All welding shall be in accordance with American Welding Society Code D1.0. Only welders who have passed qualification tests using procedures specified in American Welding Society Code D1.0, Appendix D, Part II, shall be employed on this work. The Contractor shall require any welder to retake the tests, when in the opinion of METC or their representative, the work of the welder creates reasonable doubt as to the proficiency of the welder. Welders shall have passed the qualification tests within the preceding 12 month period.

10.0 ERECTION

Erecting equipment shall be suitable and safe for the workmen. Errors in shop fabrication or deformation resulting from handling and transportation that prevent the proper assembly and fitting of parts shall be reported immediately to METC or their representative and approval of the method of correction shall be obtained.

Bearing surfaces and surfaces that will be in permanent contact shall be cleaned before the members are assembled. Mating surfaces of all members shall be inspected and shall meet these cleanliness

requirements before joining. As erection progresses, the work shall be securely fastened to take care of all dead load, wind and erection stresses. Unless removal is required, any erection bolts used in welded construction may be tightened securely and left in place.

The use of a gas-cutting torch in the field for correction of fabrication errors will not be permitted on any major member in the structural framing. The use of a gas-cutting torch will be permitted only on minor members, when the member is not under stress, and then only after the written approval of METC or their representative has been obtained.

11.0 PAINTING

All structural steel shall be prime and finish painted in accordance with the requirements of paragraph 14 PAINTING.

12.0 WEEP HOLES

All locations in exterior structural work which are not self-draining and which could retain pockets of water, shall be provided with weep holes. Number and location of weep holes shall be as indicated or as required for proper drainage. Weep holes shall be 1/2-inch diameter unless otherwise indicated.

13.0 MISCELLANEOUS METALWORK

All miscellaneous metal items indicated and those necessary for the completion of the indicated work, although such items are not specifically indicated, shall be provided and installed by the Contractor. Miscellaneous metalwork items not specifically described herein shall be acceptable standard types, of sizes, construction and finish suitable for the intended use.

13.1 Substitutions

Substitutions of sections, or modifications of details, or both, shall be made only when approved by METC or their representative.

13.2 Responsibility for Errors

Any errors in fabrication, fit, or installation of miscellaneous metalwork items shall be entirely the responsibility of the Contractor.

13.3 Materials

Materials shall be new and shall conform to the respective specifications and requirements referenced therefor. All ferrous metal shall be clean and free from loose mill scale, flake rust, or pitting.

13.4 Shop Drawings

Shop drawings showing size, details of construction, methods of installation, welding, hardware and other details of all items specified herein, shall be submitted to METC for approval.

13.5 Painting

All items not specified to be galvanized shall be shop and finish painted in accordance with paragraph 14, PAINTING.

13.6 Construction and Installation

13.6.1 Handrails

Handrails and toe plate shall be provided around all platforms, stairs and floor openings as indicated on the drawings.

13.6.2 Platform Grating

Platforms shall provide a 1-inch maximum clearance around all equipment and tanks. Grating shall be attached with galvanized steel saddle clips over welded steel studs to supporting steel in at least 2 places on each supporting member. All grating shall be readily removable.

14.0 PAINTING

Painting of all structure and miscellaneous steel shall be in accordance with Pittsburgh and Midway Coal Mining Company Specification B-33250-GC-II-II-28, Painting.

THIS PAGE
WAS INTENTIONALLY
LEFT BLANK

Appendix D

ANSI B31.3 Code Compliance Report

The Code Compliance Report from the Pipeline computer program printout is in this Appendix.

HICKSON SHICK3
SLURRY LETDOWN VALVE TEST LOOP

PIPELINE

PAGE: 0
OCT 14, '80

T A B L E O F C O N T E N T S

```
*****
* ENGLISH *
* INPUT LISTING --- 4 *
* STATIC *
* THERMAL *
* STRESS --- 18 *
* REACTIONS --- 28 *
* DISPLACEMENTS --- 29 *
* WEIGHT *
* STRESS -- 34 *
* REACTIONS -- 44 *
* DISPLACEMENTS -- 45 *
* T+P+W *
* STRESS - 50 *
* REACTIONS - 60 *
* DISPLACEMENTS - 61 *
* CODE COMPLIANCE *
* B31.3 *
* SUMMARY --- 66 *
* CODE COMPLIANCE -- 71 *
*****
```

THE PRECEDING PROBLEM HAD 106 ELEMENTS AND 3 LOAD CASES
FEE IS 439 UNITS

MCDONNELL DOUGLAS AUTOMATION COMPANY -- SAINT LOUIS

JOBNAME = FTLE0754

COMPUTER SYSTEM ID = CP21

MVS RELEASE = 03.8

JES NO. = 1904

PROGRAMMER NAME FIELD = HICKSON

----- ANSI B31.3-1976 COMPLIANCE REPORT -----										
	F R O M	T O	M A T	P R O P	O.D.	WALL	C.A.	MILL	F 302.3.5	Y 304.1.1

RUN	90	89	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
BEND	89	89	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	89	88	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
BEND	88	88	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	88	1	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	1	2	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	2	3	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	3	4	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	4	5	6	2	2.375	0.436	0.0	0.0	1.000	0.400
BEND	6	6	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	7	8	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	8	9	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	9	13	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	13	14	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	14	15	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	15	93	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	93	126	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	15	16	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	16	17	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	17	18	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	18	43	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	43	44	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	44	45	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	45	46	6	2	2.375	0.436	0.0	0.0	1.000	0.400

----- ANSI B31.3-1976 COMPLIANCE REPORT -----										
	F R O M	T O	M A T	P R O P	O.D.	WALL	C.A.	MILL	F 302.3.5	Y 304.1.1

RUN	46	47	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	47	48	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	48	49	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	49	53	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	53	54	6	2	2.375	0.436	0.0	0.0	1.000	0.400
BEND	94	94	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	55	56	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	56	57	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	57	58	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	58	59	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	59	60	6	2	2.375	0.436	0.0	0.0	1.000	0.400
BEND	95	95	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	61	62	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	62	63	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	63	67	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	67	68	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	68	69	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	69	70	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	70	71	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	71	72	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	72	42	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	42	73	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	73	74	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	74	75	6	2	2.375	0.436	0.1250	0.875	1.000	0.400

----- ANSI B31.3-1976 COMPLIANCE REPORT -----										
	F R O M	T O	M A T	P R O P	O.D.	WALL	C.A.	MILL	F 302.3.5	Y 304.1.1

RUN	75	96	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	96	125	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	75	76	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	76	77	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	77	78	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	78	82	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	82	83	6	2	2.375	0.436	0.0	0.0	1.000	0.400
BEND	84	84	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	85	86	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	86	87	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	87	92	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
BEND	92	92	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	92	91	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	18	19	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	19	22	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	22	23	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	23	123	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	27	28	6	2	0.0	0.0	0.0	0.0	1.000	0.400
BEND	97	97	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	29	30	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	30	31	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	31	33	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	130	34	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	34	38	6	2	2.375	0.436	0.1250	0.875	1.000	0.400

----- ANSI B31.3-1976 COMPLIANCE REPORT -----										
	F R O M	T O	M A T	P R O P	O.D.	WALL	C.A.	MILL	F 302.3.5	Y 304.1.1
JNT	38	41	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	41	42	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	33	130	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	123	27	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	23	26	6	1	1.315	0.250	0.0620	0.875	1.000	0.400
RUN	34	37	6	1	1.315	0.250	0.0620	0.875	1.000	0.400
RUN	49	52	6	1	1.315	0.250	0.0620	0.875	1.000	0.400
RUN	63	66	6	1	1.315	0.250	0.0620	0.875	1.000	0.400
RUN	9	12	6	1	1.315	0.250	0.0620	0.875	1.000	0.400
RUN	78	81	6	1	1.315	0.250	0.0620	0.875	1.000	0.400
RUN	122	120	6	1	1.315	0.250	0.0620	0.875	1.000	0.400
RUN	110	121	6	1	1.315	0.250	0.0620	0.875	1.000	0.400
RUN	1	122	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	122	98	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	98	99	6	2	2.375	0.436	0.0	0.0	1.000	0.400
BEND	100	100	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	101	102	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	102	103	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	103	104	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	104	105	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	105	106	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	106	107	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	107	108	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	108	109	6	2	2.375	0.436	0.0	0.0	1.000	0.400

-----ANSI B31.3-1976 COMPLIANCE REPORT-----										
	F R O M	T O	M A T	P R O P	O.D.	WALL	C.A.	MILL	F 302.3.5	Y 304.1.1

RUN	109	110	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
RUN	110	111	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	111	112	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	112	113	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	113	114	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	114	115	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	115	116	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	116	117	6	2	2.375	0.436	0.1250	0.875	1.000	0.400
JNT	117	118	6	2	2.375	0.436	0.0	0.0	1.000	0.400
RUN	118	87	6	2	2.375	0.436	0.1250	0.875	1.000	0.400

----- ANSI B31.3-1976 COMPLIANCE REPORT -----									
DATA PNT.	--PRESSURE--		--- 302.3.5 (C) STRESS		----- 02.3.5 (D) -----				
	-DES. ALLOW		---	---	---	---	---	---	---
	---	---	SLP-	SLW-	SLT-	SH-	SE-	SA-	SAL-
90 * R	2400	3499	2997	8877	11641	14800	2522	28700	31858
* U									
89 * N	2400	3499	3023	8481	11220	14800	2240	28700	32279
89 * B	2400	3499	3023	8481	11220	14800	2240	28700	32279
* N									
89 * D	2400	3499	3070	-2418	5072	14800	712	28700	38427
89 * R	2400	3499	3070	-2418	5072	14800	712	28700	38427
* U									
88 * N	2400	3499	3076	-1330	3976	14800	613	28700	39523
88 * B	2400	3499	3076	-1330	3976	14800	613	28700	39523
* N									
88 * D	2400	3499	3086	-4001	6610	14800	1529	28700	36889
88 * R	2400	3499	3086	-4001	6610	14800	1529	28700	36889
* U									
1 * N	2400	3499	2960	-1306	3919	14800	2871	28700	39580
1 * R	2400	3499	2912	1355	4207	14800	1746	28700	39292
* U									
2 * N	2400	3499	2917	1675	4529	14800	1747	28700	38970
2 * J									
* N									
3 * T									
3 * R	2400	3499	2919	1842	4701	14800	1791	28700	38798
* U									
4 * N	2400	3499	2921	1923	4786	14800	1895	28700	38713
4 * J									
* N									
5 * T									
6 * B	2400	3499	2928	-1178	4063	14800	2134	28700	39436
* N									
6 * D	2400	3499	2943	1045	3928	14800	2814	28700	39571

```

-----ANSI B31.3-1976 COMPLIANCE REPORT-----
--PRESSURE-- --- 302.3.5 (C) STRESS ----- --- 302.3.5 (D) ----
-DES. ALLOW- ---SLP- --SLW- --SLT- ---SH- ---SE- ---SA- ---SAL-
-----

```

DATA PNT.	7	8	9	13	14	15	93	93	126	15	16	17	18
* J													
* N													
* T													
* R	2400	3499	2946	552	3443	14800	3094	28700	40056				
* U													
* N	2400	3499	2947	205	3109	14800	3268	28700	40390				
* R	2400	3499	2947	205	3109	14800	3268	28700	40390				
* U													
* N	2400	3499	2954	2571	5415	14800	4180	28700	38084				
* J													
* N													
* T													
* R	2400	3499	2956	3605	6444	14800	4482	28700	37055				
* U													
* N	2400	3499	2958	4282	7119	14800	4667	28700	36380				
* R	2400	3499	2872	250	3123	14800	0	28700	40376				
* U													
* N	2400	3499	2872	116	2989	14800	0	28700	40510				
* R	2400	3499	2872	116	2989	14800	0	28700	40510				
* U													
* N	2400	3499	2872	0	2872	14800	0	28700	40627				
* R	2400	3499	2898	-4055	6425	14800	4372	28700	37074				
* U													
* N	2400	3499	2891	-4742	7133	14800	4231	28700	36366				
* J													
* N													
* T													
* R	2400	3499	2896	-5466	7911	14800	4006	28700	35588				
* U													
* N	2400	3499	2906	-5918	8388	14800	4205	28700	35111				

----- ANSI B31.3-1976 COMPLIANCE REPORT -----									
DATA		--PRESSURE--		--- 302.3.5 (C) STRESS		--- 302.3.5 (D)			
PNT.		-DES. ALLOW		---SLP-	--SLW-	--SLT-	---SH-	---SA-	--SAL-
18	* R	2400	3499	2889	-510	3094	14800	3416	28700
	* U								40405
43	* N	2400	3499	2906	-465	3066	14800	3056	28700
									40433
43	* J								
	* N								
44	* T								
44	* R	2400	3499	2936	-462	3128	14800	2708	28700
	* U								40371
45	* N	2400	3499	2941	-473	3149	14800	2687	28700
									40350
45	* J								
	* N								
46	* T								
46	* R	2400	3499	2986	-619	3409	14800	3003	28700
	* U								40090
47	* N	2400	3499	2991	-644	3442	14800	3091	28700
									40057
47	* J								
	* N								
48	* T								
48	* R	2400	3499	3037	-854	3754	14800	4114	28700
	* U								39745
49	* N	2400	3499	3055	-955	3879	14800	4627	28700
									39620
49	* R	2400	3499	3055	-203	3098	14800	4627	28700
	* U								40401
53	* N	2400	3499	3074	-243	3206	14800	5170	28700
									40293
53	* J								
	* N								
54	* T								
94	* B	2400	3499	3105	-379	3412	14800	6109	28700
	* N								40087
94	* D	2400	3499	3155	-200	3094	14800	7341	28700
									40405

----- ANSI B31.3-1976 COMPLIANCE REPORT -----
 --PRESSURE- --- 302.3.5 (C) STRESS ----- 302.3.5 (D) ----
 DATA PNT. - - - - -
 -DES. ALLOW ---SLP- --SLW- --SLT- ---SH- ---SE- ---SA- --SAL-

55 * J
* N
56 * T

56 * R	2400	3499	3154	-466	3045	14800	7069	28700	40454
* U									
57 * N	2400	3499	3153	-888	3445	14800	6511	28700	40054

57 * J
* N
58 * T

58 * R	2400	3499	3151	-866	3429	14800	5908	28700	40070
* U									
59 * N	2400	3499	3150	-407	3011	14800	5377	28700	40488

59 * J
* N
60 * T

95 * B	2400	3499	3150	-175	3141	14800	5127	28700	40358
* N									
95 * D	2400	3499	3098	-496	3495	14800	2867	28700	40004

61 * J
* N
62 * T

62 * R	2400	3499	3067	-346	3286	14800	1832	28700	40213
* U									
63 * N	2400	3499	3048	-269	3172	14800	1228	28700	40327

63 * R	2400	3499	3048	-1075	3962	14800	1228	28700	39537
* U									
67 * N	2400	3499	3030	-973	3837	14800	711	28700	39662

67 * J
* N
68 * T

----- ANSI 831.3-1976 COMPLIANCE REPORT -----									
DATA PNT.	--PRESSURE--		--- 302.3.5 (C) STRESS ---		--- 302.3.5 (D) ---				
	-DES. ALLOW	---	SLP-	--SLW-	--SLT-	---SH-	---SE-	---SA-	--SAL-

68 * R	2400	3499	2985	-756	3521	14800	1259	28700	39978
* U									
69 * N	2400	3499	2979	-730	3488	14800	1428	28700	40011
69 * J									
* N									
70 * T									
70 * R	2400	3499	2934	-555	3211	14800	2947	28700	40288
* U									
71 * N	2400	3499	2929	-537	3186	14800	3129	28700	40313
71 * J									
* N									
72 * T									
72 * R	2400	3499	2899	-483	3085	14800	4184	28700	40414
* U									
42 * N	2400	3499	2884	-490	3083	14800	4829	28700	40416
42 * R	2400	3499	2902	-3592	5944	14800	1256	28700	37555
* U									
73 * N	2400	3499	2901	-2804	5170	14800	1484	28700	38329
73 * J									
* N									
74 * T									
74 * R	2400	3499	2907	-1626	4001	14800	2668	28700	39498
* U									
75 * N	2400	3499	2911	-1111	3522	14800	3031	28700	39977
75 * R	2400	3499	2872	275	3148	14800	0	28700	40351
* U									
96 * N	2400	3499	2872	137	3009	14800	0	28700	40490
96 * R	2400	3499	2872	137	3009	14800	0	28700	40490
* U									
125 * N	2400	3499	2872	0	2872	14800	0	28700	40627

-----ANSI 831.3-1976 COMPLIANCE REPORT-----										
DATA PNT.	--PRESSURE-- --- 302.3.5 (C) STRESS ----- --- 302.3.5 (D) ----									
	-DES. ALLOW ---SLP- --SLW- --SLT- ----SH- ----SE- ----SA- --SAL-									

75 * R	2400	3499	2903	-1481	4301	14800	3533	28700	39198	
* U										
76 * N	2400	3499	2906	-1193	4022	14800	3417	28700	39477	
76 * J										
* N										
77 * T										
77 * R	2400	3499	2913	-853	3689	14800	3294	28700	39810	
* U										
78 * N	2400	3499	2947	-1097	3900	14800	3616	28700	39599	
78 * R	2400	3499	2947	-1097	3900	14800	3616	28700	39599	
* U										
82 * N	2400	3499	2953	-1080	3878	14800	3774	28700	39621	
82 * J										
* N										
83 * T										
84 * B	2400	3499	2963	-996	3797	14800	4081	28700	39702	
* N										
84 * D	2400	3499	2962	-438	3332	14800	1418	28700	40167	
85 * J										
* N										
86 * T										
86 * R	2400	3499	2964	-737	3769	14800	2832	28700	39730	
* U										
87 * N	2400	3499	2967	-1196	4262	14800	2096	28700	39237	
87 * R	2400	3499	2944	-960	3463	14800	4565	28700	40036	
* U										
92 * N	2400	3499	3075	-1805	4372	14800	12652	28700	39127	
92 * B	2400	3499	3075	-1805	4372	14800	12652	28700	39127	
* N										
92 * D	2400	3499	3122	-3682	6250	14800	17872	28700	37249	

----- ANSI B31.3-1976 COMPLIANCE REPORT -----										
DATA		--PRESSURE--		--- 302.3.5 (C) STRESS		-----		--- 302.3.5 (D) ---		
PNT.		-	-	-	-	-	-	-	-	-
		-DES. ALLOW	---	SLP-	--SLW-	--SLT-	---SH-	---SE-	---SA-	--SAL-
		-----	-----	-----	-----	-----	-----	-----	-----	-----
92	* R	2400	3499	3122	-3682	6250	14800	17872	28700	37249
	* U									
91	* N	2400	3499	3141	-7894	10471	14800	19337	28700	33028
18	* R	2400	3499	2960	-4880	7655	14800	6619	28700	35844
	* U									
19	* N	2400	3499	2956	-4621	7398	14800	7154	28700	36101
19	* J									
	* N									
22	* T									
22	* R	2400	3499	2900	-2337	5098	14800	8291	28700	38401
	* U									
23	* N	2400	3499	2909	-2159	4918	14800	8148	28700	38581
23	* R	2400	3499	2909	-2159	4918	14800	8148	28700	38581
	* U									
123	* N	2400	3499	2925	-2163	4914	14800	7899	28700	38585
27	* J									
	* N									
28	* T									
97	* B	2400	3499	3165	246	3072	14800	11971	28700	40427
	* N									
97	* D	2400	3499	3288	-590	3625	14800	18399	28700	39874
29	* J									
	* N									
30	* T									
30	* R	2400	3499	3270	-782	3822	14800	17563	28700	39677
	* U									
31	* N	2400	3499	3254	-894	3944	14800	16801	28700	39555
31	* J									
	* N									
33	* T									

----- ANSI B31.3-1976 COMPLIANCE REPORT -----										
DATA		--PRESSURE--		--- 302.3.5 (C) STRESS		-----		--- 302.3.5 (D) ---		
PNT.		-		-		-		-		
		-DES. ALLOW		---SLP-	--SLW-	--SLT-	---SH-	---SE-	---SA-	---SAL-
		-----		-----	-----	-----	-----	-----	-----	-----
130	* R	2400	3499	3035	-3291	5963	14800	12392	28700	37536
	* U									
34	* N	2400	3499	3001	-2744	5423	14800	10180	28700	38076
34	* R	2400	3499	3001	-2744	5423	14800	10180	28700	38076
	* U									
38	* N	2400	3499	2981	-2644	5323	14800	8950	28700	38176
38	* U									
	* N									
41	* T									
41	* R	2400	3499	2908	-3614	6193	14800	4152	28700	37306
	* U									
42	* N	2400	3499	2888	-3618	6195	14800	3753	28700	37304
33	* R	2400	3499	3003	-2877	5708	14800	10848	28700	37791
	* U									
130	* N	2400	3499	3035	-3211	6043	14800	12392	28700	37456
123	* R	2400	3499	2925	2120	4981	14800	7899	28700	38518
	* U									
27	* N	2400	3499	3074	607	3437	14800	7722	28700	40063
23	* R	2400	3900	2496	-58	2437	14800	0	28700	41062
	* U									
26	* N	2400	3900	2496	-37	2459	14800	0	28700	41040
34	* R	2400	3900	2496	-58	2437	14800	0	28700	41062
	* U									
37	* N	2400	3900	2496	-37	2459	14800	0	28700	41040
49	* R	2400	3900	2496	-4286	6782	14800	0	28700	36717
	* U									
52	* N	2400	3900	2496	0	2496	14800	0	28700	41003
63	* R	2400	3900	2496	4286	6782	14800	0	28700	36717
	* U									
66	* N	2400	3900	2496	0	2496	14800	0	28700	41003

----- ANSI B31.3-1976 COMPLIANCE REPORT -----									
--PRESSURE- --- 302.3.5 (C) STRESS ----- --- 302.3.5 (D) ----									
DATA									
PNT.	-DES.	ALLOW	---SLP-	--SLW-	--SLT-	---SH-	---SE-	---SA-	--SAL-

9 * R	2400	3900	2496	-58	2437	14800	0	28700	41062
* U									
12 * N	2400	3900	2496	-37	2459	14800	0	28700	41040
78 * R	2400	3900	2496	-58	2437	14800	0	28700	41062
* U									
81 * N	2400	3900	2496	-37	2459	14800	0	28700	41040
122 * R	2400	3900	2496	-4286	6782	14800	0	28700	36717
* U									
120 * N	2400	3900	2496	0	2496	14800	0	28700	41003
110 * R	2400	3900	2496	4286	6782	14800	0	28700	36717
* U									
121 * N	2400	3900	2496	0	2496	14800	0	28700	41003
1 * R	2400	3499	2964	-1014	3599	14800	4272	28700	39900
* U									
122 * N	2400	3499	3038	-920	3780	14800	5709	28700	39719
122 * R	2400	3499	3038	-288	3058	14800	5709	28700	40441
* U									
98 * N	2400	3499	3053	-370	3284	14800	6135	28700	40215
98 * J									
* N									
99 * T									
100 * B	2400	3499	3062	-503	3460	14800	6394	28700	40039
* N									
100 * D	2400	3499	3045	-229	2899	14800	5756	28700	40600
101 * J									
* N									
102 * T									
102 * R	2400	3499	3028	-671	3354	14800	5125	28700	40145
* U									
103 * N	2400	3499	3019	-860	3553	14800	4801	28700	39946

----- ANSI B31.3-1976 COMPLIANCE REPORT -----
 --PRESSURE- --- 302.3.5 (C) STRESS ----- 302.3.5 (D) ---
 DATA PNT. -DES. ALLOW ---SLP- --SLW- --SLT- ----SH- ----SE- ----SA- --SAL-

103	* J								
	* N								
104	* T								
104	* R	2400	3499	2994	-1131	3850	14800	3907	28700
	* U								39649
105	* N	2400	3499	2985	-1134	3863	14800	3602	28700
									39636
105	* J								
	* N								
106	* T								
106	* R	2400	3499	2967	-947	3699	14800	2975	28700
	* U								39800
107	* N	2400	3499	2946	-524	3316	14800	2344	28700
									40183
107	* R	2400	3499	2946	-524	3316	14800	2344	28700
	* U								40183
108	* N	2400	3499	2918	-593	3486	14800	1817	28700
									40013
108	* J								
	* N								
109	* T								
109	* R	2400	3499	2907	-1259	3991	14800	2336	28700
	* U								39508
110	* N	2400	3499	2905	-1057	3766	14800	2611	28700
									39733
110	* R	2400	3499	2905	-1895	4567	14800	2611	28700
	* U								38932
111	* N	2400	3499	2908	-1688	4339	14800	2931	28700
									39160
111	* J								
	* N								
112	* T								
112	* R	2400	3499	2916	-1482	4067	14800	3332	28700
	* U								39432
113	* N	2400	3499	2920	-1378	3952	14800	3530	28700
									39547

----- ANSI B31.3-1976 COMPLIANCE REPORT -----
 --PRESSURE- --- 302.3.5 (C) STRESS ----- 302.3.5 (D) ----
 DATA
 PNT. -DES. ALLOW ---SLP- --SLW- --SLT- ---SH- ---SE- ---SA- --SAL-

113 * J

* N

114 * T

114 * R 2400 3499 2931 -1190 3701 14800 3969 28700 39798

* U

115 * N 2400 3499 2937 -1099 3601 14800 4181 28700 39898

115 * J

* N

116 * T

116 * R 2400 3499 2945 -987 3468 14800 4491 28700 40031

* U

117 * N 2400 3499 2952 -902 3383 14800 4758 28700 40116

117 * J

* N

118 * T

118 * R 2400 3499 2960 -838 3314 14800 5078 28700 40185

* U

87 * N 2400 3499 2972 -807 3311 14800 5499 28700 40188

THIS PAGE
WAS INTENTIONALLY
LEFT BLANK

Appendix E

Preliminary Drawings

The following preliminary drawings are in this Appendix.

<u>Item No.</u>	<u>METC Dwg. No.</u>	<u>Title</u>
1	E800012	Slurry Letdown Valve Test Loops at Ft. Lewis SRC Pilot Plant
2	E800013	Loop "A"
3	E800014	Loop "B"
4	E800015	Loop "C"
5	E800016	Inlet Instrument Loop
6	E800017	Outlet Instrument Loop
7	E800018	Structural Steel for Platform Extension
8	E800019	Schematic of Valve Test Loops
9	E800020	Piping and Instrumentation Diagram for Slurry Letdown Valve Test Loops

119

MATERIAL LIST					
NO.	PART NO.	DESCRIPTION	NO. REQ'D	MAT'L SPEC.	ZONE
			GR 1 GR 2 GR 3

- NOTES:
1. THE TEST LOOPS AND STRUCTURAL STEEL SHALL BE FABRICATED IN ACCORDANCE WITH MTC ENGINEERING SPECIFICATION NO. 5-80.
 2. SHEET 1 OF THIS DRAWING SHOWS PIPING ONLY WITHOUT STRUCTURAL DETAILS. SHEET 2 OF THIS DRAWING SHOWS STRUCTURAL DETAILS ONLY WITHOUT PIPING.

PRELIMINARY
FOR INFORMATION ONLY
DRAWING NOT CHECKED
NOT FOR CONSTRUCTION

REV		ZONE	DATE	DESCRIPTION		BY	CAR	SPWD
MORGANTOWN ENERGY TECHNOLOGY CENTER 3600 UNIVERSITY DR. • FT. LEWIS, WV 26032								
DRWG TYPE	E		TITLE					
DRWG SIZE	E		SLURRY LETDOWN VALVE TEST					
REF DRWG NO.			LOOPS AT FT LEWIS SRC					
			PILOT PLANT					
800018	800013	800014	800015	800016	800017	800018	800019	800020
DESIGNED BY	DATE	11 JAN 80	DESIGNED BY	DATE	11 JAN 80	DESIGNED BY	DATE	11 JAN 80
CHECKED BY	DATE	11 JAN 80	CHECKED BY	DATE	11 JAN 80	CHECKED BY	DATE	11 JAN 80
SCALE	1" = 1'		SCALE	1" = 1'		SCALE	1" = 1'	
CODE IDENT NO.			CODE IDENT NO.			CODE IDENT NO.		

MATERIALS LIST					
NO.	PART NO.	DESCRIPTION	NO. REQ'D	DATE SPEC.	FORM
			CR 1 CR 2 CR 3

PRELIMINARY
FOR INFORMATION ONLY
DRAWING NOT CHECKED
NOT FOR CONSTRUCTION

REV		ZONE	DATE	DESCRIPTION	BY	FOR	APPROV
MORGANTOWN ENERGY TECHNOLOGY CENTER P.O. Box 2008 Morgantown, WV 26505-2008							
DRWG TYPE E DRWG SIZE E REV DRWG NO.		TITLE SLURRY LETDOWN VALVE TEST LOOPS AT FT LEWIS SRC PILOT PLANT					
800018 800019 800020 800021	800013 800014 800015 800016 800017	DRAFTS DATE DESIGNED BY DATE CHECKED BY DATE COORDINATOR NO.	DATE DATE DATE DATE DATE DATE	PROJECT NO. DATE DATE DATE DATE DATE	DATE DATE DATE DATE DATE DATE	DATE DATE DATE DATE DATE DATE	DATE DATE DATE DATE DATE DATE
800018 800019 800020 800021		800012 SHEET 2 OF 2

- NOTES:
1. PIPING SHALL BE FABRICATED, INSPECTED, HEAT TREATED AND INSULATED IN ACCORDANCE WITH METC ENGINEERING SPECIFICATION NO. 1-80
 2. WHEN LOOP "A" IS IN OPERATION, LOOPS "B" AND "C" - THE INLET INSTRUMENTATION LOOP AND THE OUTLET INSTRUMENTATION LOOP ARE OFF-LINE.
 3. OVERALL LENGTH DIMENSIONS FOR PIPING ASSEMBLY INCLUDE 1/4" PER JOINT FOR GRAYLOC CONNECTORS.

MATERIALS LIST						
NOTE	PART NO.	DESCRIPTION	NO REQD	GR 1	GR 2	GR 3
	1	2" DIA. SCHEDULE 40 SEAMLESS PIPE	14'			ASTM A312, GP 10307
	2	2" x 2" x 2" TEE, 6000 SOCKET WELD	3			ASTM A182, F307
	3	2" x 2" x 2" CROSS, 6000 SOCKET WELD	1			ASTM A182, F307
	4	GRAYLOC CONNECTORS, 2" DIA.	10			307 SS HUBS
	5	2" 304/316 INCL. PART NO. 59310	1			316 SS
	6	2" ROCKET MOUNTAIN R-CON CONNECTOR	156			307 SS HUBS, SEAL 5-1610, CLAMP C-02
	7	STILLTS SINGLE VALVES	4			TYPE 304-316 H.O.V.
	8	BLOCK VALVE ACTUATORS	2			FISHER 656 MODEL NO.
	9	CONTROL VALVE	1			FISHER 656
	10	CONTROL VALVE ACTUATOR	1			FISHER 656
VIEW B - QUANTITIES PER ASSEMBLY						
	11	REDUCER, 2" x 1", 6000, SOCKET WELD	1			ASTM A182, F307
	12	2" DIA. SCHEDULE 40 SEAMLESS PIPE	14'			ASTM A312, GP 10307
	13	1" R-CON CONNECTOR 304/316	2			307 SS HUBS, SEAL 5-0906, CLAMP C-01
	14	VALVES, ROCKWELL EDMUNDS FIG. 6629, 1	2			307 SS ROD
	15	1" CAP, SCHEDULE 6000	1			ASTM A182, F307

PRELIMINARY
FOR INFORMATION ONLY
DRAWING NOT CHECKED
NOT FOR CONSTRUCTION

DIMENSIONS SHOWN TO THIS FACE FOR GRAYLOC CONNECTORS

1" FOR GRAYLOC 2GR14

SEE NOTE 3

REV	ZONE	DATE	DESCRIPTION	BY	CAR	APPV
<p>MORGANTOWN ENERGY TECHNOLOGY CENTER</p>						
DRWG	TYPE	TITLE				
800018	800019	LOOP "A"				
800020	800021	DESIGNED	DATE	PROJECT	DATE	
800022	800023	CHECKED	DATE	BRANCH	DATE	
PROJECT		800013				
CROSS IDENT NO		800013				

122

NOTES:-

1. PIPING SHALL BE FABRICATED, INSPECTED, HEAT TRACED AND INSULATED IN ACCORDANCE WITH MTC ENGINEERING SPECIFICATION NO S-80.
2. WHEN LOOP "B" IS IN OPERATION, LOOPS "A" AND "C" ARE OFF LINE.

PRELIMINARY
FOR INFORMATION ONLY
DRAWING NOT CHECKED
NOT FOR CONSTRUCTION

[illegible]

CONTROL VALVE	DNM X	DNM Y

MATERIALS LIST						
NOTE	PART NO	DESCRIPTION	NO REQD	QTY	MATL SPEC	ZONE
1	2"	DIAMETER, SCHEDULE 40 SEAMLESS PIPE	1	1	ASTM A312, GR TP307	
2	2"	2" x 2" x 2" TEE, 6000-SOCKET WELD	3	1	ASTM A182, F307	
3	2"	2" x 2" x 2" CROSS, 6000-SOCKET WELD	1	1	ASTM A182, F307	
4	2"	R-CON CONNECTORS 80-F-2, 5135	8	1	307 SS HUBS, SEAL 5-1610, CLAMP C-02	
5	2"	R-CON BLIND	1	1	316 SS	
6	VALVES, ROCKWELL EDWARDS FIGURE 6524, 2"	4	1	1	307 SS BODY	
7	CONTROL VALVE	1	1	1	SEE TABULATION	C-9
8	CONTROL VALVE ACTUATOR	1	1	1	FISHER 557 MODEL 40

- NOTES:
1. PIPING SHALL BE FABRICATED, INSPECTED, HEAT TRACED AND INSULATED IN ACCORDANCE WITH NETC ENGINEERING SPECIFICATION NO. 5-80.
 2. WHEN LOOP "C" IS IN OPERATION, LOOPS "A" AND "B" ARE OFF LINE.

PRELIMINARY
FOR INFORMATION ONLY
DRAWING NOT CHECKED
NOT FOR CONSTRUCTION

REV		ZONE	DATE	DESCRIPTION	BY	CHK	APPRO
MORGANTOWN ENERGY TECHNOLOGY CENTER U.S. DEPARTMENT OF ENERGY							
DRWG TYPE		E		TITLE			
REF DRWG NO		800014		LOOP "C"			
800014	800015	DESIGNS	DATE	PROJ. ENG	DRW		
800016	800017	CHECK	DATE	BRANCH	DATE		
800018	800019	SCALE	DATE	DATE	DATE		
COORDINATOR NO		800015		DATE			

MATERIALS LIST					
NO.	PART NO.	DESCRIPTION	QTY	UNIT	ZONE
1		STEEL CHANNEL, AISC C 6 x 13	~27		ASTM A-36
2		STEEL BEAM, AISC W 8 x 12	~11		ASTM A-36
3		STEEL STRIP, AISC L 3 x 4	~16		ASTM A-36
4		TUB STEEL, AISC, TUBE 1/2" x 1/2" x 3/16	~45		ASTM A-501
5		DECK GRATING, STEEL 1/4" x 3/16"	~52		NEARBY PIPE R19-4, GALVANIZED
6		STEEL BEAM, AISC W 8 x 20	~4		ASTM A-36
7		STEEL ANGLE, AISC L 2 x 2 x 1/4	~3		ASTM A-36
8		STEEL PLATE, 1/2" THICK	3		ASTM A-36
9		STEEL PIPE, 1 1/2" DIA SCHEDULE 40	3		ASTM A-53

VIEW A
PIPE SUPPORT

PRELIMINARY
FOR INFORMATION ONLY
DRAWING NOT CHECKED
NOT FOR CONSTRUCTION

REV	ZONE	DATE	DESCRIPTION	BY	CHK	APPV
MORGANTOWN ENERGY TECHNOLOGY CENTER						
DRWG TYPE	E		TITLE			
DRWG NO.	800012		STRUCTURAL STEEL FOR PLATFORM EXTENSION			
REF DRWG	800013		800014			
800015	800016		800017			
800018	800019		800020			
800021	800022		800023			
800024	800025		800026			
800027	800028		800029			
800030	800031		800032			
800033	800034		800035			
800036	800037		800038			
800039	800040		800041			
800042	800043		800044			
800045	800046		800047			
800048	800049		800050			
800051	800052		800053			
800054	800055		800056			
800057	800058		800059			
800060	800061		800062			
800063	800064		800065			
800066	800067		800068			
800069	800070		800071			
800072	800073		800074			
800075	800076		800077			
800078	800079		800080			
800081	800082		800083			
800084	800085		800086			
800087	800088		800089			
800090	800091		800092			
800093	800094		800095			
800096	800097		800098			
800099	800100		800101			
800102	800103		800104			
800105	800106		800107			
800108	800109		800110			
800111	800112		800113			
800114	800115		800116			
800117	800118		800119			
800120	800121		800122			
800123	800124		800125			
800126	800127		800128			
800129	800130		800131			
800132	800133		800134			
800135	800136		800137			
800138	800139		800140			
800141	800142		800143			
800144	800145		800146			
800147	800148		800149			
800150	800151		800152			
800153	800154		800155			
800156	800157		800158			
800159	800160		800161			
800162	800163		800164			
800165	800166		800167			
800168	800169		800170			
800171	800172		800173			
800174	800175		800176			
800177	800178		800179			
800180	800181		800182			
800183	800184		800185			
800186	800187		800188			
800189	800190		800191			
800192	800193		800194			
800195	800196		800197			
800198	800199		800200			
800201	800202		800203			
800204	800205		800206			
800207	800208		800209			
800210	800211		800212			
800213	800214		800215			
800216	800217		800218			
800219	800220		800221			
800222	800223		800224			
800225	800226		800227			
800228	800229		800230			
800231	800232		800233			
800234	800235		800236			
800237	800238		800239			
800240	800241		800242			
800243	800244		800245			
800246	800247		800248			
800249	800250		800251			
800252	800253		800254			
800255	800256		800257			
800258	800259		800260			
800261	800262		800263			
800264	800265		800266			
800267	800268		800269			
800270	800271		800272			
800273	800274		800275			
800276	800277		800278			
800279	800280		800281			
800282	800283		800284			
800285	800286		800287			
800288	800289		800290			
800291	800292		800293			
800294	800295		800296			
800297	800298		800299			
800300	800301		800302			
800303	800304		800305			
800306	800307		800308			
800309	800310		800311			
800312	800313		800314			
800315	800316		800317			
800318	800319		800320			
800321	800322		800323			
800324	800325		800326			
800327	800328		800329			
800330	800331		800332			
800333	800334		800335			
800336	800337		800338			
800339	800340		800341			
800342	800343		800344			
800345	800346		800347			
800348	800349		800350			
800351	800352		800353			
800354	800355		800356			
800357	800358		800359			
800360	800361		800362			
800363	800364		800365			
800366	800367		800368			
800369	800370		800371			
800372	800373		800374			
800375	800376		800377			
800378	800379		800380			
800381	800382		800383			
800384	800385		800386			
800387	800388		800389			
800390	800391		800392			
800393	800394		800395			
800396	800397		800398			
800399	800400		800401			
800402	800403		800404			
800405	800406		800407			
800408	800409		800410			
800411	800412		800413			
800414	800415		800416			
800417	800418		800419			
800420	800421		800422			
800423	800424		800425			
800426	800427		800428			
800429	800430		800431			
800432	800433		800434			
800435	800436		800437			
800438	800439		800440			
800441	800442		800443			
800444	800445		800446			
800447	800448		800449			
800450	800451		800452			
800453	800454		800455			
800456	800457		800458			
800459	800460		800461			
800462	800463		800464			
800465	800466		800467			
800468	800469		800470			
800471	800472		800473			
800474	800475		800476			
800477	800478		800479			
800480	800481		800482			
800483	800484		800485			
800486	800487		800488			
800489	800490		800491			
800492	800493		800494			
800495	800496		800497			
800498	800499		800500			
800501	800502		800503			
800504	800505		800506			
800507	800508		800509			
800510	800511		800512			
800513	800514		800515			
800516	800517		800518			
800519	800520		800521			
800522	800523		800524			
800525	800526		800527			
800528	800529		800530			
800531	800532		800533			
800534	800535		800536			
800537	800538		800539			
800540	800541		800542			
800543	800544		800545			
800546	800547		800548			
800549	800550		800551			
800552	800553		800554			
800555	800556		800557			
800558	800559		800560			
800561	800562		800563			
800564	800565		800566			
800567	800568		800569			
800570	800571		800572			
800573	800574		800575			
800576	800577		800578			
800579	800580		800581			
800582	800583		800584			
800585	800586		800587			
800588	800589		800590			
800591	800592		800593			
800594	800595		800596			
800597	800598		800599			
800600	800601		800602			
800603	800604		800605			
800606	800607		800608			
800609	800610		800611			
800612	800613		800614			
800615	800616		800617			
800618	800619		800620			
800621	800622		800623			
800624	800625		800626			
800627	800628		800629			
800630	800631		800632			
800633	800634		800635			
800636	800637		800638			
800639	800640		800641			
800642	800643		800644			
800645	800646		800647			
800648	800649		800650			
800651	800652		800653			
800654	800655		800656			
800657	800658		800659			
800660	800661		800662			
800663	800664		800665			
800666	800667		800668			
800669	800670		800671			
800672	800673		800674			
800675	800676		800677			
800678	800679		800680			
800681	800682		800683			
800684	800685		800686			
800687	800688		800689			
800690	800691		800692			
800693	800694		800695			
800696	800697		800698			
800699	800700		800701			

MATERIALS LIST					
NOTE	PART NO.	DESCRIPTION	NO. REQ. (QTY.) (GR.) (GR.)	MAT'L SPEC.	ZONE

TOP VIEW
PART NO. 3 OMITTED
FOR CLARITY

SECTION A-A
SCALE 3"=1"

SIDE VIEW

PRELIMINARY
FOR INFORMATION ONLY
DRAWING NOT CHECKED
NOT FOR CONSTRUCTION

REV. ZONE, DATE		DESCRIPTION		BY	CHK	APPD
Morgantown Energy Technology Center Morgantown, WV						
DRWG TYPE	E	TITLE				
DRWG NO.	800012	STRUCTURAL STEEL FOR				
REF. DRWG NO.	800013	PLATFORM EXTENSION				
800019	800014	DESIGNED	DATE	CHECKED	DATE	DATE
800020	800015	LAM	5 FEB 80	DATE	DATE	DATE
800021	800016	DESIGNER	DATE	BRANCH	DATE	DATE
NOTES		CHECKED BY				
COORDINATOR NO.		SCALE				
		800018				
		SHEET 1 OF 2				

MATERIALS LIST				
NO.	PART NO.	DESCRIPTION	NO. REQ.	MAT'L SPEC.
			QTY

1. SHUT OFF LOOP BY CLOSING V1 AND V2.
2. OPEN V6 AND V7. SOURCE OF HIGH PRESSURE CLEAN SOLVENT.
3. OPEN V4 AND BACK FLUSH SLURRY LINES WITH CLEAN SOLVENT.
4. CLOSE V4 AND THEN V3 ON CLEAN SOLVENT.
5. OPEN V6 AND FLUSH SLURRY LINES WITH CLEAN SOLVENT.
6. CLOSE V6 AND THEN V5 ON CLEAN SOLVENT.
7. CLOSE V6 AND V5.
8. OPEN V4 AND V3 TO VENT PRESSURE.

DETAIL A
SOLVENT FLUSH TECHNIQUE

PRELIMINARY
FOR INFORMATION ONLY
DRAWING NOT CHECKED
NOT FOR CONSTRUCTION

128

- NOTES:
1. SAFETY CONSIDERATIONS: WHEN IT IS NECESSARY TO USE SOLVENT BLOCK VALVES ON CONTROL VALVES AND INSTRUMENTS IF LINES ARE TO BE OPENED WHILE THE PLANT IS ON-LINE.
 2. DETAIL A SHOWS THE CLEAN SOLVENT FLUSH TECHNIQUE TO BE EMPLOYED PRIOR TO OPENING LINES CONTAINING CONTROL VALVES AND INSTRUMENTS. THE INSTRUMENT BY PASS LINES SHALL NOT BE OPENED WHILE THE PLANT IS ON-LINE.

REV	ZONE	DATE	DESCRIPTION	BY	CHK	APPD
 MORGANTOWN ENERGY TECHNOLOGY CENTER						
DRWG TYPE	TITLE					
DRWG SIZE	E					
REF. DRWG NO.	SCHEMATIC OF VALVE TEST LOOPS					
800017	800018	800019	800020	800021	800022	800023
800024	800025	800026	800027	800028	800029	800030
800031	800032	800033	800034	800035	800036	800037
800038	800039	800040	800041	800042	800043	800044
800045	800046	800047	800048	800049	800050	800051
800052	800053	800054	800055	800056	800057	800058
800059	800060	800061	800062	800063	800064	800065
800066	800067	800068	800069	800070	800071	800072
800073	800074	800075	800076	800077	800078	800079
800080	800081	800082	800083	800084	800085	800086
800087	800088	800089	800090	800091	800092	800093
800094	800095	800096	800097	800098	800099	800100

MATERIALS LIST				
NOTE	PART NO.	DESCRIPTION	QTY REQD	UNIT SPEC
			CA 1/CA 2/CA 3

NOTES:
 1. THIS P AND ID DRAWING MODIFIES THE PITTSBURGH AND MIDWAY COAL MINING COMPANY P AND ID NO. P3/54. REV 22/108 THROUGH NECESSARY TO INCORPORATE THE SLURRY LETDOWN VALVE TEST LOOPS AT THE 15, 1400 PSIG, 100% OF DESIGN.

PRELIMINARY
 FOR INFORMATION ONLY
 DRAWING NOT CHECKED
 NOT FOR CONSTRUCTION

7 MORGANTOWN ENERGY TECHNOLOGY CENTER

E PIPING AND INSTRUMENTATION
 DIAGRAM FOR SLURRY LETDOWN
 VALVE TEST LOOPS